

PROSODIC PHONOLOGY IN OKLAHOMA CHEROKEE

by

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ABSTRACT

PROSODIC PHONOLOGY IN OKLAHOMA CHEROKEE

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In this dissertation, I provide an analysis for word level prosody in Cherokee, a Southern Iroquoian language spoken in Northeastern Oklahoma and Western North Carolina. Focusing on Cherokee as it is spoken in Oklahoma, I analyze right edges of Cherokee words, showing that the boundary tone is predictable, though its distribution is conditioned by lexical tonal phonology and other word-final phenomena.

In order to account for the distribution of the boundary tone, I must first provide an analysis of lexical tone in Cherokee. There have been previous comprehensive tone analyses (Lindsey 1985; Wright 1996; Uchihara 2013), which argue for a tonal inventory with two underlying tones (high and lowfall), a superhigh accent, and a default low which does not interact with the tonal phonology. I summarize these previous analyses and discuss what generalizations they can and cannot account for. I also argue that some low pitches in Cherokee are the surface realization of an underlying low tone. By including an underlying low tone in the tonal inventory of Cherokee, problematic surface pitch sequences from previous research can be explained.

Before analyzing the boundary tone, I show all possible syllable shapes and discuss Word-Final Vowel Deletion, an optional fast speech process which often results in non-

canonical word-final codas. I argue that there is a prosodic word which maps to a morphosyntactic word, as well as a larger prosodic word which includes enclitics. I also describe clitic linearization and attachment, and discuss how Cherokee clitics show a number of typologically unusual properties.

Finally, I describe all possible alignments of the boundary tone. While mentions of the boundary tone in previous literature claim that the boundary tone only appears on word-final vowels, I show a much wider range of possible surface positions for the boundary tone: 1) the boundary tone appears on a word-final vowel, 2) the boundary tone appears on a non word-final vowel, and 3) the boundary tone does not appear at all. I use a Stratal OT framework to account for the alignment of the boundary tone, as well as interactions between the surface position of the boundary tone and lexical tonal phonology, clitic attachment, and Word-Final Vowel Deletion.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

This dissertation seeks to show patterns of two edge marking phenomena in Cherokee—Word-Final Vowel Deletion and the (word-level) Boundary Tone—and explain their distribution. To completely explain these processes, it is also necessary to reexamine previous accounts of Cherokee tone and syllables, and provide an account of cliticization in Cherokee. In this dissertation, I use Optimality Theory (Prince & Smolensky 1993; McCarthy & Prince 1993) to capture phonological processes and mapping of morphosyntactic representations to prosodic representations (Match Theory, Selkirk 2011), with autosegmental (Goldsmith 1976) representations of tone.

1.2 The Cherokee Language

Cherokee is an Iroquoian language, spoken predominantly in Western North Carolina and Northeastern Oklahoma. The Iroquoian language family has two branches: the Southern branch, of which Cherokee is the sole member, and the Northern branch, whose representatives are the extant languages Tuscarora, Seneca, Cayuga, Onondaga, Oneida, and Mohawk, and the extinct languages Nottoway, Huron, Susquehannock and potentially Laurentian. All Northern Iroquoian languages are critically endangered: Mohawk has the largest number of speakers (500), and Tuscarora has less than 10 (Lewis et al. 2015).

Though Cherokee is the most robust Iroquoian language, like all indigenous languages of the United States, Cherokee is endangered—UNESCO categorizes it as “definitely endangered.” However, a good count of how many speakers exist is difficult to calculate. The Sam

Noble Museum in Norman, Oklahoma estimated that there were 9,000 speakers in 2004; however, since nearly all native speakers are elderly and there is little in-home language transmission, that estimate is considered much too high by Cherokee speakers. Community-based estimates (Cherokee Language Master-Apprentice Program) put the estimate in the 2,500 - 3,500 range, and there are few to no monolingual Cherokee speakers. The youngest native speakers I know of are in their early to mid forties, though there are younger second language speakers, produced by the Cherokee immersion school and Master-Apprentice program.

In this dissertation, I will only examine Cherokee as it is spoken in Oklahoma. Uchihara (2013) notes that there may be up to seven subdialects in Oklahoma, and speakers from Jay, Oklahoma have merged [tɬ], while this distinction is maintained in other dialects. However, since no real dialect study of Cherokee in Oklahoma exists, and I have collected data from speakers from different subdialect communities, I refer to the language in this dissertation as ‘Oklahoma Cherokee’ and note variation when relevant.

1.2.1 Phonology

1.2.1.1 Consonants

Some discrepancies exist in the argued consonant inventories of Oklahoma Cherokee. In this section, I show inventories from previous research and argue for one I think best characterizes the language. Montgomery-Anderson (2008) has twenty-three consonants in his inventory (Table 1):

Table 1: Consonants (Montgomery-Anderson 2008)

		LABIAL	ALVEOLAR	PALATAL	VELAR	GLOTTAL
STOPS	UNASPIRATED	k _w	t		k	ʔ
	ASPIRATED	k ^h _w	t ^h		k ^h	
AFFRICATES	UNASPIRATED		ts/tʃ			
	ASPIRATED		ts ^h	tʃ ^h		
FRICATIVES			s			h
LATERAL FRICATIVES			ɬ			
LATERAL AFFRICATES	UNASPIRATED		tl			
	ASPIRATED		tɬ			
LIQUIDS			l			
NASALS	UNASPIRATED	m	n			
	ASPIRATED		n̥			
GLIDES	UNASPIRATED	w		j		
	ASPIRATED	w̥		j̥		

In his system, there are phonemic distinctions between these aspirated and unaspirated pairs with obstruents /kw, k^h_w/, /t, t^h/, /k, k^h/, /ts, t^hs/, /t, t^h/, and all sonorants except /m/. For a number of reasons, this inventory is unsatisfactory. It is much larger than other Iroquoian languages, which generally have less than fifteen consonant phonemes. To contrast, Julians (2010) reconstructed Proto-Iroquoian inventory has eleven consonants:

Table 2: Proto-Iroquoian Consonants (Julian 2010)

	ALVEOLAR	PALATAL	VELAR	GLOTTAL
STOPS	t		k k ^w	ʔ
AFFRICATES	ts			
FRICATIVES	s			h
NASALS	n			
APPROXIMANTS	ɹ	j	w	

Additionally, Montgomery-Anderson (2008) includes /k/ and /kw/ as labials, rather than as labialized velars (as seen in Table 14). Considering these sounds as labials is incon-

sistent with the inventories of other Iroquoian languages, such as Seneca (Chafe 1996; Julian 2010). Iroquoian languages, as a group, are notable for lacking labials of any kind, though Cherokee does have /m/. Cherokee acquired /m/ in some words through borrowings, like the name Mary from English, or *oogalahoóma* ‘Oklahoma’ from Choctaw/English. Julian (2010) argues that /m/ is also a reflex of Proto-Northern Iroquoian (PNI) */w/ in some instances, and a reflex of PNI */n/ in cases of regressive assimilation. No matter how it arose, the Cherokee /m/ is both a marginal phoneme in Cherokee and unusual for Iroquoian languages. It therefore should probably not be a part of a class of labials that might include /kw/ or /w/.

Finally, this inventory includes aspirated consonant phonemes. Aspirated consonants, both obstruents and resonants, can be analyzed as underlyingly [h]C and often arise due to metathesis to resolve dispreferred sequences (Scancarelli 1987; Flemming 1996). Since these aspirated consonants surface due to process, it does not make sense to include them in a phonemic inventory, though they have often been included in the orthographic inventory (see §1.3.2).

An alternate phonemic consonant inventory from Scancarelli (1987); Uchihara (2013) is shown in Table 3—all non-IPA graphemes in his original table are represented in IPA here.

Table 3: Consonant Inventory (Uchihara 2013)

		BILABIAL	ALVEOLAR	PALATAL	VELAR	GLOTTAL
STOPS			t		k k ^w	ʔ
AFFRICATES	CENTRAL		ts			
	LATERAL		tl			
FRICATIVES			s			h
NASALS		m	n			
APPROXIMANTS			l	j	w	

This inventory in Table 3 inventory is much smaller—only thirteen consonant phonemes, because it does not include aspirated consonants as phonemes. He includes /kw/ and /w/ as labialized velars, rather than as labials, which is typical of Iroquoian languages. However, like Montgomery-Anderson (2008), he lists the complex consonant /ts/ as a phoneme in his inventory. While historically this sound might have been a true alveolar fricative, in contemporary Cherokee it is always pronounced as an alveo-palatal affricate, [tʃ] or [tʰʃ]. In eliciting examples from Uchihara (2013) written with a <ts> somewhere in the word, I found that speakers spontaneously produce the word with an alveo-palatal affricate [tʃ]. When I pronounced the word with the alveolar affricate [ts], they did not know which word I was talking about.

Therefore, a more accurate inventory of contemporary Cherokee phonemes is presented in Table 4. This is the inventory that I will assume for this dissertation, and I will return to it in §1.3 to explain how I chose to represent these sounds.

Table 4: Consonant Inventory (Cornelius)

		BILABIAL	ALVEOLAR	PALATAL	VELAR	GLOTTAL
STOPS			t		k k ^w	ʔ
AFFRICATES	CENTRAL			tʃ		
	LATERAL		tl			
FRICATIVES			s			h
NASALS		m	n			
APPROXIMANTS			l	j	w	

The obstruents /k, k^w, t, tl, t/ pattern together both in processes (they are part of triggering environments for laryngeal alternation and metathesis) and in terms of phonotactic restrictions. The laryngeals /h, ʔ/ also pattern together as the target of several processes, and in certain words, they are in free variation with each other. The sonorants /l, n, j, w/ also form a natural class in the language, conventionally referred to as “resonants.” The marginal

phoneme /m/ doesn't pattern with the other resonants, and is generally not included in this class.

1.2.1.2 Vowels

Cherokee has twelve vowel phonemes with contrasting length (Table 5).

Table 5: Vowel Inventory

	FRONT	CENTRAL	BACK
HIGH	i i:		u u:
MID	e e:	ẽ ẽ:	o o:
LOW		a a:	

Unlike with consonants, this vowel inventory is uncontroversial. There are five oral vowel qualities /i, e, u, o, a/ and one nasal vowel quality /ẽ/, conventionally written as <v>. The vowel /ẽ/ is typically described as being always nasalized (Scancarelli 1987:22), though Uchihara (2013) notes that for at least one of his speakers it is sometimes not nasalized. King (1975:21) characterizes /u/ and /o/ as “slightly rounded”, while the other vowels are unrounded. All vowels contrast in length.

1.2.2 Morphology

This section provides an overview of the morphology of Cherokee to give readers a sense of the morphological composition of words in glossed examples throughout this dissertation. This section shows the general order of morphemes in a word, and briefly discusses the typologically unusual morphemes found in Cherokee. For more in depth discussions of Cherokee morphology, see Cook (1979); Scancarelli (1987); Uchihara (2013); Montgomery-Anderson (2015).

A Cherokee word can maximally have the following structure, adopted from Uchihara (2013)¹:

Table 6: The Structure of Cherokee Verbs

(Proclitic)	(Pre-pronominal Prefix ⁿ)	Pronominal nominal Prefix	(Reflexive /Middle Prefix)	STEM			Aspectual Suffix	Modal Suffix	(Enclitic ⁿ)
				BASE					
				(Incorporated Noun)	Verb Root ⁿ	(Derivational Suffix ⁿ)			

The prepronominal prefixes are similar to those found in Northern Iroquoian languages. These prefixes indicate motion (CIS and TRANS), number and composition DST and PARTITIVE, irrealis IRR, and more.

The next morpheme is the pronominal prefix. This prefix refers to the subject of the verb, or when the verb is transitive, both the subject and object. Pronominal prefixes can also be used to indicate the possessor in a possessive construction. Pronominal prefixes make a person distinction (1st v. 2nd v. 3rd), and a number distinction (singular v. dual v. plural). Additionally, first person dual and plural also distinguish between inclusive and exclusive, and third person between animate and inanimate.

There are two “sets” of pronominal prefixes for subjects: A and B. Which set is used on a given word is somewhat unpredictable, though there are some semantic and morphosyntactic tendencies. When a verb is intransitive, for example, the Set A prefixes are used when the subject is an agent, and the Set B prefixes when the subject is a patient (Uchihara 2013).

The following Tables 7 and 8 show the basic paradigms for pronominal prefixes; also included are the glosses used in this dissertation. For a more comprehensive table of pronominal prefixes (including those not directly mentioned here), see Scancarelli (1987:71) and Uchihara (2013:31).

¹He notes that parentheses mark optional position classes, while a superscript *n* marks position classes which can have multiple morphemes in sequence. I include a position class for proclitics in my structure of verbs, but Uchihara (2013) does not.

Table 7: Set A Basic Paradigm–(Montgomery-Anderson 2015)

	SINGULAR	DUAL	PLURAL
FIRST PERSON INCLUSIVE	ji- (1A)	iinii- (1A.DU)	iidii- (1A.PL)
FIRST PERSON EXCLUSIVE		oosdii- (1A.DU.EX)	oojii- (1A.PL.EX)
SECOND PERSON	hi- (2A)	sdi- (2A.DU)	ijii- (2A.PL)
THIRD PERSON	a-, ga- (3A)	anii- (3A.NS)	

Table 8: Set B Basic Paradigm–(Montgomery-Anderson 2015)

	SINGULAR	DUAL	PLURAL
FIRST PERSON INCLUSIVE	agi- (1B)	ginii- (1B.DU)	iigii- (1B.PL)
FIRST PERSON EXCLUSIVE		ooginii- (1B.DU.EX)	oogii- (1B.PL.EX)
SECOND PERSON	ja- (2B)	sdi- (2B.DU)	ijii- (2B.PL)
THIRD PERSON	uu- (3B)	uunii- (3B.NS)	

Following pronominal prefixes and before the *base* of the verb, the reflexive or middle voice prefixes can appear. In the base is the verb root, an incorporated noun (Uchihara 2014), and a derivational suffix (which may be fused with an aspectual suffix (perfective PFT, imperfective IMPF, etc.)). The verb base and an aspectual suffix form the stem, to which modal suffixes are attached.

Modal suffixes are verb-final morphemes (Scancarelli 1987; Koops 2006; Uchihara 2013). These morphemes have also been called final indicative suffixes (Koops 2006) and final suffixes (Montgomery-Anderson 2008). I will refer to them as modal or inflectional suffixes in §4 to differentiate them from derivational suffixes.

Table 9: Modal Suffixes

SUFFIX	GLOSS (Uchihara 2013)	GLOSS (Montgomery-Anderson 2015)
-a	Indicative (IND)	part of PRC stem
-óʔi	Habitual (HAB)	Habitual (HAB)
-úʔi	Assertive (ASR)	Experienced Past (EXP)
-éʔi	Evidential/Reportative Past (EVID)	Non-Experienced Past (NXP)
-é:sti	Future Imperative (FUT.IMP)	Progressive Future (FUT)

I will follow this convention of treating the indicative as a separate morpheme, but for the rest, I will use Montgomery-Anderson’s (2015) glossing conventions of Habitual (HAB), Experienced Past (EXP), Non-Experienced Past (NXP), Completive Future (CMF), and Progressive Future (FUT²), because these glosses are more transparent as to their meaning.

Cook (1979) & Uchihara (2013) identify five aspectual morphemes that appear between the stem and the modal suffix. These morphemes—present (PRS), imperfective (IMPF), perfective (PFT), punctual (PCT), and infinitive (INF)—have a complicated distribution and allophony based on verb classes. Montgomery-Anderson (2008, 2015) does not parse these elements as separate morphemes, but instead part of the stem. He claims that each verb has five different stem forms, which correspond to aspectual suffixes as described by Cook (1979:Chart 4) & Uchihara (2013:24). Montgomery-Anderson’s (2008; 2015) stems are Present Continuous (corresponds to stem+PRS), Incompletive (stem+IMPF), Immediate (stem+PCT), Completive (stem+PFT), and Infinitive (stem+INF).

The differences between these approaches (and advantages and disadvantages of each) is not relevant to this dissertation. For the sake of consistency, I present my examples using Cook’s (1979) and Uchihara’s (2013) morphological analysis (stem+aspectual suffix+modal suffix), rather than Montgomery-Anderson’s (2008; 2015) analysis (stem+(final suffix)).

²Montgomery-Anderson (2015) uses PFT for this morpheme, but I use FUT so that it’s not confused with the perfective aspectual suffix, also glossed PFT. I prefer Montgomery-Anderson’s glosses because the meaning is more transparent than Cook’s/Uchihara’s, which was one of Montgomery-Anderson’s goals in writing his grammar.

A list of abbreviations used in glossing, with their phonological form(s), is provided in Appendix A.

Finally, there are Cherokee words that do not have any prefixes or suffixes. These words denote concepts that are expressed in English with nouns, and tend to be words that refer to the natural world—animal names, plant names, celestial bodies, etc. Nouns are internally complex, and take prepronominal and pronominal prefixes, as well as derivational suffixes.

1.2.3 Word Order and Syntax

While Cherokee has typically been described as having free word order, the extent to which that word order can be affected by pragmatic factors, such as topicalization, focus, clause type and complexity of utterance is not clear.

As prototypical of polysynthetic languages, “Cherokee verbs are able to stand alone as grammatically complete clauses ... because their prefixes and suffixes indicate all participants involved in the verb as well as information about tense, aspect, and mood” (Montgomery-Anderson 2015:314). However, when overt NPs are present in the utterance to further specify the arguments of the verb, there is no canonical word order, though there are tendencies. When both the subject and object are third person, the subject tends to precede the object (Montgomery-Anderson 2015). This generalization, however, could still result in the following attested word orders:

- (1) a. SOV
- b. SVO
- c. VSO

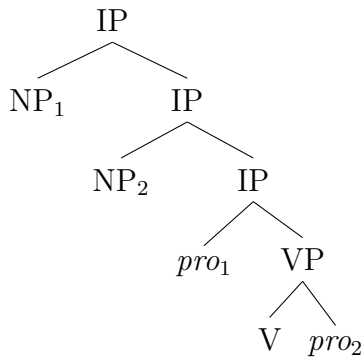
This flexibility in word order has led to the generalization that Cherokee has free word order, since all three orders in (1) essentially mean the same thing—all have the same subjects and

objects, and word order does not affect what is interpreted as a subject or object. However, since word order is flexible, it is possible to get two interpretations of a sentence like the following (2), where both NPs are animate.

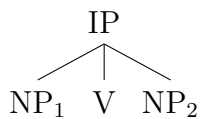
- (2) *najù achúúj yoónä ugoohé*
 na=ju achúúca yoóna uu-koooh-é(ʔi)
 that=CQ boy bear 3A-see:PFT-NXP
 ‘Did that boy see the bear?’ (DC, 2018)

In (2), it is possible to interpret either the bear or the man as the subject of the sentence, since both the subject and the object are third person and animate.

Since word order doesn’t determine interpretation of the sentence (and there aren’t case markings on the nouns), it has been proposed in both Cherokee and Northern Iroquoian languages (Baker 1996) that NPs are not arguments of the verb. This is the view that Beghelli (1996) takes for Cherokee. He proposes a hierarchical structure, where the NPs are adjuncts coindexed with pronominal morphemes that appear on the verb.



This view deviates from the previously assumed structure posited by Scancarelli (1987). In her view of Cherokee syntax, clause structure is flat.



In a hierarchical view of Cherokee syntax, the pronominal morphemes are the true subjects and objects of the utterance, while the overt NPs are there to specify additional referent information. The claim that NPs are adjoined is not unique to Cherokee among Iroquoian languages, nor among polysynthetic languages (Jelinek 1984). I assume a structure like Beghelli's (1996) in this dissertation.

1.3 Choosing a Writing System

For this dissertation, I have made a number of choices as to how to represent the language in writing. Every linguist who has worked on Cherokee has been faced with the task of writing the language in a way that is accessible to researchers, captures the relevant phonological contrasts, and still is readable to speakers of the language. Different scholars have weighted these concerns differently—more focus on phonetic detail over community readability or using multiple systems to appeal to different audiences—and so what is left in the literature is wide variety of representations, with little inter-author consensus.

In this section, I will discuss the various ways the language has been written (both by linguists and literate Cherokee speakers), and why I have chosen to write Cherokee the way I have in this dissertation. There are major four points of consideration as to writing Cherokee: *a)* whether to use the syllabary or a some other orthography, *b)* how to represent aspirated and unaspirated consonants, *c)* how to represent long and short vowels, and *d)* how to mark tone.

1.3.1 Cherokee Syllabary

The Cherokee syllabary is an important signifier of Cherokee identity and cultural heritage. It is the first writing system to be developed by indigenous people in the United States, and has been in continuous use since its creation. The Cherokee syllabary was developed in the early nineteenth century by Sequoyah, and adopted by Cherokee tribal

council in 1821 (Cushman 2011). Each grapheme in the syllabary represents the combination of a consonant (simplex or complex) and a vowel, except for the six in the first row, which are just a vowel. Below is the modern typeset version of the Cherokee Syllabary³.

Table 10: Cherokee Syllabary

	a		e		i		o		u		v	
	D	a	R	e	T	i	Ꭰ	o	Ꭱ	u	Ꭲ	v
k/g	Ꭰ	ga	Ꭱ	ka	Ꭲ	gi	Ꭳ	go	Ꭴ	gu	Ꭵ	gv
h	Ꭶ	ha	Ꭷ	he	Ꭸ	hi	Ꭹ	ho	Ꭺ	hu	Ꭻ	hv
l	Ꭼ	la	Ꭽ	le	Ꭾ	li	Ꭿ	lo	Ꮀ	lu	Ꮁ	lv
m	Ꮃ	ma	Ꮄ	me	Ꮅ	mi	Ꮆ	mo	Ꮇ	mu	*	
n/hn	Ꮎ	na	Ꮏ	na	Ꮐ	ne	Ꭰ	ni	Ꭱ	no	Ꭲ	nv
qu ¹	Ꭳ	qua	Ꭴ	que	Ꭵ	qui	Ꭶ	quo	Ꭷ	quu	Ꭸ	quv
s	Ꭹ	s	Ꭺ	sa	Ꭻ	se	Ꭼ	si	Ꭽ	so	Ꭾ	sv
t/d	Ꭾ	da	Ꭿ	ta	Ꮀ	de	Ꮁ	te	Ꮂ	di	Ꮃ	ti
tl/dl	Ꮄ	dla	Ꮅ	tla	Ꮆ	tle	Ꮇ	tli	Ꮈ	tlo	Ꮉ	tlu
ts ²	Ꮊ	tsa	Ꮋ	tse	Ꮌ	tsi	Ꮍ	tso	Ꮎ	tsu	Ꮏ	tsv
w	Ꮏ	wa	Ꮐ	we	Ꭰ	wi	Ꭱ	wo	Ꭲ	wu	Ꭳ	wv
y	Ꮑ	ya	Ꮒ	ye	Ꮓ	yi	Ꮔ	yo	Ꮕ	yu	Ꮖ	yv

While the syllabary has been credited with producing and maintaining and large number of literate speakers (Montgomery-Anderson 2008; Cushman 2011), many of the phonetic contrasts are neutralized in the use of the syllabary. The graphemes in all four resonant rows (/l n w y/) can represent syllables with onsets that are plain resonants, or resonant+[h] clusters, so the grapheme for ‘no’ can be pronounced [no] or [hno]. Vowel length is also not represented in the syllabary, so that same grapheme can also be pronounce [no:] or [hno:]. This neutralization also happens on the level of the word. In example (3) from Feeling et al. (2003), they contrast the representation of two words in syllabary and the traditional phonetic orthography, with a more detailed linguistic representation.

³The digraph <qu> is pronounced [k^w] or [k^{wh}], and the digraph <ts> is pronounced [tʃ] or [tʃ^h].

(3)

English	Syllabary	Traditional	Linguistic Representation
<i>I understand it</i>	AᵐS	go-li-ga	kooliika
<i>He understands it</i>	AᵐS	go-li-ga	kohlka

In (3), the two words for ‘I understand it’ and ‘He understands it’ have the same representation in the syllabary and in the traditional phonetic orthography, but have different pronunciations (different number of syllables, different vowel lengths, different tone). Feeling et al. (2003) notes that for native Cherokee speakers this lack of phonetic detail isn’t a problem, “since they can figure out instinctively what [the pronunciation] should be.” However, for learners, who do not have robust abstract representations of the language or the ability to intuit from context the intended meaning of the language written in syllabary, homographs like these can pose a challenge.

For linguists, the lack of phonetic detail in the syllabary has made the system undesirable for representing the language in academic work. The contrasts that native speakers can intuit (and therefore don’t need written down) are often what linguists have been interested in studying—i.e. aspiration and laryngeal metathesis (Munro 1996a), tone (Lindsey 1985; Wright 1996; Uchihara 2013). The only recent academic work to use the syllabary heavily in writing the language is Montgomery-Anderson’s (2015) grammar, which provides all examples in syllabary and in his own romanization.

It is only recently that any attempt has been made to alter the syllabary to include more phonetic detail. The Cherokee Language Master-Apprentice Program (CLMAP) uses a modified version of the syllabary that indicates both phonemic information (presence of long vowels, presence of glottal stop, underlying /h/ realized as aspiration) and phonetic information that has arisen via process (deletion of word-medial vowels to resolve dispreferred sequences, prosodic deletion of word-final vowels). This modification of the syllabary is done through the addition of punctuation marks (. : , ” ; ! ’).

(4)

English	Syllabary	CLMAP Modified Syllabary	Phonetic
<i>downstream</i>	FT	FT:	[keʔi:]

While the modified syllabary does allow for the addition of phonetic detail to the written form of the language, it still does not have any way of marking tone. While I think it will be interesting to see if the modifications made to the syllabary catch on with Cherokee learners (especially since it is so easy to employ in texting, and does not require special keyboards beyond the Cherokee syllabary keyboard), it is still not the writing system best suited for linguistic analysis.

1.3.2 Aspiration

In her introduction to the conventions of the UCLA working papers, Munro (1996b) notes that there have been a number of conventions for romanizing Cherokee. One of the outstanding problems in writing Cherokee (and other Iroquoian languages) in a ‘phonetic’ system, i.e. with a Latin alphabet, is how to capture phonetic contrasts and speaker intuitions, while also maintaining relevant phonetic detail for linguistic analysis. As mentioned above in §1.2.1.1 in the discussion of consonant inventories, the role that /h/ and aspirated consonants plays in the inventory and writing system is not entirely settled. When there is an [h] next to an obstruent or resonant (whether it is underlyingly there or came to that position via process), the [h] surfaces as aspiration on that obstruent or resonant. How this aspiration has been represented in the orthography has differed from scholar to scholar, and from academic works to community output.

Scancarelli (1987) and Cook (1979) (among others) choose to represent surface aspirated stops (e.g. [t^h], [k^h]) as sequences of a stop+/h/ (e.g. <th>, <kh>). This decision allows for some consistency from underlying representation to surface representation, and transparency of processes like Laryngeal Metathesis (so that you can see where the /h/ starts

in the underlying form and where it ends up in the surface form). Unaspirated surface stops are simply represented as their IPA graphemes: <t> for [t], <k> for [k], etc.

In the UCLA Cherokee papers, Munro (1996b) and the students who produced the other papers decided to use the romanization in the Feeling (1975) Dictionary and Pulte & Feeling (1975) grammar sketch. In this system, unaspirated stops (which to English ears sound voiced or almost voiced) are written <d> for [t], <g> for [k], etc. Aspirated stops are not written as a cluster stop+/h/, but instead with a single grapheme <t> for [t^h], <k> for [k^h], etc.

While the ‘t/th’ system that Scancarelli (1987) and Cook (1979) employs is desirable for surface transparency and one-to-one grapheme-to-phoneme correspondence, the ‘d/t’ system that Munro (1996a) and Feeling (1975) use is perhaps more accepted by the community. Munro (1996b) notes that intuitions of native speakers of Cherokee more align with the ‘d/t’ system (though this could be an effect of the syllabary or other written materials), and therefore sees it as preferable over the more analytically transparent ‘t/th’ system.

However, instead of choosing between the two systems, I will follow Uchihara’s (2013) precedent and use both the ‘d/t’ and ‘t/th’ phonetic writing systems. I will represent the top line of any examples in the ‘d/t’ system, with lower lines (i.e. lines with morpheme breaks) in the ‘t/th’ system. By using both systems, I can represent the language in a way that has broader community acceptance and understanding with the ‘d/t’ system, as well as preserve the phonetic detail present in the ‘t/th’ system.

- (5) **‘d/t’:** *ksdeéla*
‘t/th’: sk(i)-steél-a
gloss: 2/1-help:IMP-IND
Free translation: ‘Help me!’

The following chart, based on Koops (2006), shows the correspondences between systems of representing consonants and a phonetic transcription (Table 11)⁴.

Table 11: Consonant correspondences

Unaspirated			Aspirated			Never aspirated
‘d/t’ system	‘t/th’ system	IPA	‘d/t’ system	‘t/th’ system	IPA	
d	t	[t]	t	th	[t ^h]	m, ʔ, h, s
g	k	[k]	k	kh	[k ^h]	
j	c	[tʃ]	ch	ch	[tʃ ^h]	
dl	tl	[tl]	tl	tlh	[tl ^h]	
gw	kw	[k ^w]	kw	kwh	[k ^{wh}]	
w	w	[w]	hw/wh	hw/wh	[w̥]	
y	y	[j]	hy/yh	hy/yh	[j̥]	
n	n	[n]	hn/nh	hn/nh	[n̥]	
l	l	[l]	hl	hl	[l̥]	

1.3.3 Long and short vowels

While not as debated in the academic literature, the representation of short and long vowels is also an issue to consider when writing Cherokee. Both the syllabary and traditional writing system don’t make a distinction between short and long vowels; all vowels are written the same regardless of length (6).

(6)

English	Syllabary	Traditional	IPA
<i>water</i>	Dḥ	ama	[ama]
<i>salt</i>	Dḥ	ama	[á:ma]

The Feeling (1975) Dictionary distinguishes between short and long vowels by marking short vowels with a dot under the letter, and leaving long vowels are unmarked. The Feeling (1975); Pulte & Feeling (1975) way of marking vowels is generally not the way that most

⁴Often in papers on Northern Iroquoian languages, the Americanist Phonetic Alphabet *c* is used for the affricate /ts/. As discussed above, I think this affricate is /tʃ/ in contemporary Cherokee, but following Uchihara (2013), I use *c* to refer to this affricate in the ‘t/th’ transcriptions.

academic sources differentiate between long and short vowels. Linguistic analyses choose instead to mark long vowels, either with the IPA long vowel symbol : (Cook 1979; Scancarelli 1987; Uchihara 2013) or by doubling the vowel (Lindsey 1985; Montgomery-Anderson 2015; Feeling et al. 2003; Uchihara 2013).

(7)	English	Pulte & Feeling (1975) Feeling (1975)	Cook (1979) Scancarelli (1987)	Montgomery- Anderson (2015)	IPA
	<i>water</i>	ạ ² ma	ama	ama	[ama]
	<i>salt</i>	a ³ ma	á:ma	áama	[á:ma]

For this dissertation, long vowels will be represented as doubled vowels. In recent major works on the language (Montgomery-Anderson 2015; Uchihara 2013), doubled vowels have been used⁵. Additionally, recent output from community scholars, such as Feeling et al. (2003), uses doubled vowels in all of their written examples.

Doubled vowels will also be useful when creating autosegmental representations of tone (and discussing the behavior and patterns of pitch more broadly in the language), since the Tone Bearing Unit (TBU) for tone is the mora, rather than the vowel (§2.6).

1.3.4 Writing Tone

The final necessary consideration that needs to be made for writing Cherokee is how to mark tone and other pitch phenomena. Feeling’s (1975) Dictionary is the first work that marks tone. Previous academic analyses (e.g. King 1975) and language written down by Cherokee native speakers (e.g. in newspapers, on legal documents, etc.) didn’t include tone in their representations. For native speakers, tone marking is unnecessary, since they have full mental representations of the language (Koops 2006). However, for learners and for linguists, tone marking is a crucial part of writing Cherokee. For learners, they need as much phonetic detail of the language in the written record so that they can create mental

⁵Uchihara (2013) marks long vowels with the IPA long vowel symbol : for the top line of his examples (those written in the ’d/t’ system), but uses doubled vowels for his phonetic representations.

representations of the language; Koops (2006) claims that the choices to mark long and short vowels and tone in the Feeling (1975) Dictionary were made to aid second-language learners with the language. For linguists, whose interests are often in the pitch contrasts and complexities of Cherokee, including some marking for tone is necessary to describe and analyze pitch patterns.

In this dissertation, I use a system of marking tone most similar to Uchihara's (2013). The only difference between our systems of marking tone is how the superhigh and boundary tone are marked. Following Feeling et al. (2003), I mark superhigh accent as $\acute{\acute{a}}$ ⁶. Unlike any previous system I also mark the boundary tone. Since the boundary tone is predictable (Feeling 1975; Montgomery-Anderson 2008; Uchihara 2014), it has traditionally been unmarked. However, since much of this dissertation will deal with the boundary tone and its placement, I mark the boundary tone as \grave{a} on examples from my fieldwork, or that I have recordings of⁷. Finally, since surface contours are not phonemic, and knowing to which mora the high tone associates is crucial for tone analysis, I will mark low-high and high-low contours with a high tone on the mora to which it associates. Instead, I will write them following the system from Feeling et al. (2003) to show that high-low and low-high surface contours are not one unit, but rather the result of two tones in sequence ($\acute{a}a$ and $a\acute{a}$ for high-low and low-high respectively).

Table 12 shows a comparison of how tone has been written in previous research, and the system of tone marking to be used in this dissertation.

⁶This marking also represents that the TBU for the superhigh is the syllable, rather than the mora.

⁷Since historically this tone hasn't been marked, in written examples that come from other sources, I will not mark the boundary tone because I cannot do so with any kind of certainty.

Table 12: Comparison of tone in orthography

	Pulte & Feeling 1975	Munro 1996	Montgomery-Anderson 2008, 2015	Uchi-hara 2013	Cornelius 2018
low	a ²	à, àà	a, aa	a, a:/aa	a, aa
high	a ³	á, áá	á, áa	á, á:/áá	á, áá
low-high	a ²³	àá	aá	ǎ:/aá	aá
high-low	a ³²	áà	áà	â:/áa	áa
low fall	a ¹	àa	aà	à:/àà	àà
superhigh	a ⁴	áa	áá	ǎ:/aǎ	ǎǎ
extra high fall	a	a	a	a	à

1.4 Data sources

Data used for this dissertation comes from fieldwork that I have done, supplemented by previously published data. I have conducted fieldwork on Cherokee starting in 2013, spending about 2-3 weeks per year in Tahlequah, Oklahoma. My fieldwork includes texts, elicitation, speaker judgements, and some informal experimentation.

To recognize the contributions and expertise of speakers I have worked with, I credit each speaker I worked with by their initials. I have worked primarily with male speakers, the youngest being in his early- to mid-forties, while the rest (male and female) are in their sixties to eighties. While recordings were made in Tahlequah, OK, the speakers I worked with mostly came from surrounding communities, such as Jay, Greasy and Marble City.

Examples not from my fieldwork come from a variety of sources. Additional audio examples come from Montgomery-Anderson's (2015) reference grammar, as well as a recording of a story he provided me. The recordings for his grammar come from one male speaker, Durbin Feeling, and the recording of the story comes from another male speaker.

Additional written examples come from Feeling (1975); Scancarelli (1987); Haag (1999); Montgomery-Anderson (2008, 2015); Uchihara (2013).

1.5 Organization

The main goal of this dissertation is to account for the prosodic word domains in Cherokee, and the distribution of edge marking phenomena. In order to provide an analysis for the prosodic phonology of Cherokee, a reexamination of tone analyses is first necessary (Chapter 2). In Chapter 2, I demonstrate the pitch melodies in Cherokee, and discuss the ways pitch has been previously analyzed. In Chapter 3, I argue for a few modifications to Uchihara's (2013) analysis, including the addition of an underlying low tone. The basic tonal properties and constraints argued for in this chapter become the building blocks for analyzing the boundary tone.

In Chapter 4, I introduce the six minimally distinct forms that will need to be accounted for in this dissertation and show canonical syllables in Cherokee. Also in that chapter, I show the patterns of deletion found with Word-Final Vowel Deletion (WFVD), and discuss the impact of laryngeals on syllabification and WFVD. Chapter 5 shows how Cherokee enclitics both fit in to and differ from traditional views of second-position clitics. I discuss how Cherokee clitics attach, and evaluate three approaches to clitic linearization. Both WFVD and clitic form and attachment condition the location of the boundary tone, so these chapters are crucial for establishing what right edges of words look like in Cherokee.

Chapter 6 describes the distribution of the boundary tone for words with and without WFVD, and with and without a toneless clitic. I also show in this chapter that two clitics must have underlying tone, and that lexical tone on the clitic pushes the boundary tone into the word one syllable.

Finally, in Chapter 7, I provide a complete analysis for boundary tone placement. I use a Stratal OT framework to show that surface forms can be accounted for by three levels of phonological processes and operations in the phonetics/phonology interface. A Stratal OT approach allows me to account for processes of WFVD and boundary tone alignment

occurring in different prosodic domains, how prosodic words domains of different sizes are created, and clitic linearization.

CHAPTER 2

CHEROKEE PITCH AND TONE ANALYSES

2.1 Introduction

The nature of Cherokee tone has been of long-standing interest, with many different analyses proposed to explain the surface pitch melodies. Some researchers have claimed Cherokee is a pitch accent language, with two types of accent (Lindsey 1985), while others argue that the distribution and behavior of pitches are more like a tone language (Feeling 1975; Montgomery-Anderson 2015), or a language that has both tone and accent (Wright 1996; Johnson 2005; Uchihara 2013). In this chapter, I will discuss what tone and accent languages look like, provide examples of pitch melodies in Cherokee, and examine four major previous accounts of Cherokee pitch.

2.2 Accent v. Tone

Hyman (2006) claims that there are three possible word-prosodic systems: stress accent, tone, and pitch accent. Stress accent and pitch accent languages essentially do the same thing; they mark prominence of some metrical constituent. Both stress and pitch accent languages can mark prominence with pitch, but the pitch melody of stress may show some variation, while the pitch melody of pitch accent will be invariant (Hayes 1995; Beckman 1986). Therefore, in this discussion of accent and tone, I consider stress accent and pitch accent into a single category: accent.

Tone and accent are not necessarily phonetically distinct—the pitches themselves do not have any inherent tonal or accentual properties. Both tone and accent are instead realizations of pitch within a system, and the behavior of pitch in a tone system will look

different than the behavior of pitch in an accent system. Within a system, pitch is relative—i.e. there is no absolute value we expect for all ‘high’ pitches in a language.

Three major points of phonological distinction between accent and tone can be summarized as (from Hyman 2006):

- (8) a. Tone is lexical; accent is post-lexical
- b. Tone is featural and paradigmatic; accent is structural and syntagmatic
- c. Tone is identified on each tone-bearing unit (TBU); accent is located in the word (Hyman 2006)

A language with accent is one that marks word-level prominence with pitch (i.e. a higher pitch than surrounding syllables), while a tone language has “indications of pitch” at an underlying level (Hyman 2006:229).

Accent is not (necessarily) part of the underlying representation of a word or a morpheme. Rather, it is a means of marking prosodic, not morphemic, structure. With accent, “rules of the lexicon cannot introduce tones without introducing new phonological categories” (Pulleyblank 1986:46).

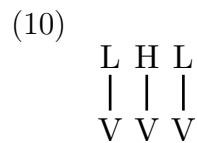
Tone is lexically determined in at least some morphemes—the “indication of pitch” is part (or all) of the lexical entry for a morph. Tones may also be introduced by rule in the lexical phonology, and apply cyclically (Pulleyblank 1986). In a particular language, all morphemes may be specified for a particular pitch, but it is also possible that only some or very few morphemes have tone. For example, Kinga, a Bantu language of Tanzania (Schadeberg 1973), and Nubi, a Sudanese-Arabic based creole (Gussenhoven 2006), allow only one tone per word. However, despite the sparse distribution of tones, Hyman (2006) considers these two languages to be tone languages because the pitch is lexical, and not derived from metrical structure.

Accent, as discussed above, is part of the metrical structure of a word; it therefore marks the most prominent syllable, and can be moved or deleted to satisfy the need to be metrically well-formed. Tone, being lexically assigned or introduced by (lexical) phonological rules, can move, spread, form contours, etc. in order to be *tonally* well-formed (Goldsmith 1976; Pulleyblank 1986).

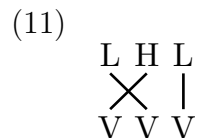
Both accent and tone are autosegmental, i.e. on separate phonological tiers from the phonemic representation. Accent is found on the metrical tier and tone on the tonal tier. On the metrical tier is a grid used to indicate varying levels of prominence (cf. Hayes 1995), and stress or accent is assigned to the most prominent syllable. On the tonal tier are unassociated, lexically determined tones, which associate (or link) to segments on the phonemic tier by convention. Pulleyblank (1986:31) proposes two general rules for tone association and wellformedness:

- (9) a. ASSOCIATION CONVENTIONS:
 Map a sequence of tones onto a sequence of tone-bearing units, a) from left to right, b) in a one-to-one relation.
- b. WELLFORMEDNESS CONDITION:
 Association lines do not cross.

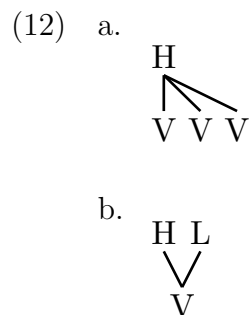
The representation in (10) is an example of an autosegmental representation. There are three tones on the tonal tier, and three segments (in this case, some vowel which acts as a TBU) on the phonemic tier.



This example (10) is well-formed because each tone is associated to a single TBU. Additionally, the first tone (from left to right) is associated with the first available TBU, the second tone with the second available TBU, etc. Contrast (10) with the example in (11):



In (11), the first tone is associated to the second TBU, and the second tone is associated to the first TBU, creating crossing association lines. This example (11), is therefore not well-formed. Based on the conditions in (9), the examples below in (12) *should* also not be well-formed, but are generally considered to be well-formed by language-specific tone association conventions:



These examples have one tone associated to multiple TBUs (12a), or multiple tones associated to one TBU (12b). Though these examples do not follow the association conventions as discussed in (9), forms like the above are common in tone languages.

While Pulleyblank (1986) argues that the general rules which govern association and wellformedness (9) are universal, individual languages may have rules that allow for one tone being assigned to multiple TBUs (i.e. spreading), or multiple tones being assigned to one TBU (i.e. contour tones). Spreading and contour tones are well-attested in tonal languages, though specific languages may allow or disallow spreading, and allow or disallow contour tones. However, it would not be surprising to find a tone languages that has tone spreading, contour tones, or both.

Spreading and contours are hallmarks of tone, but not of accent. Accent appears on the most prominent part of a metrical constituent, and cannot spread to other metrical

constituents, or combine with other prominent elements to make a new accent. A pitch accent may be complex—its melody may rise from a lower pitch to a higher pitch, or fall from a higher pitch to a lower pitch. However, two pitches of an accent do not associate to a syllable the same way tone does. An accent will always be the same melody (whether simple or complex); its surface form is not due to association conventions.

Though these two systems (tone and accent) use pitch differently, there is no reason to assume that these two systems can't coexist in a single language. Hyman (2006) points to Saramaccan, a creole spoken in Suriname and French Guiana, which has a stratified lexicon. In Saramaccan, some words have tone, while others have pitch accent (Good 2004). Remijsen (2002) claims that it is also possible for properties of both tone and accent to surface on a single word in Ma'ya, an Austronesian language of Papua New Guinea. The tone and stress accent systems of Ma'ya operate independently of each other, and are both lexically distinctive.

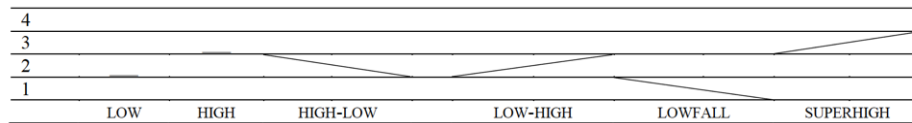
Therefore, it could be the case that Cherokee is simply an accent language, simply a tone language, or a language that has both tone and accent—previous accounts have argued for all three possibilities. This chapter examines previous analyses of Cherokee pitch, comparing those accounts' classification of Cherokee data, and fits the data, in an effort to determine whether Cherokee fits the expected behavior of a tone or accent language (or both).

2.3 Cherokee Pitch Melodies

Before discussing how previous analyses handle Cherokee pitch, it is important to first have a sense of the surface melodies observed in the language. Cherokee is traditionally described as having 6 tones (see Feeling 1975 for example) or 7 tones (Koops 2006). However, as I will discuss in this chapter and the next chapter (§3), these conventional systems seem to conflate a number of pitch phenomena occurring in Cherokee—lexical tone, pitch accent,

and intonation. Putting aside the potential seventh tone (a predictable boundary tone, see §6), the most commonly discussed and accepted “tones” in the language are the six melodies schematized in Figure 1.

Figure 1: Tone Schematization (Uchihara 2013)



This figure shows an approximation of the six melodies, two level and four contours. The numbers 1-4 approximate the relative pitch range and pitch targets for these melodies. There is a level low, a level high, a contour that falls from high to low (high-low), a contour that rises from low to high (low-high), a contour that falls from low to a lower point (lowfall), and a contour that rises from high to a higher point (superhigh). The low and high can occur on both long and short vowels, while the contours can only appear on long vowels (see 2.6.2).

Melody	Abbreviation	Vowel Length	Position in a Word
Low	L	V, VV	anywhere, except word-final σ
High	H	V, VV	anywhere, except word-final σ
High-low	HL	VV	anywhere, except word-initial and word-final σ
Low-High	LH	VV	anywhere, except word-final σ
Lowfall	LF	VV	anywhere, except word-final σ
Superhigh	SH	VV	penultimate or antepenultimate σ
Boundary Tone	H%	V, VV	word-final σ

In the following sections showing the phonetic pitch melodies §2.3.0.1-2.3.1, monomorphemic nouns are used when possible. The expectation is “that suprasegmental processes would be at their most transparent in [monomorphemic] forms” (Haag 2001:413). Examples

and recordings come from Montgomery-Anderson (2015), unless otherwise indicated—all recordings made by Montgomery-Anderson (2015) are of the same speaker, Durbin Feeling. Whether the recording is Montgomery-Anderson’s (2015) or mine, pitch traces are made by me. The final syllables in the following words has a H% boundary tone. As will be discussed in 6, the boundary tone can have a falling or level pitch phonetic realization.

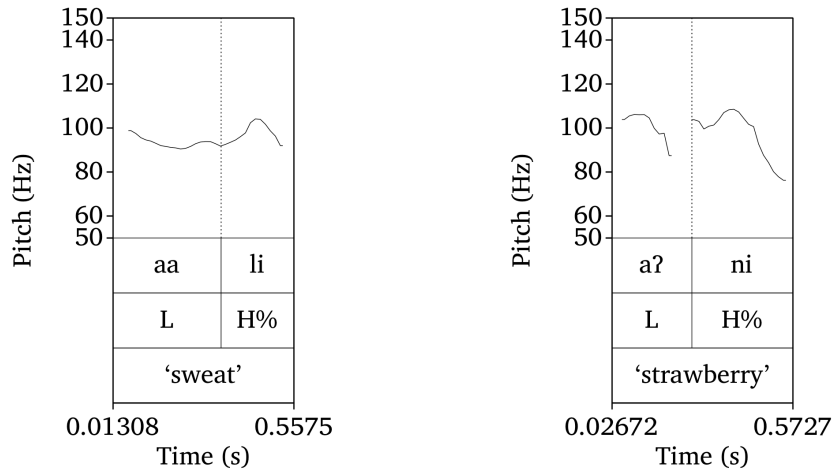
2.3.0.1 Low

Lows appear on long (13a) and short vowels (13b), and in all positions in the word, except the final syllable or one mora tonal dip sequences, such as $\acute{V}\acute{V}C\acute{V}\acute{V}C\acute{V}\acute{V}$. Low pitches are the most frequent (Uchihara 2013).

- (13) a. aali
 ‘sweat’
 b. aʔni
 ‘strawberry’

In the following pitch traces, the first syllables have low pitches on their first syllables. The word *aali* ‘sweat’ has a long low pitch, and the word *aʔni* ‘strawberry’ has a short low pitch. The final syllables of both words (and all other words in the examples with other phonetic melodies) have a boundary tone, which will be discussed in later in this section, and in depth in §6.

Figure 2: Low



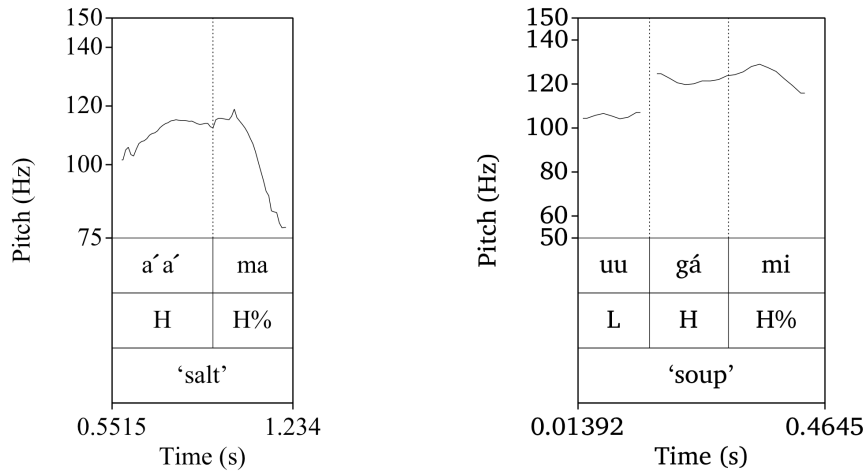
2.3.0.2 High

Highs also appear on long (14a) and short vowels (14b), and also can occur on any syllable in the word, except the final syllable. As (14) shows, highs can be initial (14a) or medial (14b).

- (14) a. *ááma*
 'salt'
 b. *uugámi*
 'soup'

In the following pitch traces, the word *ááma* 'salt' has a long high pitch on the first syllable, and the word *uugámi* 'soup' has a short high pitch on the second syllable (the first syllable has a long low pitch).

Figure 3: High



2.3.0.3 Low-High and High-Low

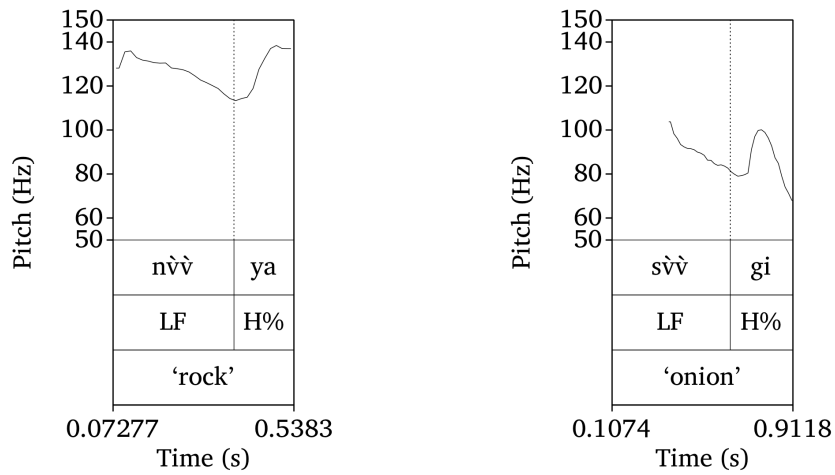
The the high-low starts at the level of a high and falls to the level of a low (15a), and low-high melody starts about the same level of a low and rises to a high (15b). Both the the high-low and low-high phonetic melodies only occur on long vowels—there are no contours on short vowels.

(15) *kiyúuga*
‘chipmunk’

(16) *yoóna*
‘bear’ (DC, June 2017)

In the following pitch traces, the word *kiyúuga* ‘chipmunk’ has a short low pitch on the first syllable, and a pitch that starts high and falls on the second syllable. The word *yoóna* ‘bear’ has a pitch that starts low and rises on the first syllable. In §2.5 and §2.6, previous treatment of these contours as tonemes or sequences of tones is discussed.

Figure 5: Lowfall



Though both the high-low and lowfall have falling melodies, there is distributional and behavioral evidence as to why we should think of them as distinct pitch patterns. First of all, high-low rarely occurs on the first syllable of the word, while lowfall frequently does occur on the first syllable. Secondly, when preceded by a low, the lowfall starts at the same level as the low and falls to a lower point, while the high-low starts higher than the low and falls to about the point of the low (see Figure 6).

Figure 6: LF v. HL - Preceded by L

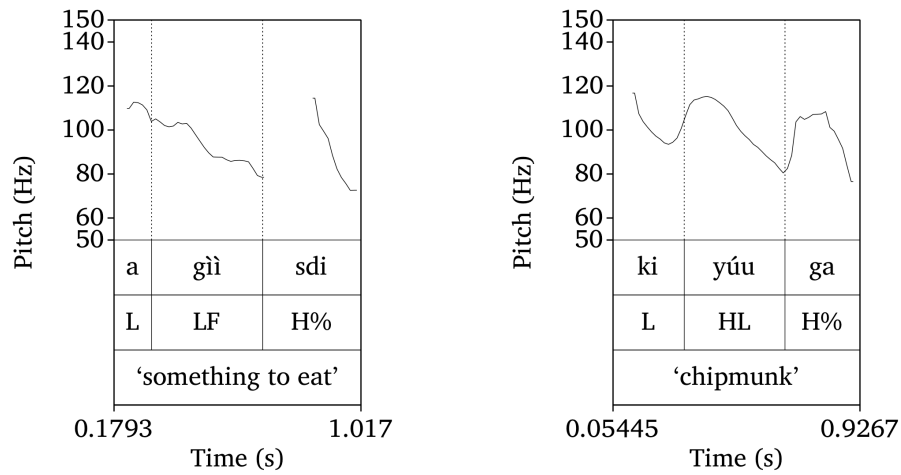
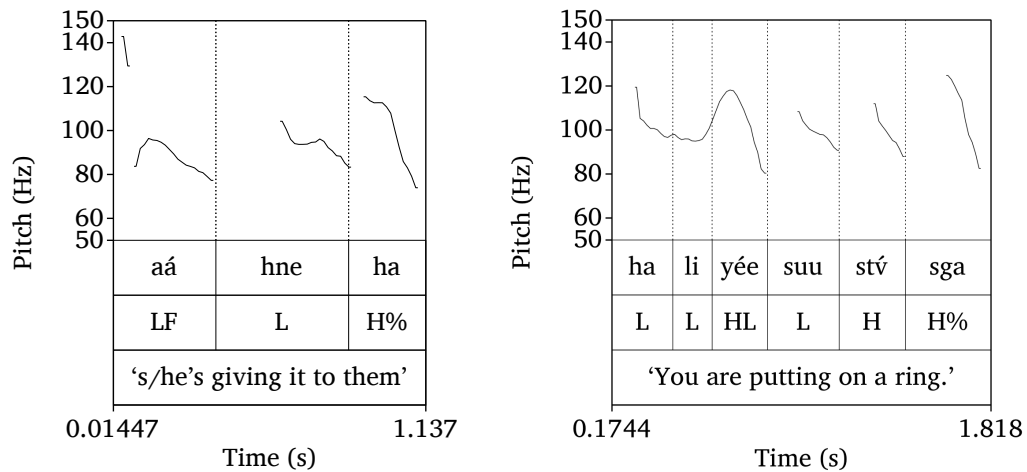


Figure (7) shows the phonetic realization of LF and HL when followed by a low tone. For the word *aàhneha* 'S/he's giving it to them', the peak of the LF on the first syllable is about at the same level as the following low tone. For the word *haliyéesuustúsga* 'You are putting a ring on', the peak of the HL contour is higher than the following low tone.

Figure 7: LF v. HL - Followed by L

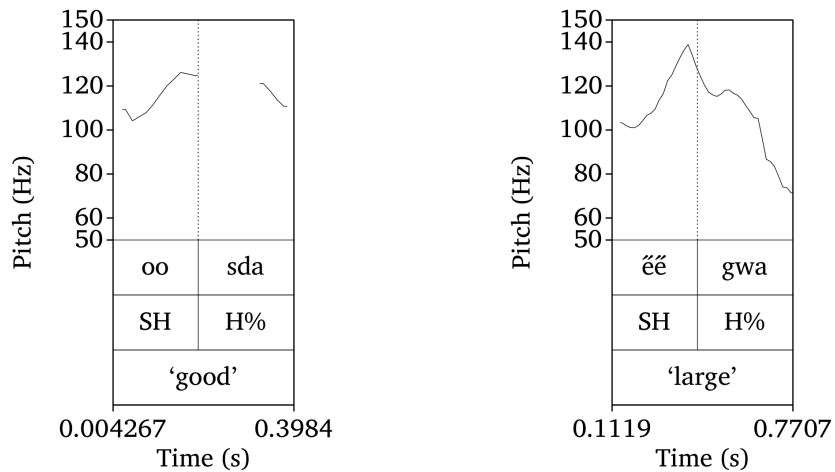


2.3.1 Superhigh

The superhigh starts at about the level of a high tone (though it can start lower) and rises to a point higher than a high. Uchihara (2013:177) characterizes the superhigh as “a gradual rise in pitch that rises to a point above the normal high tone register”. The superhigh also may only appear once per word.

- (18) a. ǒǒsda
 ‘good’
 b. ǎǎgwa
 ‘large’

Figure 8: LF v. HL



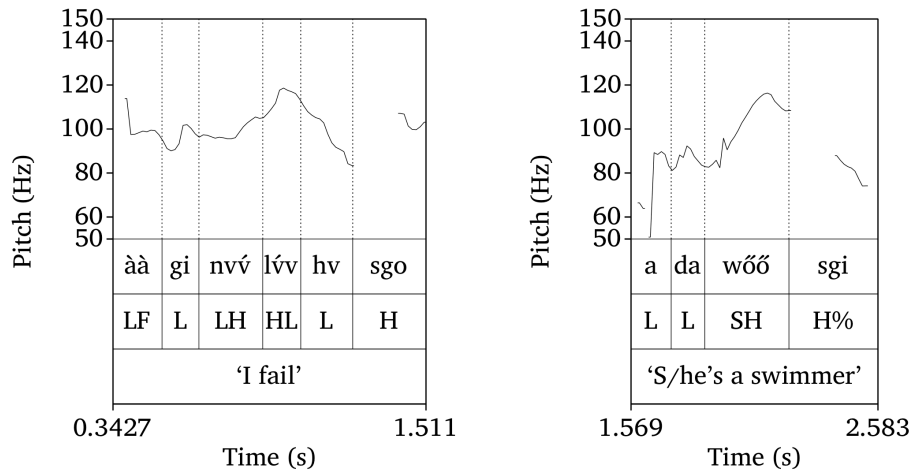
The low-high and superhigh can be differentiated by several factors. First of all, since the superhigh shows accentual properties (see §2.6), it should only appear once per word; the low-high has no such restriction.

- (19) a. *yigawóon^{'''}iíha*
 yi'-ka-woon-iih-a
 IRR-3A-speak-PRS-IND/SH
 'When s/he is speaking.' (Uchihara 2013:331)
- b. *ùùdaadoó^{''}líistanvú?i*
 uu-taatoóliista-hn-vvú?i
 3B-pray-PFT-EXP
 'S/he prayed' (Feeling 1975:2)

In (19a), the superhigh appears once in the word, on the penultimate syllable. In (19b), a LH melody can be observed on two syllables in the same word, on the third syllable [doó] and on the penultimate syllable [nvú].

Secondly, the the superhigh will rise to a point higher than the register of a normal high tone, while the low-high often doesn't show much of a rise at all.

Figure 9: LF v. HL



- (20) a. *ààginvólóvhvsgó jalagi agiwooniíhístííʔi*
 aki-nv́lív́hv-sk-ó(ʔi) calagi aki-woonií-híst-iiʔi
 1B-fail-IMPF-HAB Cherokee 1B-speak-INF-NOM
 ‘I can’t speak Cherokee.’ (Montgomery-Anderson 2015:96)
- b. *adawóósgí*
 a-ataa-awóo-sk-i
 3A-MDL-bathe-IMPF-AGT
 ‘S/he’s a swimmer.’ (Montgomery-Anderson 2015:123)

In Figure 9, the LH in the word *ààginvólóvhvsgo* does not have as large a pitch excursion as the SH. Additionally, the peak of the LH is on the following syllable (which has a high-low melody—see discussion of spreading in §2.6.3), while the peak of the superhigh occurs before the end of the syllable.

2.3.2 Boundary Tone

The ‘seventh tone’ of Koops’ (2006) system—the boundary tone—is an extra high fall that starts at about the level of a superhigh and falls to a lower point, though the “downslur [is not] always present” (Lindsey 1985:125). Haag (1999:35) explains the differences in its phonetic realization, saying that this seventh tone is “a ‘falling superhigh’ ... unless preceded by a superhigh, in which case it is a normal high.” Despite the multiple phonetic realizations, this tone is considered to be predictable—occurring only on final-syllables of words. The boundary tone will be discussed in detail in §6.

2.4 Tone Systems

There are several different ways to analyze the role of pitch in Cherokee. Potentially, Cherokee could have six tonemes; many languages of Central America have six or more tones, including phonemic contours. San Martín Itunyoso Trique, for example has nine tones—four level tones and five contours—which can all be found on monosyllabic words

(DiCanio 2008). Another potential analysis is to assume that the contours observed in Cherokee are not tonemes, but instead sequences of tones. The distribution of tones in Cherokee lends itself to an analysis where contours are a sequence of tones. The most telling piece of evidence is that contours only appear on long vowels—this fact has led many researchers working on Cherokee to conclude that high-low and low-high melodies are the surface representation of an underlying low followed by high, or vice versa (see §2.6.1-2.6.3). Additionally, the distribution of surface melodies could be further complicated by the presence of other phonological systems which use tone, like accent and intonation.

In the following sections, I give an overview of previous analyses on pitch in Cherokee. The focus of these sections will be on high and low pitches, and the high-low, low-high, and lowfall contours. Little attention will be paid to the superhigh in this chapter. The superhigh is cumulative, appearing only once per word if present, and therefore has been conventionally called an accent (Johnson 2005; Uchihara 2013).

Cherokee accent (the superhigh melody) is described by Johnson (2005:5) as “[o]ne prominence-marking pitch accent per word may occur on the penultimate or antepenultimate syllable.” He contrasts this with lexical tone, which “may co-occur before the pitch accented syllable, and in longer words there may be more than one lexical tone” (Johnson 2005:5). Wright (1996) additionally makes it clear that the superhigh is accent rather than tone since it overrides the tonal melody of the syllable it occurs on, something that no other tone does in the language.

Pitch accent additionally has been identified in Lake Iroquoian languages (a subset of Northern Iroquoian languages that includes Mohawk, Oneida, Onondaga, Seneca and Cayuga), stemming from a Proto-Northern Iroquoian (PNI) penultimate accent (Michelson 1988). Mithun (1974:280) also shows that Tuscarora, another Northern Iroquoian language, has penultimate stress that is accompanied by a high or rising tone. The Cherokee superhigh accent may be a remnant of a Northern Iroquoian-like quantity sensitive stress system, which

has been preserved only on adjectives, locatives, deverbal nouns and verbs in subordinate clauses (Wright 1996; Yip 2002).

2.5 Analysis 1: Six Tones

The analysis used by both Feeling (1975) and Montgomery-Anderson (2015) is a six tone system: all phonetic melodies (Low, High, Low-High, High-Low, Lowfall, and Super-high) are contrastive “tones”. The boundary tone is unmarked in the dictionary, but it is identified in the forward matter of the dictionary.

This account doesn’t attempt to analyze the contour tones as smaller units, but instead focuses on showing how these phonetic melodies contrast in the language. This is the way the tone system of the language is taught in the immersion school in Tahlequah, OK, and revitalization teaching efforts have also employed this system (see Herrick et al. 2013).

The advantage of this analysis is its relative simplicity, which could be easier for learners. Learners don’t necessarily need to know whether or not a contour is phonemic or not—just that it can be found in the language. Despite its potential pedagogical advantage, it is analytically opaque. This kind of analysis would require that the melody on every syllable be determined and learned (whether native speaker or second language speaker), rather than produced by rule. It therefore probably does not give us a good sense of how tone operates.

2.6 Analysis 2: High Tone Analyses

Despite the community acceptance of a six tone analysis after the publication of the Feeling (1975) dictionary, Cherokee researchers have questioned the underlying representations of tone in the language, and sought an autosegmental analysis of the tone system of Cherokee.

The observation that the four contour tones also occur only on long vowels has prompted researchers (Lindsey 1985; Wright 1996; Uchihara 2013) to question whether these contour tones are underlying units or the surface forms of the concatenation of underlying sequences of tones. Since Cherokee has long and short vowels, these systems argue that the mora is the Tone Bearing Unit (TBU) of the language, and some contour tones are the result of a high associating to one mora of a long vowel, and a (default) low associating to the other mora.

Cook (1979) claims that only a high toneme is necessary to account for the high and low level pitches, as well as the high-low and low-high contours. This claim seems to have influenced tonal analysis that followed—no linguist has so far argued for a low toneme.

In the sections below (§2.6.1-§2.6.3), I will explain the arguments for the tone and accent system of Cherokee put forward by previous researchers. I will discuss below the development of academic analyses of Cherokee pitch phenomena from purely accentual to hybrid tone/accentual systems. In all three systems discussed below, there is an argument for a privative system (/H/ v. / \emptyset /), plus a lowfall tone (or accent) and superhigh accent.

2.6.1 Analysis 2a: Lindsey 1985

In Lindsey's (1985) explanation of the pitch phenomena seen in Cherokee, he argues that Cherokee has a pitch-accent system, rather than a true tone system. He divides the system into 'atonic' and 'tonic' accent—'atonic' accent words have the superhigh accent (mostly on the penultimate syllable), and 'tonic' accent words have high tone accent (which can occur anywhere in a word). The idea of tonic and atonic forms doesn't originate with Lindsey, but rather with Cook (1979), who claimed that the morphosyntactic properties of a word determine whether it is tonic or atonic. Under Cook's (1979) configuration of tonicity, tonic forms include indicative main verbs and some non-derived nouns, while atonic forms

include deverbal nouns (most nouns), adjectives, and subjunctive, infinitive and subordinate forms of verbs.

Atonic accent is culminative, and the accentual unit for atonic accent is the word. The phonetic realization of atonic accent is the superhigh, which occurs almost always on the penultimate syllable in Feeling's (1975) dictionary. Lindsey (1985) notes however, that it can also appear on a long vowel in the antepenultimate syllable if the penult is short, or the first syllable of disyllabic words.

He contrasts this with tonic accent, which he claims is not so culminative as the atonic accent, since a word in a tonic form "may lack accent altogether" (Lindsey 1985:129). Unlike the atonic accent, the tonic accent's accentual unit is the morpheme, and there may be at most one tonic accent assigned per morpheme. He claims the tonic accent (high tone) is assigned to the first mora of the morpheme and iterates rightward over the remaining moras. If H is assigned to the first mora of a long vowel, H iterates to the right, and a long H surfaces. However, if H is assigned to the second mora of a long vowel, LH surfaces, because any toneless moras to the left of an accented mora (that don't get their tone from some other accented morph), are assigned low by default.

Lindsey (1985) states that at that time it was not clear how far rightward an H might iterate, though there was evidence that it could spread over syllable boundaries. He tentatively claims that H iterates only one mora to the right (regardless of morpheme and syllable boundaries)—something that Wright (1996) deals with in his analysis (discussed below in §2.6.2).

Lindsey (1985) argues that the lowfall melody is not an accent or tone, but instead the result of a phonological process, or interaction of phonological processes. He noticed that lowfall seems to arise from a historic loss of glottal stop in the Oklahoma dialect of Cherokee. Compare the two synchronic forms of the word 'onion' in 21—in the North Carolina form,

there is a short vowel and a glottal stop, while in the Oklahoma form, there is a long vowel and falling tone.

- (21) a. svʔki (NC)
b. sv̀̀gi (OK)
 ‘onion’

This loss of a glottal stop and concurrent low/falling tone is not unusual for Iroquoian languages—the same process is observed in Mohawk (Michelson 1988). Lindsey (1985) also claims that the lowfall is creaky, perhaps suggesting that the creak of the absent glottal stop remains with a falling pitch. The creakiness of /ʔ/ and lowfall pitch is something important in Wright’s (1996) analysis, though in both Uchihara’s (2013) and my phonetic analysis, it’s not clear that there is any synchronic creak associated with lowfall tone.

Though Lindsey’s (1985) approach is rejected by both Wright (1996) and Uchihara (2013), who argue that Cherokee has a tone system, rather than a purely accentual system, many of his claims and observations are adopted and tweaked in their approaches. Later analysis both build on the observations that H tones spread, H and SH are different systems, the use of HL% (or H%) to denote the boundary tone, and the LF is related to loss of glottal stop.

2.6.2 Analysis 2b: Wright 1996

Wright (1996) claims that the behavior of pitch in Cherokee is evidence for a true tone system, rather than an accent system. His three main arguments are: *a*) more than one tone is specified per word, *b*) the rise and downdrift typical of pitch-accent languages is absent, and *c*) a floating H tone.

Despite disagreeing with Lindsey (1985) on the nature of the pitch system in Cherokee, Wright (1996) builds on his work in several crucial ways. First of all, Wright (1996) notes that

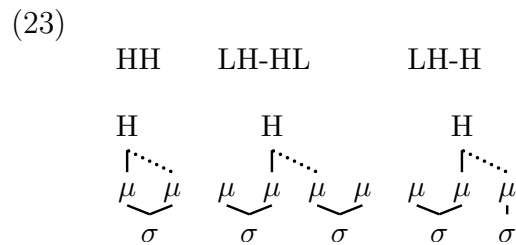
level pitches (H and L) are found on long and short vowels, while contour tones (specifically HL and LH) are only found on long vowels. Since a short vowel is one mora and a long vowel is two moras, this distribution of level and contour tones leads Wright (1996) to conclude that the mora is the TBU (in line with Lindsey’s 1895 analysis).

Secondly, Wright (1996) observes that H tones usually come in pairs, except at the right edge of words. This observation surfaces as *a*) a level high on a long vowel (HH), *b*) a low-high contour in one syllable followed by a high-low in the following syllable (LH-HL), *c*) a low-high in one syllable followed by high tone on a short vowel (LH-H), *d*) a high tone on a short vowel in one syllable followed by a high-low contour in the following syllable (H-HL).

Therefore, since the mora is the TBU and H tones occur in pairs (across syllable boundaries, any number of onset consonants), Wright (1996) proposes a new rule to account for the behavior of H tones in Cherokee:

- (22) *High Spread* (Wright 1996:13)
 Spread H rightwards non-iteratively.

In 23, three examples of the spreading are shown: spreading within a syllable (HH), spreading across a syllable boundary to a long vowel (LH-HL), and spreading across a syllable boundary to a short vowel (LH-H).



After all highs spread, all toneless moras are assigned low by default. Wright (1996) makes it clear that these leftover moras are not remaining toneless, but are getting tone before being pronounced. Phonetically, they show clear tonal targets rather than interpolation

between the word edge and high tones, which would be expected if they remained toneless (Pierrehumbert & Beckman 1988). Crucially, low tone fill in must be ordered after High Spread in Wright's (1996) analysis so that lows filled in by default don't block the spread of high tones.

The only problematic examples for Wright's (1996) analysis are words with L-HL sequences, which he accounts for with underlying laryngealization. Like Lindsey (1985), he argues for glottal stop lenition, which results in vowel lengthening and a concurrent falling tone, relying the [+constricted glottis] feature. This feature is associated with underlying glottal stops that are lost in morphological alternations or historical change, and surface as vowels with lowfall tone.

However, Wright (1996) uses this feature to also explain the lower pitch in HL contours (in addition to lowfall melodies). The [+constricted glottis] can appear in the same syllable as a H tone, but if it were to surface, Wright (1996) claims that the glottalization would prevent the H tone from surfacing. Therefore, to avoid that, the [+constricted glottis] is delinked, but only at a point after H tones spread. After the [+constricted glottis] feature is delinked, default lows fill in and the result is a HL contour without a H that results from spreading (i.e. L-HL sequence)². In (24), the [c.g.] feature prevents rightward spreading in the words *táàli* 'two' and *deèjîmóóye* 'I'm fanning them', but is delinked before the default low fills in.

²In §3, I show that neither the [+c.g] feature or rule ordering is needed to account for these patterns.

(24)

$\begin{array}{c} \text{H[c.g]} \\ \quad \\ \text{t a a l i} \end{array}$	$\begin{array}{c} \text{H[c.g]} \quad \text{H} \\ \quad \quad \quad \quad \quad \\ \text{d e e j i i n o o y e} \end{array}$	H Spread
$\begin{array}{c} \text{H[c.g]} \\ \quad \neq \\ \text{t a a l i} \end{array}$	$\begin{array}{c} \text{H[c.g]} \quad \text{H} \\ \quad \neq \quad \quad \quad \quad \\ \text{d e e j i i n o o y e} \end{array}$	Laryngeal Delinking
$\begin{array}{c} \text{H L} \\ \quad \vdots \\ \text{t a a l i} \end{array}$	$\begin{array}{c} \text{L} \quad \text{H L} \quad \text{H} \\ \vdots \quad \vdots \quad \vdots \\ \text{d e e j i i n o o y e} \end{array}$	Low fill in
táali 'two'	dèèjînoóye 'I'm fanning them.'	

Finally, Wright (1996), like Lindsey (1985) argues that the superhigh (what he calls the 'high rise') is a word-level accent. He cites three factors that clearly show that this pitch is not tone (as seen with the high tones earlier in his analysis), but accent: its position is predictable (rightmost long vowel or first syllable), its starting pitch level is variable and rises to a higher point, unlike other highs in Cherokee, and it "is imposed over the existing tonal pattern, overriding the melody of the syllable on which it occurs" (Wright 1996:21). He analyzes this superhigh pitch as being the remnant of a Northern Iroquoian metrical stress system.

Therefore, Wright's (1996) biggest contributions to our understanding of Cherokee pitch are: 1) arguing that the pitch patterns of the language indicate a tonal system, with one pitch accent (SH), 2) showing that H tones tend to come in pairs, indicating the spreading is non-iterative, and 3) showing that contours (LH and HL) are non-phonemic and 4) arguing that the TBU in Cherokee is the mora.

2.6.3 Analysis 2c: Uchihara 2013

Uchihara's (2013) analysis is the most recent and comprehensive analysis of the Cherokee tone system. He assumes a system similar to Wright's (1996): two tones (H and LF),

one default tone (L) and one accent (SH). He also assumes the same source of LF as Lindsey (1985) and Wright (1996), i.e. historic or synchronic loss of glottal stop. Unlike Lindsey (1985) and Wright (1996), Uchihara (2013) uses constraints to explain the tonal processes he discusses.

Uchihara (2013) is very interested in the *source* of H tone, and that drives his argumentation. He argues for 3 H tones, each with its own phonetic/historical source, and its own phonological behavior. In this section, I will discuss H1 and ignore H2 and H3—see his dissertation for a complete argument for these other H tones.

The H1 tone (hereafter referred to as H1 or just H) can occur anywhere in a word, and there can be multiple H1 tones in a word. As in Wright’s (1996) analysis, the TBU for H1 is the mora. Like Lindsey’s (1985) and Wright’s (1996) analyses, Uchihara (2013) notes that spreading can occur within syllables (to create H tones on long vowels) or across syllable boundaries (to create contour tones HL and LH).

However, Uchihara (2013) claims that H1 spreads maximally one mora **leftwards**, contrary to previous accounts of H tone in Cherokee, which have H spreading **rightwards**. The examples in (25) show H1 associating to short vowels and the first and second moras of long vowels—then spreading one mora to the left.

- (25)
- | | | | | | |
|----|---------------------|----|------------------|----|----------------------|
| a. | goohweélíʔa | b. | ganoóyǘ̀v̀ga | c. | gahlǘ̀v̀ʔiha |
| | H1 | | H1 | | H1 |
| | ····l | | ····l | | ··l |
| | goohweélíʔa | | ganooyv̀v̀ga | | gahlv̀v̀ʔiha |
| | ‘He is writing it.’ | | ‘He is sinking.’ | | ‘He is tying it up.’ |

The leftward spreading of H1 can be accounted for by internal reconstruction, according to Uchihara (2013). He claims that the phonetic source of H1 is a historic glottal stop, and whether it docks to the first or second mora of a long vowel depends on whether the glottal stop was pre- or post-consonantal. Therefore, a contemporary sequence CǘVC could have

- d. the preceding mora is part of pronominal or reflexive prefixes.

He uses these generalizations with constraints like *TROUGH and MAX-T, and the previously introduced DOM BIN, to account for H tone spreading. Relevant to my discussion of tone in §3 is the constraint MAX-T:

- (29) MAX-T (Yip 2002:83)
No deletion of tone

Additionally, Uchihara (2013) argues that if H1 is blocked from spreading to the left (by one of the conditions in 28), it can spread rightward in the same syllable. This kind of rightward spreading is the result of the constraint DOM BIN, which requires H tones span two moras.

However, like previous analyses, he does not propose an underlying low tone, only a default low assigned to syllables that are still toneless after all other association, spreading, processes, etc.

2.7 Summary of Previous Analyses

In all three analyses (Lindsey 1985; Wright 1996; Uchihara 2013) discussed in this chapter, it is clear that a “mixed” approach to word-prosody is necessary. There is no previous linguistic analysis which treats all pitches in Cherokee as part of one system. Lindsey (1985) has two accent systems—*atonic* and *tonic*—which affect different words in the language. However, Hyman (2006) makes no mention of a language that has two accent systems functioning simultaneously, which would make Lindsey’s (1985) analysis typologically odd. Additionally, Lindsey’s (1985) use of diacritic accent (for tonic forms) does not seem to be a genuine implementation of accent. Diacritic accent in Lindsey’s (1985) analysis is marked at the level of the morpheme, though a morpheme is not a meaningful phonological or metrical constituent. Since the tonic accent does not mark prominence in a metrical constituent, it

is difficult to accept his analysis as a purely accentual one. Therefore, the “accent” must be lexical, i.e. specified in the underlying representation, and underlying tones is a property associated with a tone system. This is the approach that both Wright (1996) and Uchihara (2013) take—H tones are assigned lexically.

This is the view that Wright (1996) and Uchihara (2013) take: the ‘tonic’ accent of Lindsey’s (1985) analysis, is actually lexical tone. Therefore, Cherokee pitch melodies are the result of a tone system and an accent system, where H and LF are active tones, and SH is a pitch accent. In Hyman’s (2006) typology of word-prosody, he notes that mixed systems are not all that unusual (see Saramaccan, Good 2004). Therefore, it is not really all that surprising that Cherokee might employ pitch for both lexical tone and for pitch accent.

Though Lindsey (1985) and Wright (1996). and Uchihara (2013) differ in their theoretical conception of tones, they all make similar assumptions about them. First of all, H spreads non-iteratively one mora. Though Uchihara (2013) claims that H spreads to the left, while Lindsey (1985) and Wright (1996) both argue for rightward spreading, all three agree that a H is associated to a mora, and can spread to only one additional mora. This observation is seen in numerous H tone pairs found throughout Cherokee.

Secondly, all three treat LF differently than H. While LF is also an active tone, it cannot spread like H. Uchihara (2013) even goes so far as to claim that the TBU of LF is the syllable, not the mora. The fact that a H tone may spread while other tones may not is not surprising, though different tones having different TBUs might be.

Finally, L is not an active tone in any previous work. All three analyses treat lows as default pitches generated after all other pitches (both tones and accent) have been associated. The evidence for this assumption is that L doesn’t spread, there are no floating lows, and L doesn’t block morphological alternations (as H does in Uchihara’s analysis). Therefore, all three assume that low tones in Cherokee are inert and are the result of fill in, rather than being specified at an underlying representation.

However, both Wright (1996) and Uchihara (2013) have a hard time accounting for sequences like L-HL. In Wright's (1996) analysis, the H should spread to the right to make a L-HH sequence, but the spreading does not occur. In Uchihara's (2013) analysis, leftward spreading of the H is blocked since the preceding L is on a short vowel, but then rightward spreading should occur, also producing L-HH. Since spreading doesn't always occur, both Wright (1996) and Uchihara (2013) use a rule feature to generate the attested L-HL forms. For Wright (1996), it is the [+constricted glottis] feature, and Uchihara (2013) uses a feature called [-H1 Displacement], which disallows spreading.

By employing these features, both can generate the L-HL surface pattern, but this is a stipulation. Words (or morphs) have to be idiosyncratically marked for these diacritic features, which are not related to the rest of the tonal phonology. In my analysis in the next chapter (§3), I argue that an active L is necessary. Assuming the presence of a L not assigned by default allows me to explain L-HL surface sequences using the phonological constraints on tone argued for by Uchihara (2013), and not stipulate a feature. In the next chapter, I build on Uchihara's (2013) analysis of H1 and leftward spreading, using the MAX-T and DOM BIN constraints he motivates.

CHAPTER 3

THE LOW TONE IN CHEROKEE

3.1 Introduction

In my analysis of Cherokee tone, I assume many of the same components of previous systems. There is clearly (at least one) high tone, which can spread maximally one syllable. There is also some low falling tone, which may have arisen from a glottal stop. There is a superhigh accent on the penultimate or antepenultimate syllable of certain classes of words (some deverbal nouns, adjectives, location nouns, inalienably possessed body part terms, diminutives, and subjunctive, infinitive and subordinate forms of verbs), which is culminative and can override existing tonal patterns. Finally, there is a boundary tone—not an underlying lexical tone, but a prosodic tone that appears on the final syllables of words either as a high (H%) or highfall (HL%) melody (Lindsey 1985; Johnson 2005).

In this chapter, I will argue that low tones *do* show some phonological behavior, even if it not to the extent seen with high tones. Low tones can block spreading, a distinctly phonological behavior, which requires them to be part of the underlying representation, rather than just a default tone. However, this doesn't mean that *all* low tones in Cherokee are specified. In fact, if all low tones were specified, it would be much harder to explain the patterns seen with high spreading and the boundary tone. Therefore, both phonological, specified low and unspecified, default low are necessary for a full analysis of Cherokee tone.

3.2 The Typology of Low Syllables

Crucial to the discussion of low tones in Cherokee is Yip's (2002:63) typology of "low" syllables:

- (30) a. Low tone specified throughout the phonology and phonetics; phonetically low
- b. Toneless throughout phonology and phonetics, pitch acquired by phonetic interpolation only
- c. Toneless during phonology, but L tone specified at phonology/phonetics interface

Syllables of type (a) are specified low underlyingly and surface reliably with a phonetically low pitch. Low syllables of this type are phonologically active. They can have typical tone-like behaviors—they can spread, be deleted under OCP, form contours, etc—though there may be an asymmetry between the behavior of low tone and other active tones.

Type (b) syllables are toneless in the underlying representation, and toneless in the surface representation. Since there is no active underlying tone, the syllable does not participate in the tonal phonology. These syllables may acquire pitch, but only by pitch interpolation between specified pitches.

Low syllables of type (c) are also toneless at the underlying level. Type (c) syllables have reliably low pitches in the phonetics, but do not participate in the tonal phonology. Since these type (c) syllables do not have a specified tone, they may acquire tone from other specified tones spreading or gain a low tonal target in the phonetics/phonology interface. The assignment of a “default low” at the interface is “presumably driven by a requirement in such languages for full specification at the start of the phonetics” (Yip 2002:63).

Phonetically, a phonological low tone (a) and a default low (c) might not look different, since both have low tone targets, and surface reliably low. The difference between types (a) and (c) isn’t phonetic, but phonological. Since type (a) has a specified low tone, that tone can participate in various tonal processes; the tone of a type (c) syllable is associated after all other phonological processes.

So which of these three types are Cherokee low syllables? Wright (1996) rejects the idea that Cherokee syllables surface phonetically toneless (type b). The kind of pitch interpolation

and pitch variability that would be characteristic of toneless syllables is never observed in the language. Therefore, all TBUs must have tonal targets.

Therefore, it is possible that Cherokee low tones could be either type (a) or type (c). Until this point, past analyses have argued or assumed that all low tones observed in Cherokee are type (c). This type of low tone is inert at the level of the tonal phonology, but will surface with reliably low pitches. Lindsey (1985), Wright (1996) and Uchihara (2013) all claim that all low tones observed in the language are a result of default low insertion as the last part of a derivation.

However, in the rest of this chapter, I will argue that low syllables of type (c) are not sufficient to explain the distribution of pitch melodies in Cherokee. I will argue that type (a) is also present; specified low tones are present and participate in the tonal phonology.

3.3 The Case for Specified Low Tone

A true low tone (type a) does not exist in most tonal analyses in the Cherokee literature. This likely comes as a result of Cook's (1979) assertion that only a H is necessary to account for all tonal patterns. In the privative high systems (Lindsey 1985, 1987; Wright 1996; Uchihara 2013), the low tone is only ever a default tone—i.e. lows are assigned in the phonetics/phonology interface. These systems do not identify any phonological behavior of low tones, and assume that what surfaces as a “low”, is actually toneless in the phonology (type (c) in Yip's (2002) typology).

Johnson (2005:17) is the only researcher to identify a phonological low tone in Cherokee, though he says that it is “phonetically low falling”. Therefore, he's not talking about the low level tone seen on long and short vowels, but instead about the lowfall. This assertion of LF as a distinct toneme (even though he calls it L), matches other analyses of the Cherokee tonal system. However, his claim about an underlying L is not the focus of his paper, and is not fully fleshed out.

An underlying low tone—a low level tone—has not been proposed before in analyses of the Cherokee tonal system. However, I argue in this chapter that an underlying L must be present in the tonal system. Low tones can block the spread of high tones; this behavior of lows cannot be explained by having only default low tones in the language.

3.3.1 Low Tone and Phonetic Contours

A phonological low tone is needed to explain patterns of high tone spread. As mentioned in §2.6.3, Uchihara found a number of examples in his database with a singleton H tone—L-HL, LL-HL, and LF-HL. In these examples, the H tone on the first mora of the second syllable should spread to the left across the syllable boundary to create H-HL or LH-HL sequences, but spreading to the left is blocked. Uchihara (2013) posits three contexts in which H spreading is blocked to the left: *a*) when a short vowel precedes the H tone (see §3.3.3), *b*) when a specified tone precedes the H (LF or H from another source, i.e. H3 in his analysis), or *c*) when spreading will cause a one mora tonal dip— $\acute{V}CV\acute{V}C\acute{V}\acute{V}$.

As mentioned in §2.6.3, Uchihara (2013) uses the constraint DOM BIN to account for non-iterative H spread. When a H tone is blocked from spreading to the left, it can spread to the right in the same syllable, creating a long, level H tone. This satisfies the DOM BIN constraint because the H tone spans two moras. The examples below in (31) show rightward spreading when spreading to the left is blocked—high tones span two moras (Uchihara 2013: 203, from Feeling 1975):

(31)

- | No spread to the preceding σ | Spread to the preceding σ |
|---|--|
| a. daàlhtadeéga
LF H
^
daalhtadeega
t-∅-al(i)hthat-ée(?)k-a
DST-3A-carry.LG.on.shoulder-AND:PRS-IND
'He is carrying a long object on his shoulder.' | b. ààhnohliíneéga
LF H
^
aahnohliineega
∅-aahnohliin-ée(?)k-a
3A-jump-AND:PRS-IND
'He is jumping.' |
| c. ààgwadééga
LF H
^
aagwadeega
akw-at-ée(?)k-a
1B-REFL?-AND:PRS-IND
'I am throwing it.' | d. gansiínéèga
H

gansiineega
ka-n(a)siin-ée(?)k-a
3A-drag-AND:PRS-IND
'He is dragging it.' |

In (31a) and (31c), H spreads to the right because a short vowel precedes the H tone, creating a L-HH sequence. However, the H tone can spread to the second mora of the preceding long vowel in (31b) and (31d), creating a LH-HL sequence.

However, in L-HL, LL-HL, LF-HL sequences, the H is blocked from spreading to the left (based on one of the three above parameters), but then it also does not spread to the right in the same syllable, as shown in (32) (Uchihara 2013: 203, from Feeling 1975).

(32)

- a. kanawóòga
 H
 |
kanawooga
'He is cold.'
- b. ùùliyèèsuusdga
LF H
 ^ |
uuliyeesuusdga
'He is wearing a ring.'
- c. ààsganv̀v̀ga
LF H
 ^ |
aasganv̀v̀ga
'He is committing a crime.'

The crucial difference between examples (31) and (32) is how high tones can spread. H can spread to the right in the same syllable after being blocked from spreading to the left in the examples in (31), but in the examples in (32), the H does not spread to the left or the right, and what surfaces is a HL contour. The pitch traces below show HL contours, where H does not spread to the left across a syllable boundary (Figures 10 and 11).

Figure 10: LL-HL and L-HL sequences

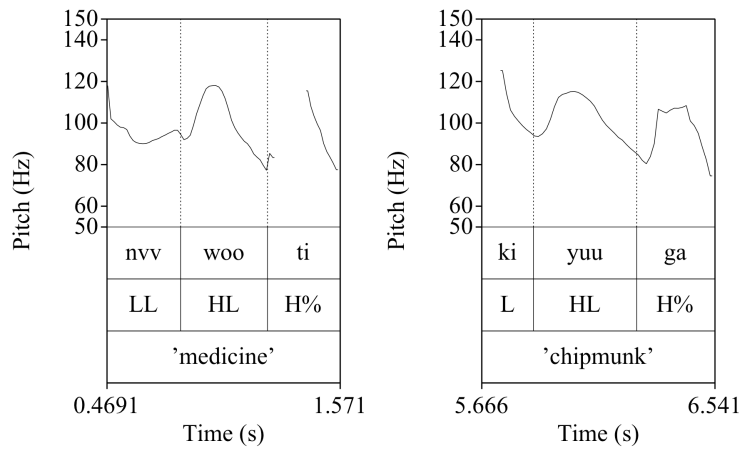
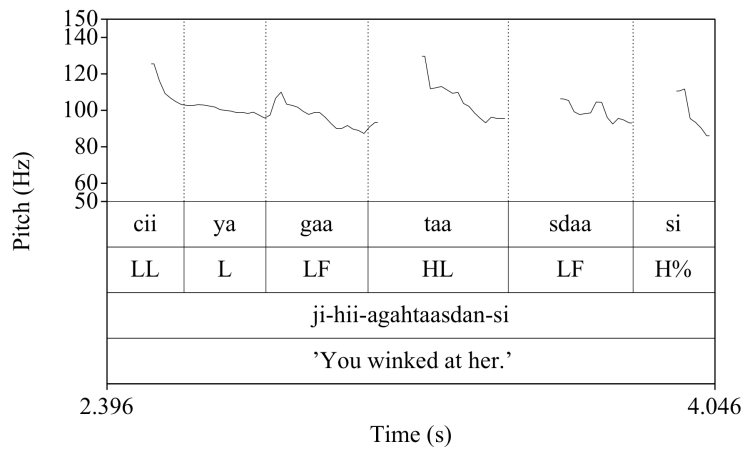


Figure 11: LF-HL sequence



To explain why high tones can spread in (31), but not in (32), I propose that a phonological low tone is blocking spreading to the right in the same syllable (after H was already blocked from spreading to the left). Using the MAX-T constraint Uchihara (2013) has already motivated in his analysis, I argue that spreading of the H tone to a mora with a L tone would violate MAX-T because MAX-T requires input-output tonal faithfulness. Therefore, MAX-T must be higher ranked than the DOM BIN to prevent spreading.

(33)

	LF	H	L		
Input:	μ	.	μ	μ	
				MAX-T	DOM BIN
	LF	H	L		
☞ a.	μ	.	μ	μ	*
	LF	H	L		
	⊕	⋯			
b.	μ	.	μ	μ	*!
	LF	H	L		
			⊕		
c.	μ	.	μ	μ	*!

In tableau (33), the underlying representation has a tone aligned with each mora: a LF in the first syllable, a H on the first mora of the second syllable, and a L on the second mora of the second syllable. Candidate (a) violates DOM BIN because the H tone does not span two moras. However both candidate (b) and (c) are eliminated because spreading would cause either the preceding LF or following L to delete or delink. Therefore, the attested sequence LF-HL, is optimal.

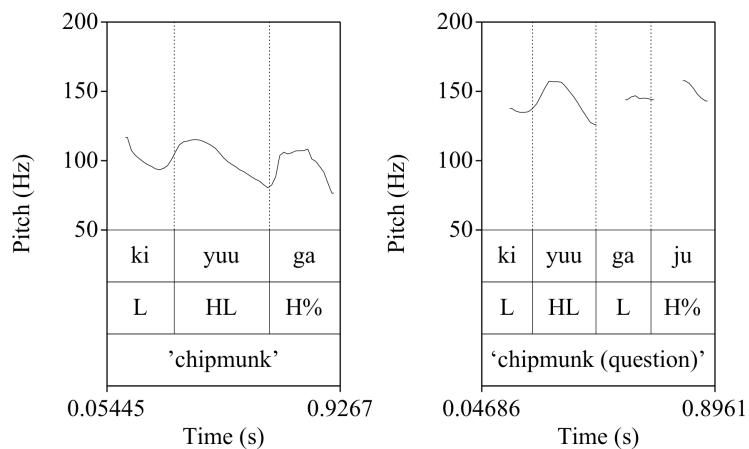
There are two alternate analyses that I am going to walk through first before I further explain why a phonological L in L-HL, LL-HL, and LF-HL sequences is the most efficacious analysis. The first is that rightward spreading within a syllable is optional after leftward spreading is blocked (§3.3.1.1). The second is that there is a historic difference between HL

and HH long vowels, and that difference is maintained synchronically through a rule feature (§3.3.1.2).

3.3.1.1 Optional Rightward Spreading

If rightward spreading within the syllable is optional (after leftward spreading is blocked), then the mora to the right of a H tone can be toneless—there is no need to posit an underlying tone associated to this mora. In the phonology-phonetics interface, this second mora of the long vowel gets a default L target, and the syllable is realized as a phonetic HL contour. However, optional spreading predicts that in the word for ‘chipmunk’ *kiyúùga*, both HL and HH could be possible on the second syllable of the word [yuu], but only HL is ever attested. In Figure 12, the word ‘chipmunk’ *kiyúùga* is pronounced by two different speakers in two different contexts (the one on the left was produced in isolation and the one on the right was produced in a sentence); in both productions of this word, the HL contour on the second syllable is constant.

Figure 12: ‘Chipmunk’



In Uchihara’s (2013) data, he shows that some lexical items allow H to spread rightward in the same syllable but others do not (examples 31 vs. 32). If this were a truly optional process, it would not be restricted lexically. Therefore, the difference must not be an optional process but instead an underlying distinction. At an underlying, phonological level, there must be some mechanism that allows some lexical items to spread H to the right in the same syllable after spreading is blocked on the left, while this is not allowed (by the same mechanism) in other lexical items. Uchihara (2013) accounts for this difference with a rule feature [-H1 Displacement] (§3.3.1.2, however I will argue that this feature is not needed if a L toneme is assumed (§3.3.2).

3.3.1.2 Historical Reconstruction and [-H1 Displacement]

The second analysis for this difference is Uchihara’s (2013) rule feature approach, which does posit a diacritic distinction. To understand his argument, it is first necessary to explain how he accounts for the alignment of H tone to the first mora of two mora syllables.

Uchihara (2013) reconstructs two historical sequences that yielded a long vowel with a H tone aligned to the first mora: *VʔC and *VVʔC. In the first case (*VʔC), the pre-consonantal glottal stop was lost and the vowel was lengthened to compensate for the lost mora.

(34)

VʔC	→ →	VVC
historic form	glottal stop deletion	contemporary form
	compensatory lengthening	

In the second case (*VVʔC), the glottal stop was also deleted, but the long vowel remained long.

(35)

VV?C	→ →	VVC
historic form	glottal stop deletion	contemporary form

Therefore, these two historically distinct sequences have neutralized to VVC, with a H tone associated to the first mora in both cases.

(36)

*V?C	→	VVC
*VV?V	→	VVC

Uchihara (2013) argues that these two historic forms differ as to whether or not they allow rightward spreading. Historic *VV?C sequences allow rightward spreading in the same syllable if leftward spreading is blocked (short vowel in the preceding syllable, other tone associated in the preceding syllable, etc.). However, *V?C sequences cannot spread H tone rightward if leftward spreading is blocked.

In the examples in (37), high tone spreading to the left is blocked by a short vowel in the first syllable for both forms. The *VV?C sequence allows rightward spreading of H tone in the second syllable; the *V?C does not allow rightward spreading (examples from Uchihara 2013, citing Feeling 1975).

(37)

<p>*V?C</p>	<p>*VV?C</p>
<p>kanawóoga</p> <p>‘He is cold.’</p>	<p>dààlhtadééga</p> <p>‘He is carrying a long object on his shoulder’</p>

To explain this difference synchronically, Uchihara (2013) proposes a feature [-H1 Displacement] on historic *V?C sequences. This feature [-H1 Displacement] does not allow for

rightward spreading in the same syllable in contemporary reflexes. Therefore, the difference between examples (31) and (32) is a difference of a rule feature marked on the relevant syllable in Uchihara’s (2013) analysis¹.

Uchihara’s (2013) rule feature account can explain L-HL and LF-HL sequences, because the short L and the LF block leftward spreading. Then, the [-H1 Displacement] feature blocks rightward spreading on certain lexical items. However, there are two reasons why I reject this approach. The first reason is that this approach cannot account for LL-HL sequences. According to Uchihara (2013), there is no reason that the H in a LL-HL sequence doesn’t spread to the preceding more. The second reason is that it requires a diacritic feature to account for an underlying distinction. In my analysis in the next section §3.3.2, I argue that a L toneme also differentiates between these two forms on an underlying level. An underlying L tone can also explain why H doesn’t spread in LL-HL sequences.

3.3.2 Specified Low and Phonetic Contours

There are three surface tonal sequences that are problematic for Wright’s (1996) and Uchihara’s (2013) tonal analyses: LF-HL, L-HL, and LL-HL. Both Wright (1996) and Uchihara (2013) propose a diacritic to explain LF-HL and L-HL, but neither have an explanation for LL-HL. I argue in this section that these sequences aren’t actually problematic, if a L tone is part of the language’s tonal inventory.

Building on Uchihara’s (2013) analysis, I propose that the difference between historic *V?C and *VV?C can be explained synchronically, using existing mechanisms already present in the tonal phonology of the language (MAX-T and DOM BIN). The spreading behavior of these two historically distinct sequences can be analyzed as a difference of un-

¹Wright (1996) also uses a diacritic, [+constricted glottis], to explain HL contours, though he doesn’t make reference to reconstructed forms

derlying tone instead of a *feature*, if there is a phonologized low tone on *V?C sequences (38).

$$(38)$$

$$*V?C \quad \longrightarrow \quad \begin{array}{c} H \ L \\ | \ | \\ V \ V \ C \end{array}$$

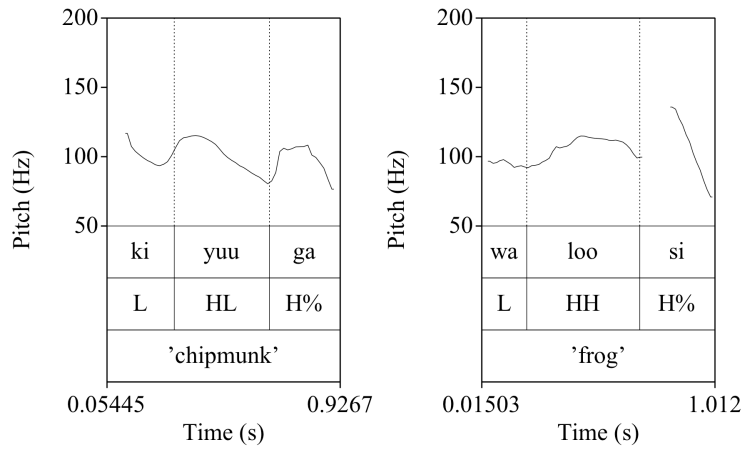
$$*VV?C \quad \longrightarrow \quad \begin{array}{c} H \\ | \\ V \ V \ C \end{array}$$

If there is an underlying L on the second mora of the long vowel, L can block rightward spreading in the same syllable (MAX-T). If L blocks spreading, then it is clear that L cannot be a default tone, but rather a specified, underlying tone. Toneless syllables can't block H spreading, so if H doesn't spread, H must be blocked by a specified tone.

A minimal tonal pair can be seen with the words 'chipmunk' *kíyúuga* and 'frog' *walóósi*. Both words have a short vowel in the first syllable, and a long vowel in the second syllable². Looking at the second syllables in these words below, the word *kíyúuga* has a HL melody on its second syllable, and the word *walóósi* has a long, high pitch.

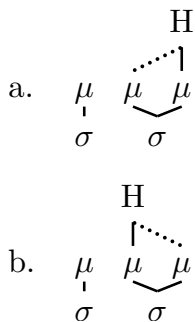
²Though the vowel qualities are different, there is no indication that this would affect tone.

Figure 13: ‘Chipmunk’ and ‘Frog’



While the surface realization of *kiiyúuga* (L-HL) makes it clear that the H tone is aligned to the first mora of the second syllable, it is less clear where the H is aligned in *walóósi* based on the surface form alone—the high tone could be associated to the first or second mora of the second syllable. Per Uchihara’s (2013) analysis of H1 tones spreading, both a H tone aligned to the second mora of the second syllable and a H tone aligned to the first mora of the second syllable could surface with the same phonetic melody (L-HH), as shown in (39).

(39)



In the (a) configuration in (39), the H tone is associated to the second mora of the second syllable, and it spreads left one mora. This generates the phonetic long high melody.

In the (b) example, the H tone is associated to the first mora of the second syllable. It is blocked from spreading leftward to the first syllable because the first syllable is a short vowel (in Uchihara’s analysis—see §3.3.3); therefore, to satisfy the need for H tones to span two moras (DOM BIN), the H tone spreads to the right, also resulting in a phonetic long high melody.

To adjudicate between these two possibilities (H tone associated to the first or second mora on *walóósi*), I will make reference to Uchihara’s (2013) historic forms to assess which alignment is most likely. According to Uchihara (2013), the alignment of the H tone is dependent on the historic position of the glottal stop (pre- or post-consonantal)—pre-consonantal glottal stops yielded H tones aligned to the first mora or long vowels, while post-consonantal glottal stops yielded H tones aligned to the second mora of long vowels. Therefore, forms with H aligned to the second mora of a long vowel in contemporary Cherokee—V[́]V—derive from historic *VVC[?] sequences, while contemporary V[́]V sequences are reflexes of *VV[?]C.

In the case of *walóósi*, the H tone must be aligned to the first mora of the long vowel in the second syllable, because syllabic restrictions make it clear that a historic post-consonantal glottal stop (**waloos[?]i*)³, and therefore a H tone aligned to the second mora, is unlikely for this word. Uchihara (2013) claims that a *s[?]* sequence is unattested in his database of contemporary Cherokee. Phonotactic constraints require that if /s/ is followed by consonant, it must be an obstruent or /l/, which it can form an onset cluster with; /s/ can’t be a coda followed by a glottal stop onset (§4.2.1, §4.2.3). Furthermore, there is no form in Uchihara’s (2013) analysis that has a reconstructed **s[?]* sequence.

Conversely, a pre-consonantal glottal stop is not only attested in contemporary Cherokee (glottal stops *are* an allowable word-medial coda), but many of Uchihara’s (2013) reconstructed words have **[?]s* sequences. Therefore, the word *walóósi* must be reconstructed as having a pre-consonantal glottal stop (*VV[?]C → **waloo[?]si*), which induced a H tone

³The asterisk in this example indicates a historical form.

aligned to the first mora of the second syllable, following Uchihara’s (2013) model of Cherokee tonogenesis.

Consequently, this reconstruction means that *kíyúuga* and *walóósi* are a true tonal minimal pair. Both words have a H tone associated to the first mora of the second syllable, but they surface with different phonetic tonal melodies. This indicates that there *must* be a further difference between these two words at the underlying level of tonal representation. As discussed previously, Uchihara (2013) explains this minimal distinction with the feature [-H1 Displacement]. So, in his analysis, the word *kíyúuga* would be marked with that feature [-H1 Displacement], but this feature is not marked on the word *walóósi*.

However, I propose that the historic *V?C sequences do not have a synchronic rule feature [-H1 Displacement]. Instead, the loss of glottal stop and concomitant compensatory lengthening has been phonologized as a synchronic L tone aligned to the second mora of the long vowel.

(40)

$$\begin{array}{l}
 \text{*V?C} \quad \longrightarrow \quad \begin{array}{c} \text{HL} \\ | \quad | \\ \text{k i y u u g a} \end{array} \\
 \text{*VV?C} \quad \longrightarrow \quad \begin{array}{c} \text{H} \\ | \\ \text{w a l o o s i} \end{array}
 \end{array}$$

By proposing a phonological L, there is no need for a feature stipulation; instead, the constraints and generalizations already present in Uchihara’s (2013) H tone analysis can be used to account for the minimal distinction between *kíyúuga* and *walóósi*. This minimal pair is now distinguished by a single toneme, rather than a rule feature. In (41), I show that assuming an underlying low generates the correct surface form for *kíyúuga*, if using the constraints Uchihara (2013) posed for his H1 tone analysis: MAX-T and DOM BIN. I

have added an additional (temporary) constraint—*SV-SPREAD—which is a formalization of Uchihara’s (2013) generalization that high tone does not spread to short vowels (42).

(41)

	HL 			
Input:	k i y u u g a	*SV-SPREAD	MAX-T	DOM BIN
☞ a.	HL k i y u u g a			*
b.	HL ... k i y u u g a	*!		
c.	HL ≠ k i y u u g a		*!	

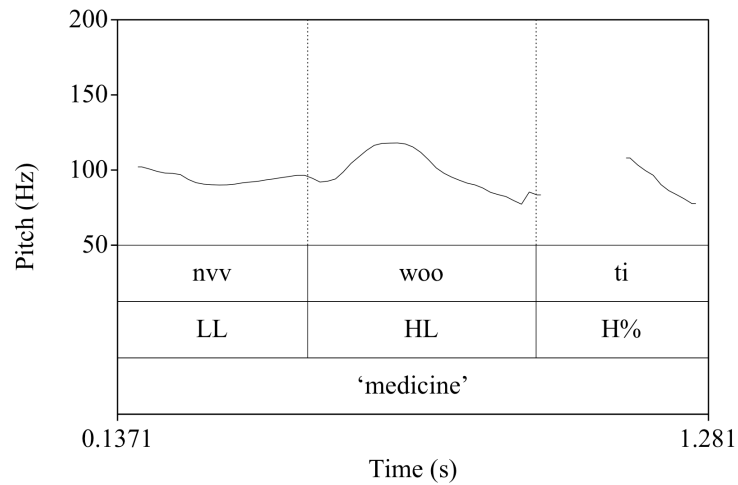
(42) *SV-Spread
Don’t spread high tones to short vowels.

In tableau (41), candidate (b) is eliminated because the H spreads to a short vowel, violating the highly ranked *SV-SPREAD constraint. Candidate (c) violates the MAX-T constraint by spreading to a mora that already has a tone associated to it. Therefore, candidate (a) is the optimal candidate; it violates the DOM BIN constraint, which requires H tones span two moras, but that constraint is ranked lower than *SV-SPREAD and MAX-T.

This same ranking of constraints also generates the correct surface form for *walóosi* ‘frog’ (43). Candidate (a) violates DOM BIN and candidate (b) violates *SV-SPREAD, but candidate (c) has no violations. Therefore, candidate (c) is the optimal candidate, and that is the attested form.

14, the first syllable has a long and low tone, and the peak of the H tone is on the second syllable.

Figure 14: LL-HL



Therefore, I posit that there are two underlying low tones in the word *nvvwóòti* ‘medicine’ such that the underlying tonal pattern is /LHL/ (45).

$$(45) \quad \begin{array}{c} \text{L} \quad \text{HL} \\ | \quad || \\ \text{nvvw} \text{oo} \text{ti} \end{array}$$

With the underlying representation in (45), the high tone on the second syllable can’t spread to the left because it is blocked by the underlying low tone. Then, H is blocked from spreading rightward by a L immediately to its right. Though this surface form violates DOM BIN, it does not violate MAX-T, the higher ranked constraint (46).

(46)

	MAX-T	DOM BIN
L HL a. n v v w o o t i		*
L HL ≠... b. n v v w o o t i	*!	
L HL ≠ b. n v v w o o t i	*!	

Positing underlying L tones in the word *nvvwóoti* can explain its surface pattern, a pattern that was problematic in Uchihara’s (2013) analysis. Additionally, no diacritic feature is necessary in my account, and the generalizations and mechanisms already present in the tonal phonology are sufficient to derive surface forms.

3.3.3 Specified Low Tone and Short Vowels

A specified low tone might also explain the Uchihara’s (2013) observation that H tones don’t spread to short vowels. There’s nothing inherent about short vowels that should block spreading, and H tones can dock to short vowels (i.e. *uugámi* ‘soup’) in non-spreading contexts. Therefore, instead of positing an analysis that relies on H tones being blocked by short vowels, I claim that these short vowels in Uchihara’s (2013) data actually have underlying low tones.

	L HL
(47) a.	k i y u u g a
	L H
b.	w a l o o s i

The addition of a specified low on these short vowels allows me to account for the surface tonal patterns of *kíyúuga* ‘chipmunk’ and *walóosi* ‘frog’ without having to use the unmotivated constraint *SV-SPREAD. Spreading of H tone to the first syllable is now blocked by MAX-T.

(48)

	L HL Input: k i y u g a	MAX-T	DOM BIN
	L HL a. k i y u g a		*
	L HL ≠· b. k i y u g a	*!	
	L HL ≠ c. k i y u g a	*!	
	L H Input: w a l o o s i		
	L H a. w a l o o s i		*!
	L H ≠· b. w a l o o s i	*!	
	H · c. w a l o o s i		

In these tableaux without a constraint blocking spreading to short vowels, H doesn't spread to the left but because it violates MAX-T. Claiming that there is a specified low on the short first syllable vowels in *kíyúuga* 'chipmunk' and *walóosi* 'frog' simplifies the analysis instead of positing additional mechanisms (don't spread H to short vowels) to explain the surface tonal patterns.

This kind of analysis (specified low) also accounts for some data that Uchihara (2013) found problematic (49).

- (49) a. ààhyvhq**wídú**vsga
 'He is bending it.' (Feeling 1975:29)
- b. ààgvvh**álúu**ysga
 'He is chopping it up.' (Feeling 1975:19)

In the examples in (49), the bolded portion shows where H spreads from the first mora of a long vowel to a short vowel, which runs contrary to Uchihara’s (2013) generalization that H1 doesn’t spread to short vowels. However, if the short vowels in these examples are not specified for tone, then there is no reason why the H tone can’t spread one mora to the left.

In this section, I have shown that at least *some* low tones must be specified before the phonology-phonetics interface (Yip 2002) to do the phonological work of blocking H spreading. Minimal tonal pairs can be found with nouns *kiyúùga* and *walóósi*, as well as toneless short vowels and short vowels with a low tone. These minimal pairs shows that a phonological low exists at the level of underlying representation to explain the different phonological behavior of these pairs and the different surface forms.

The addition of a phonological low does not rule out the possibility that there still is a default low in the language. In the next section, I argue that tonelessness at the level of the phonology is still necessary to get H spreading at all.

3.4 Unspecified Low

Though I have shown in the previous section that a phonological low tone is necessary for an analysis of the Cherokee tonal system, not all lows in Cherokee are the same low. Yip’s (2002) typology of ‘low’ syllables included phonological low tones (as I argued for in §3.3), toneless TBU’s (which Wright 1996 and I show are not present in Cherokee) and a default low—phonologically toneless, but phonetically low. This default low has been assumed to be the only low in the Cherokee by previous analyses of tone and accent in Cherokee, and while I have shown that a phonological low is needed in the tonal system, so too are toneless moras.

As shown in the previous section, underlying tones block high tone spread. This is the realization of a highly ranked MAX-T constraint, a faithfulness constraint which requires all input tones to surface in the output (Yip 2002; Uchihara 2013). Since underlying tones

must surface in the output, and high tone spread is a well-observed process in Cherokee, Cherokee must have underlying toneless moras to allow for this spread. If every TBU had an underlying tone and MAX-T was still a high ranked constraint, high tone spread would never be attested. Instead, all instances of two adjacent high tones (H1 tones in Uchihara’s (2013) analysis) would have to be two underlying H tones, and this would violate the OCP:

- (50) *Obligatory Contour Principle in Oklahoma Cherokee (Uchihara 2013):*
 Adjacent H1 tones are prohibited

*HH
 | |
 μ μ

- (51)

	OCP	MAX-T	DOM BIN
a. $\begin{array}{c} \text{H H} \\ \\ \mu \mu \end{array}$	*!		*
b. $\begin{array}{c} \text{H H} \\ \text{⊕} \\ \mu \mu \end{array}$		*!	
c. $\begin{array}{c} \text{H} \\ \dots \\ \mu \mu \end{array}$			

Therefore, as in previous analyses, tonelessness at the level of the phonology is required to account for high tone spread seen in the language. But, since there is no tonal interpolation observed, all moras must get tonal targets, and so a default low inserted at the point of phonology-phonetics interface is still necessary (Yip’s 2002 ‘low’ type (c)).

3.5 Summary

Previous analyses have shown that there are a number of functions for pitch in Cherokee: lexical tone, accent, and intonation. Some systems have viewed all of these different pitches as just “tone” (as in Feeling’s 1975 dictionary and Montgomery-Anderson’s 2015

grammar), while others have identified Cherokee as having a hybrid tone-accent system (Wright 1996; Johnson 2005; Uchihara 2013). While the Six Tone system might be preferable for teaching purposes, the hybrid tone-accent system appears to be closer to the phonological reality. The superhigh is culminative, attracted to long vowels and appears only on penultimate or antepenultimate syllables—this looks much more like an accent than a tone. Additionally, as shown in tone analyses (§2.6.1-2.6.3), the high-low and low-high melodies are restricted to long vowels (vowels with two moras), and can be explained through high tone spread. These facts make it unlikely that either HL or LH is an underlying unit.

Therefore, I assume a tone and accent inventory similar to Uchihara’s (2013): there is at least one high tone (the other high tones won’t be discussed further in this dissertation), a lowfall, a superhigh accent, and a default low. I add to his inventory a phonological low tone, which I have shown to be necessary in this chapter.

Table 13: Comparison of Tone and Accent Inventories

Source	Lexical (Underlying) Tone	Default Tone	Accent	Phonetic Melody	Prosodic Tone
Feeling, Montgomery-Anderson	H, L, HL, LH, SH, LF				
Lindsey		L	H, SH	LF, HL, LH	H%
Wright	H, LF	L	SH	HL, LH	
Uchihara	H1, LF	L	SH, H2, H3	HL, LH	H%
Cornelius	H, LF, L	L	SH	HL, LH	H%

CHAPTER 4

CHEROKEE SYLLABLES AND WORD-FINAL VOWEL DELETION

4.1 Introduction

In Cherokee, syllables are considered to be a fundamental unit—the writing system, the syllabary, is a point of pride and cultural touchstone for the Cherokee people, whether or not they are speakers. Uchihara (2013) claims that the syllable is more salient than the mora, citing the fact that native speakers have a hard time identifying long and short vowels without training.

In this chapter, I discuss the shapes of syllables in Cherokee, and a process called Word-Final Vowel Deletion (WFVD). An understanding of this process is crucial for the following chapters (§5 and §6); with these three chapters, I account for six minimally distinct forms¹:

(52)

	NO WFVD	WFVD
NO CLITIC	a. $CV(V)C\check{V}$	b. $CV(V)C$
CLITIC, NO UNDERLYING TONE	c. $CV(V)CV=C\check{V}$	d. $CV(V)C=C\check{V}$
CLITIC, UNDERLYING TONE	e. $CV(V)C\check{V}=C\acute{V}$	f. $CV(V)C=C\acute{V}$

These six forms differ in three ways: whether or not the final vowel is deleted (discussed in this chapter), whether or not the form has a clitic, and whether or not that clitic has an underlying tone (§6). These three factors taken together can account for the distribution of the boundary tone (marked as \check{V}).

¹In (52), C stands for any consonant, or any permissible cluster, and the acute accent diacritic on the vowel (\acute{V}) represents either low or high underlying tone for this schematization.

(53)

FORM	WFVD?	CLITIC?	BOUNDARY TONE PLACEMENT
a. CV(V)C [̈]	No	No	Word-final vowel
b. CV(V)C	Yes	No	No Boundary Tone
c. CV(V)CV=C [̈]	No	Yes, no Tone	Clitic-final Vowel
d. CV(V)C=C [̈]	Yes	Yes, no Tone	Clitic-final Vowel
e. CV(V)C [̈] =C [́]	No	Yes, Tone	Word-final Vowel
f. CV(V)C=C [́]	Yes	Yes, Tone	No Boundary Tone

In this chapter, the first factor, Word-Final Vowel Deletion, is analyzed, including its domain of application, why clitics are excluded, and why it can create syllable shapes that are otherwise illegal in the language.

4.1.1 How to Know Where Syllables Begin and End

One of the challenges of discussing syllables in Cherokee is getting accurate judgments from literate native speakers. There is no way to represent coda consonants in the syllabary, so codas are represented by a full syllable grapheme. For example, a word *yansi* ‘buffalo’ has two syllables, but is written **ᵛᵛᵛᵛᵛ**. This representation includes three graphemes: <ya>, <ni>, and <si>. Therefore, literate native speakers might say that *yansi* has three syllables, instead of two.

In his dictionary, Feeling (1975), a native speaker, denotes syllables through placement of tone diacritics. A tone diacritic will always follow the coda in his dictionary.

- (54) a. *noh²ji* ‘pine’
b. *go²hwe²li* ‘paper’

In (54a), the superscript 2 to mark low tone follows the *h*, indicating that the *h* is in the first syllable. In (54b), the superscript 2 preceded the *h*. This indicates that *h* is in the second syllable, not the first.

In his chapter on syllables and phonotactics, Uchihara (2013) uses three criteria for determining syllabification: native speaker judgment, Maximal Onset Principle, and segmental processes. As discussed above, getting speaker judgements is not unproblematic. Feeling's (1975) markings of syllables are consistent in his dictionary, but he also has linguistic training. Judgements from other (literate) native speakers are not as consistent.

The second criterion Uchihara (2013) uses is the Maximal Onset Principle:

(55) *Maximal Onset Principle* (Selkirk 1982:359, Uchihara 2013:121)

In the syllable structure of an utterance, the onsets of syllables are maximized, in conformance with the principles of basic syllable composition of the language.

He maximizes word-medial onsets of syllables, provided that they occur word-initially. In §4.2.1, I discuss the gaps in data which make this approach not so straightforward. There are a number of simple and complex onsets that do not occur both word-initially and word-medially.

The third criterion Uchihara (2013:122) uses is segmental processes. One process, Closed Syllable Shortening, where certain consonant sequences across syllables (*h.C*, etc.) cause vowel shortening—therefore the /h/ has to be in the same syllable as the shortened vowel to condition shortening.

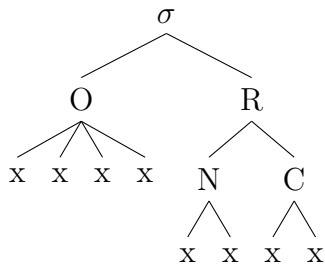
An additional consideration for determining syllabification is the distribution of codas. In Cherokee, there is no stem or word-final morph that ends in a consonant underlyingly, i.e. there are no final codas for citation forms. Since there are no word-final codas (save for those produced by WFVD), word-medial codas have to be justified by other criteria. This is discussed more in §4.2.3.

In my discussion of the syllable, I assume Uchihara’s (2013) basic syllabification is correct. However, I do reorganize the onset and coda clusters he describes.

4.2 The Canonical Syllable

A schematization of the maximal syllable in Cherokee is shown in (56)—(Uchihara 2013).

(56)



Uchihara (2013) claims that the onset (O) is maximally four consonants and minimally zero consonants—onsetless syllables are possible in Cherokee. The rime (R) is made up of the nucleus and coda. The nucleus (N) can be either a short (1 mora) or long vowel (2 moras), but not a diphthong. Uchihara (2013) also claims that the coda (C) may be one or two consonants. Syllables without codas are also possible.

In the following sections, I evaluate Uchihara’s (2013) claims about the maximal syllable in Cherokee. All examples in these sections (§4.2.1-4.2.3) are from Feeling (1975), unless otherwise noted.

4.2.1 Onsets

Simple onsets occur in both word-initial and word-medial contexts. The sequences /k^w/ and /tl/ are analyzed as complex segments, rather than clusters (as discussed in §1.2.1.1). In Table 14, (morphologically simple) examples of all attested word-initial and word-medial simple onsets are provided.

Table 14: Simple Onsets, Word-Initial and Word-Medial

	Cherokee	English gloss
/t/	doo .si nvv. da	‘mosquito’ ‘sun, moon’
/k/	gvv .he kóó. ga	‘bobcat’ ‘crow’
/k ^w /	ěě. gwa	‘huge’
/ʔ/	jo. ʔi	‘three’
/tʃ/	jóó .gi noh. ji	‘upstream’ ‘pine’
/tʌ/	dlaa .mee.ha dii. dla	‘bat’ ‘toward’
/s/	saa .sa	‘goose’
/h/	hi. ʔa kòò. hi	‘this’ ‘today’
/m/	ka. maa .ma	‘elephant’
/n/	nuú .na	‘potato’
/l/	loo .lo	‘locust’/‘cicada’
/j/	yoó .na jí. yu	‘bear’ ‘boat’/‘airplane’
/w/	woo .yi ku. waa .ya	‘pigeon’ ‘huckleberries’

There are several consonants that cannot appear as simple onsets word-initially—/k^w, ʔ, m/. In the case of /k^w/, this seems to be an accidental gap; as far as I know, there is no reason why this sound should not appear word-initially. Neither Feeling (1975) nor Montgomery-Anderson (2015) provide an example of a word-initial /k^w/ that is not part of a cluster /kwh/. Glottal stop /ʔ/ also never occurs at the beginnings of words as a simple onset². When /ʔ/ is word-medial and preceded by a vowel, it is parsed as part of the onset of the following syllable. The only word with word-initial /m/ is the name *Meéli* ‘Mary’,

²That is, as a phonemic onset. There is no contrast between /#ʔV/ and /#V/. However, there may be phonetic glottal stop insertion at the beginnings of words, as evidenced by higher initial pitches for (some) vowel-initial words. This is a typologically common process (see Garellek 2013), and the variability of word-initial phonetic glottal stop pronunciation is also found in English.

a borrowing. Since /m/ in Cherokee mostly comes from borrowings, it is unsurprising that there are no other words that are /m/-initial in the language.

According to Uchihara (2013), complex onsets can be two segments (CC), three segments (CCC) or four segments (CCCC). In the rest of this section, I discuss why this description is problematic, and I reorganize the onsets Uchihara (2013) identified into simple onsets (with and without /h/), CC clusters, and CCC clusters.

When onset CC clusters surface, one member of the cluster must be /s/ or /h/, according to Uchihara (2013). However, as far as /h/ is concerned, it may not be accurate to describe consonant sequences with /h/ as *clusters*. Obstruents adjacent to /h/ surface as aspirated obstruents, and resonants adjacent to /h/ surface as voiceless resonants (see Scancarelli 1987; Munro 1996b, etc.).

- (57) a. *kóóga* ‘crow’
 /**kh**óóga/ → [k^hóó.ga]
 b. *kwana* ‘peach’
 /**k^wh**ana/ → [k^wh.a.na]
 c. *goohweeli* ‘paper’
 /**koo**hweeli/ → [koo.ɰee.li]

In (57), the underlying clusters /kh/, /k^wh/, and /hw/ all surface as single segments [k^h], [k^wh] and [ɰ]. Syllabification should occur after phonological processes, so it is likely the case that the syllable parser doesn’t treat [h]-obstruent and [h]-resonant sequences as clusters.

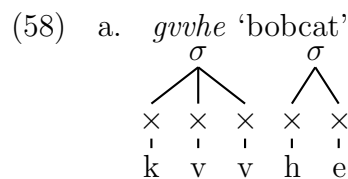
In her explanation of syllabification and epenthesis in Cayuga, Dyck (1990) argues that /s/, /h/, and /ʔ/ show exceptional phonological behavior. The phonemes /h/ and /ʔ/ do not look like full consonants when they surface after obstruents; instead, she argues that they “behave like release features on consonants”—aspiration for /h/ and glottalization for /ʔ/ (Dyck 1990:29). The alveolar fricative /s/ combines with obstruents to form affricates (such as [ts] and [ks]), which show different phonological behavior than their component phonemes.

The observed patterning of /h/, /ʔ/, and /s/ leads her to argue that these consonants are not represented on the timing tier, and instead act as floating features which associate to a node of the preceding segment.

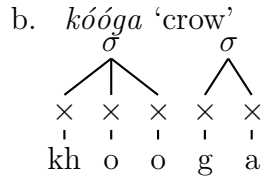
In Cherokee, only /h/ and /s/ combine to form onset CC clusters. Unlike Cayuga, /s/ in Cherokee it does not block alternations or create complex segments (/s/ also precedes the other consonant in a cluster, while in Cayuga /s/ follows the other consonant). Cherokee obstruents do become aspirated when followed by [h]³, and /h/ following a resonant doesn't surface as an [h], but as voicelessness on the resonant.

These realizations of /h/ in proximity to other consonants can be explained in terms of phonetic naturalness. In terms of their articulation, [h] and aspiration are essentially the same: they both have friction produced at the vocal folds. I'm not sure that a listener could perceptually distinguish between an obstruent followed by a full [h] and an aspirated obstruent. Voicing assimilation and concurrent loss of /h/ can explain the surfacing of voiceless resonants. This surfacing of voiceless resonants due to an underlying /h/ is not typologically unusual—similar behavior has been observed in Oceanic languages, such as Lenakel (Lynch 1978).

It therefore could be the case that these processes that arise due to articulatory phonetics have been phonologized in a similar way to Cayuga /h/, /ʔ/ and /s/—i.e. Cherokee /h/ does not have its own representation on the timing tier when in an underlying sequence with an obstruent or resonant.



³Whether the /h/ underlyingly follows the obstruent or it is moved there by Laryngeal Metathesis.



In (58a), the segment /h/ associates to the timing tier because it cannot combine with the preceding or following vowel. In (58b), /h/ is realized as aspiration on the preceding obstruent /k/, and therefore does not associate to a slot by itself on the timing tier. Since it does not associate to a position of its own, a CC sequence with an /h/ is not a surface cluster (as claimed by Uchihara 2013), but a complex segment. Underlying onset CC clusters with /h/ can therefore be considered simple onsets⁴.

In Table 15, all possible single consonant onsets are represented. All unaspirated consonants can appear as onsets. The aspirated consonants [t^h, k^h, k^{wh}, tʃ^h, tʃ^h], and the voiceless resonants [ŋ̥, ʈ̥, j̥, w̥] can also appear as single consonant onsets. The phoneme /h/ doesn't appear in sequence with /ʔ, s, h/ or /m/.

⁴The underlying order of the /h/ and resonant don't seem to matter; e.g. both /hw/ and /wh/ will surface as w̥. There is some evidence that the position of the /h/ with respect to the resonant does make a difference for phonological processes, but that won't be discussed here. See Munro (1996a); Uchihara (2013) for a more in depth discussion.

Table 15: All Possible Surface Simple Onsets (In Phonetic and Orthographic Representations)

PR	OR	PR	OR
[t]	<d>	[t ^h]	<t>
[k]	<g>	[k ^h]	<k>
[k ^w]	<gw>	[k ^w h]	<kw>
[ʔ]	<ʔ>		
[tʃ]	<j>	[tʃ ^h]	<ch>
[tʎ]	<dl>	[tʎ ^h]	<tl>
[s]	<s>		
[h]	<h>		
[m]	<m>		
[n]	<n>	[n̥]	<hn, nh>
[l]	<l>	[ɬ]	<hl, lh>
[j]	<y>	[j̥]	<hy, yh>
[w]	<w>	[w̥]	<hw, wh>

Though /h/ surfaces as a phonetic feature on the preceding consonant and therefore is not a member of an onset cluster, there are numerous examples of CC clusters with /s/. In these clusters, /s/ can precede or follow the other member of the cluster—both /sk/ and /ks/ are attested, for example. When /s/ is the first member, and can be followed by an obstruent /t, k, k^w, tʎ/ or /l/. When /s/ is the second member, it can be preceded by /k/ or /k^w/. There are no onset clusters /stʃ, tʃs/, /sh, hs/, /sʔ, ʔs/, /sm, ms/, /sn, ns/, or /sj, js/. Uchihara (2013) notes that the clusters /sl/ and /stl/ are not well attested—there are only two tokens of /sl/ in Feeling’s (1975) dictionary, and just one of /stl/.

As Uchihara (2013) notes, onset clusters whose first member is /s/ violate the Sonority Sequencing Principle (Blevins 1995); a cluster like /st/ falls in sonority, the opposite of the generalization that clusters generally rise or plateau as members of a syllable get closer to the syllable peak (the nucleus). However sC clusters have been observed in many languages, and Barlow (2001) treats /s/ as adjoined to the syllable, rather than part of the onset. In this dissertation, I show that /s/ in Cherokee surfaces before, after, and between other consonants

in the onset; however, the extent to which /s/ is part of the abstract representation of the Cherokee syllable is not addressed.

Table 16: CC Onsets with /s/

	Cherokee	English gloss
/st/	sd ùù.di	‘door, gate’
/sk/	sgoó .hi	‘ten’
/sk ^w /	sgw àà.hlóé.sdi	‘ball’
/stl/	dàà. sdl úu.sga	‘He is splitting it’
/sl/	àà. sla .dí	‘You’re roping me’ (JRS, Uchihara 2013)
/ks/	da. ksi	‘turtle’
/k ^w s/	no. kws i	‘star’

There are also ten possible CC clusters with /h/ (which Uchihara 2013 classifies as CCC). These clusters are /khk/, /kht/, /khtf/, /khtl/, k^wht/, /thk/, /tht/, /thtl/, /skh/, and /sth/. Examples of data with some of these onsets are provided in the Table below:

Table 17: Some CC Onsets with /h/

	Cherokee	English gloss
/kht/	kdii .ha	‘He is using it’ (DC, August 2017)
/tht/	ì. tdí (.ha)	‘We are (all) using it’ (JRS, Uchihara 2013; DC, Aug 2017)
/thtl/	ì. tdlí (.ha)	‘We are (all) sharpening it’ (JRS, Uchihara 2013; DC, Aug 2017)
/skh/	sko.ní .yi	‘overseas’

Finally, there are several CC clusters (CCCC per Uchihara 2013) that have two instances of /h/. These are /khth/, /khtlh/, and /thtlh/.

Table 18: Some CC Onsets with 2 /h/’s

	Cherokee	English gloss
/khth/	któó .ʔa	‘(a long object) is hanging’
/thtlh/	dvv. ttli	‘He is running toward here’ (DJM, Uchihara 2013)

Since some of the onsets Uchihara (2013) describes as CCC and CCCC (shown above) have one or more /h/, I think it is more accurate to think of them as CC clusters. In Table 19, all possible CC onsets are listed. As with simple onsets, not all are attested word-initially. For example, at least the clusters /tht/ and /thtl/ likely arise due to morpheme concatenation.

Table 19: All Possible Surface CC Onsets

PR	OR	PR	OR
[st]	<sd>	[st ^h]	<st>
[sk]	<sg>	[sk ^h]	<sk>
[sk ^w]	<sgw>		
[stl]	<sdl>	[tl ^h]	<stl>
[k ^h k]	<kg>		
[k ^h t]	<kd>	[k ^h t ^h]	<kt>
[k ^h tʃ]	<kj>		
[k ^h tl]	<kdl>		
[k ^w ht]	<kwd>		
[t ^h k]	<tg>		
[t ^h t]	<td>	[t ^h t ^h]	<tt>
[t ^h tl]	<tdl>	[t ^h tl ^h]	<ttl>

In addition to CC clusters, a few CCC onset clusters are attested: /ksk/, /kst/, /ksl/, /k^wsk/, and /k^wst/. These clusters are attested both in Uchihara’s (2013) fieldwork and mine (Table 20). Additionally, there are two cluster with /h/—/ksth/ and /sthk/—which I also consider CCC clusters.

Table 20: Some CCC Onsets

	Cherokee	English gloss
/kst/	ksdeé .la	‘Help me!’ (JRS, Uchihara 2013; DC, Aug 2017)
/ksl/	ksla .dí(.ʔi)	‘You are roping me’ (JRS, Uchihara 2013; JR, Aug 2017)
/ksth/	dùù. ksta .nóv.ʔi	‘S/he vomited’ (DC, Aug 2017)
/sthk/	àà.li.yée.suu. stgí .ʔa	‘S/he is taking off a ring’

Additionally, there are a few clusters that I was unable to elicit. Uchihara (2013) lists the clusters /tsk/, /tsk^w/, /tst/, and /tsl/. The speakers I talked to either didn't pronounce a /t/, changed it to a different segment, or gave me a different word. I am not the only researcher who has had difficulty with these /ts/ clusters—Lindsey (1985) transcribes the word for 'bug' as *skoóya*, while it appears as *tsgoóya* in Feeling (1975).

Table 21: CCC clusters with /ts/

	Uchihara (2013)	JR, Aug 2017	DC, Aug 2017	English gloss
/tsk/	tsgoó.sv (JRS)	<i>hi.sgoó.li</i>	ja.sgoó.sv.ʔi	'You dug it'
/tsk ^w /	tsgwa.lée.gwa.la	sgwa.lée.gwa.li	ksgwa.lée.gwa.li	'whipporwill'
/tst/	tsd'v'v'v (JRS)	<i>wiidv'v'ga</i>	ja.d'v'v'v	'You put it (FL) in the fire/ you put it (unspec.) in the fire'

Since there is so much variation in the data, I will put these /ts/ clusters aside for now.

Therefore, the possible CCC onset clusters are summarized in Table 22⁵.

Table 22: All Possible Surface CCC Onsets

PR	OR
[ksk]	<ksg>
[kst]	<kzd>
[ksth]	<kst>
[ksl]	<ksl>
[k ^w sk]	<kwsg>
[k ^w st]	<kwzd>
[sthk]	<stg>

These clusters, like many CC clusters arise due to morpheme concatenation in combination with other phonological processes. For example, the cluster /kst/ surfaces in the word

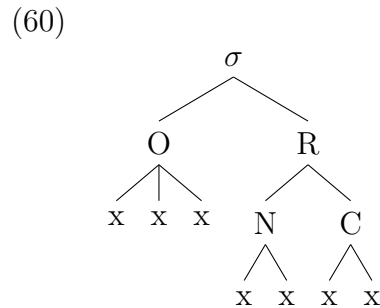
⁵Even though /k/ and /k^w/ are typically written <g> and <gw> respectively, in CCC clusters, they are conventionally written <k> and <kw> (see Feeling 1975; Montgomery-Anderson 2008, 2015; Uchihara 2013).

ksdeéla ‘Help me!’ due to a number of phonological processes that occur on the combined local pronominal prefix⁶ *sgi-*:

- (59) *ksdeéla*
 sk(i)-steél-a
 2/1-help:IMP-IND
 ‘Help me!’

In this example (59), the vowel in *sgi-* is deleted⁷. If vowel deletion occurs, the sequence would be [skst], a cluster that is otherwise not legal. So, the first [s] is also deleted, and *ksdeéla* [ksteé.la] surfaces.

In this section, I’ve shown that onsets can be of one, two or three consonants. These consonants can also be internally complex: [k^w], [tl], [tʃ], [t^h], etc. Therefore, revising the maximal syllable template from (56) is necessary. The revised schematization is shown in (60).



⁶This prefix is used “to refer to combinations of subject and object where both are local persons” (Montgomery-Anderson 2015:251).

⁷A North Carolina Cherokee speaker would say *sgisdeela* (Uchihara 2013). However, speakers I consulted in Oklahoma also produced *sgisdeéla*. The vowel deletion rule seems optional in other cases as well—I also elicited *sgisladi* for *ksladi(ʔi)* ‘You are roping me’.

4.2.2 Nucleus

The nucleus of a syllable can be either a short vowel (one mora) or a long vowel (two moras). All vowel qualities can appear as short and long. In the following Table, examples of long and short vowels (in non-final positions) in morphologically simple words are provided.

Table 23: Cherokee Nuclei

	Short Vowel	Long Vowel
/a/	sa.li ‘persimmon’	gaá.da ‘dirt’
/e/	ge.ʔi ‘downstream’	seé.di ‘walnut’
/i/	hi.ʔa ‘this’	gií.ga ‘blood’
/o/	jo.ʔi ‘three’	yoó.na ‘bear’
/u/	tu.sdi ‘boil (sore)’	nuú.na ‘potato’
/ã/	yv.gi ‘fork, nail, needle’	kvv́.hli ‘raccoon’

In some cases, the length of vowels may be predictable. In Feeling’s (1975) dictionary, long and short vowels are distinguished with a dot under short vowels (ȧ). However, vowels in closed syllables were not written with a dot, because closed syllables have predictably short vowels (Koops 2006). Munro (1996b) and Uchihara (2013) note that, though rare, long vowels do appear in closed syllables. Uchihara (2013) argues that in (61), the vowel in the second syllable must be long—it bears accent, and accent only occurs on long vowels⁸.

(61) *alsdė́łhdohdi*
al.stė́łh.toh.ti

‘aid, assistance (financial)’ (Feeling 1975:41, Uchihara 2013:125)

Finally, There are no diphthongs attested as nuclei; glides are either parsed in the onset or the coda.

⁸Accent can appear on short vowels *only* in disyllabic words where the first syllable has a short vowel. Since this word is more than two syllables, the accent must appear on a long vowel.

4.2.3 Codas

Only resonants /l, n, j, w/ and laryngeals /h, ʔ/ can appear in codas, and only word-medial codas are allowed (unless there is Word-Final Vowel Deletion, as will be discussed in §4.3). There are no final codas attested in citation forms. In Table 24, there are examples of all possible word-medial simple codas:

Table 24: Simple Codas, Word-Medial

	Cherokee	English gloss
/n/	u.wan.sʷʷ.ʔi	‘ripe’
/l/	a.l.sduu.lo	‘cap’
/j/	a.jʷʷ.y.sdi	‘light, lamp’
/w/	ù.ù.waw.svʷ.ga	‘S/he smells it.’
/h/	nvh.gi	‘four’
/ʔ/	joʔ.sgoó.hi	‘thirty’ (Montgomery-Anderson 2015)

The consonants /n, l, j, w, h, ʔ/ can be justified as codas because word-initial resonant-initial or laryngeal-initial clusters are never attested. Additionally, if /h/ were in the same syllable as the following, we might expect that it is realized as part of the consonant (i.e. aspiration), rather than a full segment.

The laryngeal /h/ can appear in the coda with a resonant; as with onsets, /h/+resonant sequences surface as voiceless resonants. Examples of coda voiceless resonants /hl, hn, hw, hj/ are provided in Table 25:

Table 25: Codas with /h/, Word-Medial

	Cherokee	English gloss
/nh/	à.à.daanh.té.ha	‘S/he is thinking.’
/lh/	galh.dí.ha	‘cap’
/jh/	áyh.ga	‘[A rooster]’s crowing.’
/wh/	à.à.goowh.tí.ha	‘S/he sees it.’ (DF, Uchihara 2013)

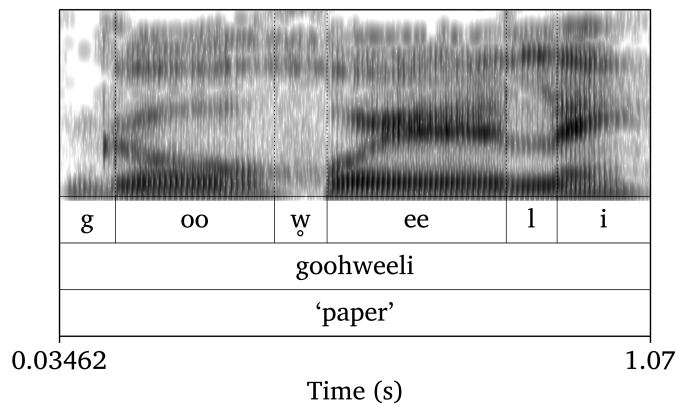
The realization of /h/ as voicelessness on the resonant must occur before syllabification. In the example (62)—from (57 above)—since /h/ is a legal coda, it would be possible for the sequence /hw/ to be syllabified either with /h/ in the coda (62a) or as part of the resonant in the onset (62b).

(62) *goohweeli* ‘paper’

- a. /koo^hweeli/ → [koo^h.wee.li]
- b. /koo^hweeli/ → [koo.^wee.li]

However, the syllabification in (62a) does not occur. As shown in the following spectrogram (63), word-medially, there is only a voiceless resonant [w̥].

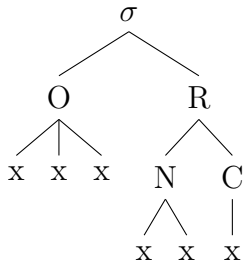
(63)



This spectrogram shows that the realization of voicelessness on the resonant /w/ by the neighboring /h/ occurs before syllabification. If syllabification took place before /h/ was realized as voicelessness, it might be the case that the syllabification in (62a) is possible. Since this is not the case, again, I think it is more accurate not to think of /h/+obstruent or /h/+resonant underlying sequences as surface clusters.

Therefore, it is again necessary to revise the maximal syllable template from (56). The revised schematization is shown in (64) to account for the generalization that word-medial codas can surface as maximally one segment (either a resonant, laryngeal, or voiceless resonant).

(64)



4.3 Word Margins and Word-final Vowel Deletion

Word-Final Vowel Deletion (WFVD) is a process that occurs often in fast or informal speech, where some word-final element is deleted. This deletion of a vowel or a syllable can create words that end in consonant or a vowel (65).

- | | | | |
|------|--|---|---------------------------|
| (65) | No Deletion | | Word-Final Vowel Deletion |
| | a. <i>iinada</i> | ~ | <i>iinad</i> |
| | ‘snake’ (DC, Oct 2014) | | |
| | b. <i>nvvdǎvneeleeʔi</i> | ~ | <i>nvvdǎvneelee</i> |
| | <i>ni-ii-uunii-advn-eel-eʔi</i> | | |
| | PRT-ITR-3B.NS-do-PFT-NXP | | |
| | ‘They did...’ (Montgomery-Anderson 2015:428) | | |

As (65) shows, WFVD occurs regardless of part of speech or morphological complexity. In (65a), the final vowel of *iinada* ‘snake’ is deleted, resulting in *iinad*, a consonant-final word. In (65b), the final *ʔi* syllable is deleted, resulting in a vowel-final word. Though (65b) ends in a vowel, the final vowel *-e* is not the final vowel of a citation form for this verb. The

alternation of the word-final reported past morpheme *-eʔi~e* shows that WFVD occurs, though it does not create a consonant-final form.

However, WFVD often creates consonant-final forms. These forms have a word-final consonant or consonant cluster (see 65a) which is otherwise not legal. Additionally, these word-final codas are not the same codas found word-medially. Word-medial codas can be only resonants, laryngeals, or voiceless resonants (underlyingly /h/+resonant). Word-final codas can be almost any consonant in the language—obstruents, resonants, aspirated obstruents, voiceless resonants—as well as consonant clusters. However, word-final consonants can *never* be laryngeals.

It is often the case the word edges have special phonotactic properties. Goldsmith (2014) notes that wellformed words are not always comprised of wellformed syllables. As mentioned in §4.2.1, not all consonants are attested as word-initial onsets, but all consonants can be onsets word-medially. Similar restrictions exist at the ends of words. There are no word-final consonants in citation forms—every word in the Feeling (1975) dictionary ends in a vowel and Scancarelli (1987:22) claims that “all Cherokee words end in vowels at an underlying level”. However, when WFVD occurs, a much wider range of codas is allowed to appear word-finally than word-medially. It is perhaps odd that the resulting codas would be otherwise illegal (i.e. they never occur in word-medial position)—however, fast speech processes have been observed to produce structures that violate the phonotactics of a language (see §4.3.4).

Scancarelli (1987:22) characterizes this process as: “final vowels and final HV⁹ syllables are generally deleted except at the end of a phrase or utterance”. There are three parts to her definition that will need to be addressed in the following sections: 1) clearly describing exactly what does and does not delete, 2) the domain of deletion, and 3) the effect of position in an utterance on deletion.

⁹The notation H represents any laryngeal—either /h/ or /ʔ/

To address the final part first: Feeling (1975) notes that before a pause (what Scancar-elli 1987 interprets as an utterance-final position) word-final vowels are generally not deleted. However, he also notes that often, even before a pause, the word-final vowel is deleted. In the previous literature, there is no good definition of what an utterance corresponds to in Cherokee, though for this dissertation, I propose the following working definition for Cherokee: a unit of speech bounded by pauses. Michelson (2000) notes that it is difficult to define the utterance in Oneida without being circular. In a text, I interpret the end of an utterance coinciding with a pause following the end of a clause. In elicitation, if I ask for a sentence, I interpret the utterance as the entirety of the elicited form.

If WFVD does occur less frequently at the ends of utterances (as previously described), it might be the case that *not* deleting is signal for the end of an utterance or turn. However, since deletion still occurs at the ends of phrases and turns, it is hard to draw any definite conclusions. In my fieldwork, I have not found a robust pattern which can predict which words in an utterance will and will not have their final vowels pronounced.

Since there doesn't seem to be a pattern (except maybe WFVD is less frequent at the ends of utterances), I think WFVD can be best analyzed as an optional, fast speech process. The following sections will address the first two parts of Scancar-elli's (1987) definition—what does and does not delete, and the domain of deletion.

4.3.1 Vowel Deletion resulting in consonant-final forms

When the final syllable of a word in citation form is CV, and C is any consonant but a laryngeal, WFVD results in a **consonant**-final form. This consonant (or consonant cluster) only appears after WFVD—it is not other a legal word-final coda. After WFVD occurs, word-final simple consonants can be any consonant, except [ʔ] and [h]. Table 26 below demonstrates all permissible word-final simple codas.

Table 26: WFVD Morphologically Simple Words

CODA C	CITATION FORM	WFVD FORM	ENGLISH GLOSS	SOURCE
/t/	gaá.da	gaád	‘soil, dirt’	JR, DC, Aug 2017
/k/	goo.gi	goog	‘summer’	JR, Aug 2017
/kw/	?	?	?	
/tʃ/	waá.ji	waáj	‘clock, watch’	JR, Aug 2017
/tl/	?	?	?	
/s/	weé.sa	weés	‘cat’	DC, Oct 2014
/m/	a.ma	am	‘water’	DC, Oct 2014
/n/	ii.na	iin	‘far’	JR, Aug 2017
/l/	suu.li	suul	‘fire’	DC, JR, Aug 2017
/j/	nṽṽ.ya	nṽṽy	‘rock’	DC, JR, Aug 2017
/w/	ku.wa	kuw	‘mulberries’	DC, JR, Aug 2017

Voiceless resonants are also attested as word-final codas after deletion of the final vowel (Table 27). Voiceless resonants, like the plain consonants above, are onsets in the citation form, but become codas after WFVD.

Table 27: hR and WFVD

UNDERLYING C’S	CITATION FORM	WFVD FORM	ENGLISH GLOSS	SOURCE
/h/+/l/	oo.hli	oohl [oɪ]	‘soap’	JR, DC, Aug 2017
/h/+/j/	a.geé.hya	a.geéhy [ə.kě:ʝ]	‘woman’	DC, Oct 2014
/h/+/w/	tòò.juú.hwa	tòò.juúhw [tʰò:dʒũ:w]	‘red bird’	JR, Apr 2015

Word-final clusters can be either two consonants (CC) or three consonants (CCC). However, WFVD coda clusters are not limited to the set of possible onset clusters shown in §4.2.1. For example, the word *gaansdi* ‘stick’ becomes *gaansd* after WFVD. The coda cluster [nst] is not a legal onset, but it does appear here as a word-final coda.

Table 28: Clusters and WFVD

UNDERLYING C's	CITATION FORM	WFVD FORM	ENGLISH GLOSS	SOURCE	LEGAL ONSET?
/kht/	i.yú.wǎǎ. kdi	i.yú.wǎǎ kd	'time'	(Montgomery-Anderson 2015:425)	YES
/khth/	uu. kta	u kt	'seed'	JR, DC, Aug 2017	YES
/k ^w s/	no. kws i	no kws	'star'	JR, DC, Aug 2017	YES
/nst/	gaan. sdi	gaan sd	'stick'	JR, Aug 2017	NO
/nhtʃ/	vún. hji	vún hj	'snow'	JR, Aug 2017	NO

True clusters with /h/ are attested as word-final codas (unlike the onsets and codas discussed above). For example, after WFVD, the word *wahga* 'cow' is pronounced as [wahk^h]¹⁰.

Table 29: /h/-Clusters and WFVD

UNDERLYING C's	CITATION FORM	WFVD FORM	ENGLISH GLOSS	SOURCE
/hk/	wah. ga	wah g [wahk ^h]	'cow'	JR, Aug 2017
/htʃ/	noh. ji	noh j [nohtʃ ^h]	'pine'	JR, Aug 2017

While it may be true that all Cherokee words end with a vowel underlyingly (per Scancarelli 1987), this data makes it clear that a wider variety of codas than previously described can surface, but only at the ends of words and only after deletion has occurred. Though these unexpected codas only occur after a process, it is unlikely that WFVD is an attempt to repair bad strings or syllables (as is the case with medial deletion or Laryngeal Metathesis (see Flemming 1996).

If WFVD were a process motivated by trying to create some particular syllable shape, we would expect to see the same syllable shape every time WFVD applies. Instead, as Table

¹⁰When WFVD occurs word-final obstruents are often aspirated.

30 shows, WFVD applies to a variety of syllable shapes in citation form and creates a variety of new word-final syllable shapes.

Table 30: Final syllable shape

ENGLISH GLOSS	NO DELETION		WFVD	
	phonetic transcription	final σ shape	phonetic transcription	final σ shape
‘snake’	ii.na. da	CV	ii. nad	CVC
‘woman’	a.geé. hya	CV	a. geéhy	CVVC
‘seed’	uu. kta	CCV	uukt	VVCC
‘stick’	gaan. sdi	CCV	gaansd	CVVCCC
‘They did...’	nvvn.dív.nee.le. ?i	CV	nvvn.dív.nee. le	CV

Table 30 also shows that the same final syllable shape (CV) can appear both before (nvvn.dív.nee.le.**?i**) and after (nvvn.dív.nee.**le**) WFVD applies. If WFVD were a repair process or a process intended to produce ideal word-final syllables, we would not expect to see the same syllable shape both with and without the process applying—the process should just not apply. Additionally, the variety of syllable shapes produced by this process (with a variety of word-final segments and clusters) suggests that WFVD doesn’t apply to “fix” the final syllable of words.

4.3.2 Vowel Deletion resulting in vowel-final forms

When the final syllable of a word in citation form is CV, and C is a laryngeal (/h/ or /ʔ/), WFVD results in a **vowel**-final form. Like in §4.3.1, the final vowel is deleted, but when the consonant is /h/ or /ʔ/, that consonant is also not pronounced.

Most often vowel-final forms after WVFD occur with verbs. Most verbal suffixes are of the form -*Vʔi* where V is some long or short vowel. Of the twelve verbal suffixes Montgomery-Anderson (2015) identifies, seven are of the form -*Vʔi*. Additionally, the indicative suffix -*a*

(not identified by Montgomery-Anderson 2008, 2015) is frequently preceded by an aspectual morpheme that ends in /h/¹¹.

Table 31: Verbal Suffixes

MORPH TYPE	SUFFIX	GLOSS
Derivational suffixes	-i	Agentive (AGT)
	-dohdi	Causative (CAU)
	-da	Participle (PCP)
	-ǎǎna	Negative Deverbalizer (NDV)
	-ǎǎʔi	Deverbalizer (DVB)
	-ʔi	Locative (LOC)
	-iinééʔi	Ordinal (ORD)
	-háǎʔi	Adjective (ADJ)
Inflectional suffixes	-ó(ó)ʔi	Habitual (HAB)
	-vʔi	Experienced Past/Assertive (EXP)
	-é(é)ʔi	Nonexperienced Past/Reportative Past (NXP)
	-éésdi	Progressive Future (PFT)
	-vvʔi	Future Command (FCM)
	-a	Indicative (IND)

Because so many of these suffixes end in a *hV* or *ʔV* syllable, when WFVD occurs on a verb, the new final-segment often is a vowel. The inflectional suffixes (called modal suffixes by Cook 1979 and Uchihara 2013, and final suffixes by Montgomery-Anderson 2008, 2015) are frequent suffixes, because these are the morphemes that provide tense information. Montgomery-Anderson (2015) even claims that the inflectional suffixes *-vʔi* EXP, *-é(é)ʔi* NXP, and *-ó(ó)ʔi* HAB more often occur in the “shortened” form than the full form. In my fieldwork, both in elicitation and in texts, speakers frequently delete the final vowel of these three suffixes, as well as the indicative suffix.

¹¹For Montgomery-Anderson (2015), aspectual morphemes are part of the stem. As discussed in the introduction, for the sake of consistency I use Cook’s (1979) and Uchihara’s (2013) morphological analysis of aspectual morphemes which can be separated from the stem. Montgomery-Anderson (2015) also treats the indicative suffix as part of the stem (the present continuous stem in his analysis). However, I also separate this morph from the stem.

In the following examples (66), I provide several words that have had their final vowel (or *hV* or *?V* syllable) deleted. For ease of reading, the top line shows the word as it is pronounced. The second line has the morpheme boundaries, including whatever was deleted in parenthesis. Also in these examples, I have included what morpheme (or morphemes) have had segments deleted by WFVD¹².

- (66) a. **go**
 ko(?i)
 ‘grease’ (JR, Aug 2017) STEM
- b. **aliiha** *jahnawo*
 alii-ha(?i) ca-ahnawo
 sweat-ADJ 2B-shirt
 ‘sweaty shirt’ (Montgomery-Anderson 2015:380) -háá?i ADJ
- c. *noówu* **ta?liiné** *wunííííháj*
 noówu tha?li-iiné(?i) wi-uunii-?lú-hj-(a)
 now two-ORD TRN-3B.NS-arrive-PFT-CVB
 ‘When they arrived at the second,’ (Montgomery-Anderson 2015:428) -iinéé?i ORD
- d. **ààdehlgwaasgo**
 a-adehlkwaa-sk-ó(?i)
 3A-learn-IMPF-HAB
 ‘S/he learns.’
 (Montgomery-Anderson 2015:77) -ó(ó)?i HAB
- e. **ààgwuuhiiíó?v**
 aki-uhiiíóo-?v(?i)
 3B-wash(T)-PFT-NXP
 ‘S/he washed it.’ (Montgomery-Anderson 2015:79) -vó?i EXP

¹²Montgomery-Anderson (2015) often doesn’t indicate the tone of the final vowel after deletion. Since no marking is a low tone or a boundary tone in his system, I’m not sure what tone he is indicating in the examples in b, d, and f. Based on my fieldwork, the new final-vowel, post-WFVD, should have the same tone as the morph without WFVD. Therefore *aliiha* should be *aliihá*, but without his recordings, it is impossible to tell what tone the new final vowel has.

- f. ***ùùwuuhiióoʔe***
 uu-uhiióo-ʔ-é(ʔi)
 3B-wash(T)-PFT-NXP
 ‘S/he washed it.’ (Montgomery-Anderson 2015:79) -é(é)ʔi NXP

Of course, if the verbal suffix has a final CV syllable, where the C is *not* a laryngeal, consonant final forms surface after WFVD (67).

- (67) a. ***gaachinóósd*** *ganvvhnv*
 ka-:chinóós-d(a) *gahnvvnv*
 3A-straighten-PCP road
 ‘straight road’ (Montgomery-Anderson 2015:378) -da PCP

However, when WFVD does result in a vowel-final form, it may be due to deletion of a whole morpheme in addition to deletion of a laryngeal that preceded that morpheme (68).

- (68) a. ***ùùduulí***
 uu-aduul-í(h-a)
 3B-want-PRS-IND
 ‘S/he wants it.’ (DC, Apr 2016) -íh-a PRS+IND
- b. *dààtihniídóohe* *daahnaw* ***aneedóó***
 tee-a-ahnih-íítóoh-e(ʔi) *taahnaw(a)* *anii-eetoo(h-i)*
 DST-3A-lead-AMB:PRS-NXP war 3A.NS-walk.around:PRS-AGT
 ‘He was leading a war party.’ (Montgomery-Anderson 2015:432)
-eetoo*h*-i STEM:PRS+AGT

In (68a), the final vowel /a/ is deleted, as well as the preceding /h/. In this case, the final vowel is an entire morpheme, the indicative suffix *-a*. Since vowel deletion results in a word-final /h/—the last segment in the present aspectual suffix *-íh*—the /h/ is also deleted. In (68b), again the final vowel /i/ is a morpheme on its own, the agentive derivational suffix *-i*. Deletion of /i/ results in a laryngeal-final form (in this case, the inflected stem *-eedooh*), so the laryngeal is also deleted. In both cases, WFVD doesn’t respect morpheme boundaries. In

all previous examples, WFVD has deleted a segment or syllable from one stem or morpheme. However, these examples in (68) show that WFVD is a process that is not bounded by the domain of a morpheme—this process is not just allomorphy, and cannot be explained by calling this alternation “long” and “short” forms, as in Montgomery-Anderson (2015). This data suggests that WFVD targets the prosodic word, something that will be further discussed in §4.4.

4.3.3 What Doesn’t Delete

While WFVD occurs on all parts of speech, there are some words which do not allow deletion.

Table 32: Exceptional Words

CITATION FORM	WFVD FORM	ENGLISH GLOSS	SOURCE
ale	*al	‘and, or’	JR, DC, Aug 2017
gvvhe	*gvv(h)	‘bobcat’	
guule	*guul	‘acorn’	
iiya	*iiy	‘pumpkin’	
jiíyu	*jiíy	‘boat, airplane’	
tuúya	*tuuy	‘beans’	
aadla	*aadl	‘rubber’	
saasa	*saas	‘goose’	RQ, fall 2013
seélu	*seél	‘corn’	

The majority of words that allow WFVD end in /i/ or /a/. However, as shown in Table 32, *tuúya* ‘beans’, *saasa* ‘goose’ and *aadla* ‘rubber’ don’t allow WFVD. The words *jiíyu* ‘boat’ and *seélu* ‘corn’ both end in /u/ and cannot have their final vowels deleted; however, the word *gùùgu* ‘bottle’ can be pronounced as *gùùg* [kù:k^h]. Finally, I have yet to find a word-final /e/ that can be deleted. I don’t know yet if this is an accidental or motivated gap¹³.

¹³There are no words in citation form, or word-final morphs, that end in *v* /ã/.

Scancarelli (1987) explains that some word-final vowels cannot be deleted because they are underlyingly long. Instead of being deleted, word-final long vowels are shortened, and can only be identified when followed by a clitic (69).

(69)

	Without Clitic	With Clitic = <i>sgo</i>
a.	seélu	seéluusg
	seélu(u)	seéluu=sk(o)
	corn	corn=Q
	‘corn’	‘corn?’ (JRS, Uchihara 2013:63)
b.	hawiiya	hawiiyaasg
	hawiiya(a)	hawiiyaa=sk(o)
	meat	meat=Q
	‘meat’	‘meat?’ (JRS, Uchihara 2013:63)
c.	dìisuúlo	dìisuúloosg
	ti-ààsuúlo(o)	tìisuúlo=sk(o)
	DST-3A-shoe	DST-3A-shoe=Q
	‘shoes’	‘shoes?’ (JRS, Uchihara 2013:63)

This claim potentially solves the problem of some word-final vowels deleting and others not, without having to posit some feature on certain lexical items. However, there are some additional facts about WFVD that it doesn’t capture.

First of all, some singleton consonants never appear as word-final codas after WFVD. Word-final vowels can’t be deleted when the word-final syllable is k^wV or tIV . It is unclear at this time if this is a motivated or accidental gap. Additionally, some names allow WFVD to occur when it otherwise would not be permitted. The name *gwaagwu* ‘Bob’ can be pronounced as *gwaagw* [kwa:k^{wh}], though there are no other examples of WFVD that results in a final singleton [k^w]. Additionally, *guule* ‘acorn’ cannot be shortened to **guul* unless it is used for a girl’s name. Finally, word-final /e/ never deletes. If Scancarelli (1987) is correct about word-final long vowels, then it could just be the case that all instances of word-final [e] are long underlyingly /e:/.

While Scancarelli's (1987) claim of word-final long vowels cannot account for the above cases, it seems that these are low frequency, or otherwise not indicative of the process overall. In the case of word-final /e/ (or /e:/), there are only seven entries in Feeling's (1975) dictionary that have a word-final /e/. Additionally, phonotactic rules of names (and onomatopoeia) can differ from phonotactic rules of other morphologically simple words of a language (Bauer 2015). Therefore, the deletion of word-final vowels in name probably should not be considered when making generalizations about WFVD.

The only non-marginal case of final vowels never deleting is when the word-final vowel is a clitic vowel. This will be discussed below in §4.5.

4.3.4 Why WFVD must be a Deletion Process

All previous mentions of this process in the literature (see Scancarelli 1987; Uchihara 2013; Montgomery-Anderson 2015) treat this as a deletion process. As of now, there has been no evidence to counter this assertion, and in fact there are several reasons why thinking of WFVD as insertion creates problems.

First of all, final vowels are not predictable. All vowels (except / $\tilde{\lambda}$ /) can occur as word-final vowels in citation forms. If WFVD were an insertion process, we might expect that all words end in the same vowel, or a vowel could be predicted by the neighboring consonants or vowels. However, there is no discernible pattern that would predict the quality of final vowels.

Some final vowels, however, are in free variation, though some speakers prefer one to the other and native speakers have indicated that this variation may be driven by dialect. Many nouns in the dictionary that end in [i] or [a] can be pronounced with either vowel:

(70)

	Citation form	Pronunciation	English gloss
a.	giihli	[ki:ʔi], [ki:ʔa]	‘dog’
b.	wooya	[wo:ja], [wo:ji]	‘pigeon’

(JR, DC, Aug 2017)

As shown in (70), both the words for ‘dog’ and ‘pigeon’ can be pronounced with either [i] or [a] as the final vowel, depending on the speaker.

However, most final vowels do not appear in free variation. If a noun ends in [u] or [e], it cannot alternate with [i] and/or [a]:

(71)

	Citation form	Pronunciation	English gloss
a.	seélu	[sě:lu], *[sě:li], *[sě:la]	‘corn’
b.	gvvhe	[kã:he], *[kã:hi], *[kã:ha]	‘bobcat’

(JR, DC, Aug 2017)

Final vowels of inflectional suffixes also cannot alternate—the indicative suffix is always *-a*, never *-i*, and the habitual suffix *-óʔi* is never *-óʔa*. At least for the indicative, this makes sense; there is also a derivational suffix *-i*. So if the vowel changed, the meaning would change, too. Therefore, the final vowel free variation is limited to only a small set of Cherokee nouns.

Crosslinguistically, deletion also frequently occurs in colloquial speech and conversation—registers where the speaker produces words at a faster rate and less precisely. Vowel elision or devocalization in fast speech is a well-observed phenomenon (see Beckman (1996) for English/German schwa deletion, and Japanese/Korean/Montréal French devocalization). In English, schwa deletion in unstressed initial syllables can create onset clusters that are both otherwise attested in the language, as well as onset clusters that should be illegal (Davidson 2006). In (72b), when the first schwa in *fatigue* is deleted, the illegal cluster *ft* is created.

- (72) a. semester → smester [sm] *legal onset cluster*
 b. fatigue → ftigue [ft] *illegal onset cluster*
 (Davidson 2006:80)

This creation of otherwise illegal phonotactic structures in fast speech in English is similar to WFVD in Cherokee. WFVD creates word-final codas that are otherwise unattested, and WFVD occurs most often in casual speech.

Additional evidence that WFVD is a deletion process comes from speaker judgement and potential compensatory lengthening. Based on judgments I have elicited from speakers, that final vowel is not perceived to still be present after deletion. Though words in citation form and WFVD are treated as interchangeable to the speakers I consulted, and would be written the same way in syllabary, speakers told me that the consonant-final forms after WFVD do end with a consonant. Furthermore, at least one speaker lengthens short medial vowels when the word-final vowel is deleted. For this speaker, when a word of the shape CVCV has its final vowel deleted, the resulting word has a vowel about twice as the short vowel in the original first syllable: CVVC. This could be compensatory lengthening to meet the two mora minimal word requirement. However, this observation is preliminary, and will need further investigation.

4.4 WFVD as a Prosodic Process

Going forward, an analysis of WFVD needs to account for several observations: First of all, as shown throughout this chapter, WFVD occurs regardless of part of speech or internal morphology; WFVD can occur on any word with a word-final short vowel. Secondly, it is important to discuss why both word-final vowels and *hV/?V* delete. *V* and *hV/?V* aren't a natural class, so it is odd that they are both targeted by WFVD. Finally, as will be shown in §4.5, if the word-final vowel is a clitic vowel, the clitic vowel doesn't delete.

To address the first point, I posit that WFVD targets the prosodic word. As shown in the previous sections, there is no indication that WFVD targets either a single segment or phonological sequence for deletion. There is also no indication that WFVD is morpheme-specific, i.e. only targeting stems or certain suffixes. The fact that WFVD occurs regardless of part of speech and deletes vowels in many different sequences of segments indicates that this alternation targets prosodic words.

By appealing to a prosodic constituent, these different kinds of words can all be mapped to the same phonological structure.

The Prosodic Hierarchy (Selkirk 1978; Nespor & Vogel 1986; Hayes 1989) is a system of organization of phonological domains. This system posits that there is a hierarchy of phonological units which exist separate from morphosyntax, though not completely independently. In this model, a mora is the smallest unit, and an utterance is the largest (Table 33).

Table 33: The Prosodic Hierarchy

Utt	Utterance
ι /IntP	Intonational Phrase
ϕ	Phonological Phrase
ω	Prosodic Word
Ft	Foot
σ	Syllable
μ	Mora

In this hierarchy, there are units that are below (or potentially at) the level of the word—mora, syllable and foot—and units of the word and larger—prosodic word, phonological phrase, intonational phrase, and utterance. The word level is meaningful place to split the hierarchy because a phonological word is “the lowest constituent of the prosodic hierarchy which is constructed on the basis of mapping rules that makes substantial use of nonphonological notions” (Nespor & Vogel 1986:109). The mora, syllable and foot are all

purely phonological units, while the prosodic word, phonological phrase, intonational phrase and utterance all may take into account syntactic groupings. A prosodic constituent of the prosodic word or larger can be mapped to a morphological or syntactic unit, which does not have to be a uniform size, shape or part of speech.

WFVD occurs on the final vowel or syllable of the a word-final morph—whether this is a stem, verbal suffix, nominal suffix, etc. Therefore, WFVD needs to target a morphological structure ‘word’; by mapping a phonological constituent ‘prosodic word’ to the morphosyntactic word, the phonological process can target a phonological domain.

In this dissertation, I assume syntactic to phonological mappings based on Match Theory (see Selkirk 2011). Match Theory builds on a edge-based theory of mapping (Alignment Theory, Selkirk 1986) that requires edges of syntactic constituents to align with edges of phonological constituents. In Match Theory, “Match (α, π) can be construed as a constraint requiring simply that both the right and left edges of a syntactic constituent of a designated type α correspond, respectively, to the right and left edges of a prosodic constituent π ” (Selkirk 2011:16). Selkirk (2011) uses the morphosyntactic notions of ‘word’, ‘phrase’ and ‘clause’ for syntactic constituents, and prosodic word ω , phonological phrase ϕ , and intonational phrase ι for phonological constituents.

In this chapter (as well as in §6 on the Boundary Tone), only MATCH(WORD, ω) is relevant.

(73) MATCH(WORD, ω):

The left and right edges of a word in the input syntactic representation must correspond to the left and right edges of a prosodic word (ω) in the output phonological representation.

In Cherokee, identifying a syntactic word is not as straightforward as in isolating languages. Since Cherokee words are (generally) morphologically complex (see §1.2.3), it may not be the case that a Cherokee word is the same as a syntactic terminal element (how Elfner

2015 defines a word in Connemara Irish) or lexical words (see Selkirk 1996). However, for this dissertation, I will assume that $\text{MATCH}(\text{WORD}, \omega)$ maps a prosodic word to a terminal element, putting aside morphosyntactic complexity of verbs for now¹⁴.

This mapping of a morphosyntactic word to a phonological word is motivated by other phonological processes in Cherokee. Metathesis and H tone spread can only occur within a morphological word domain; these processes can occur across *morpheme* boundaries, but not across *word* boundaries. For example, in a sequence of CVhR—where C is an obstruent, V is any vowel, h is the segment /h/, and R is any resonant—/h/ will metathesize (Laryngeal Metathesis). The underlying sequence CVhR is realized as ChVR. However when the sequence CVhR occurs over a prosodic word boundary, /h/ does not metathesize.

(74) Metathesis: CVhR /kihn/ → ChVR [k^hin]

àà**ki**naalúʔi
 aki-hnaal-úʔi
 1B-angry:PRS-EXP

‘I am angry.’ (Flemming 1996:23)

(75) No Metathesis: CVhR /kihn/ → CVhR [kin]

gahlgwoó**gi**hnóó deekánahtv yidéenalgoóna
 kahlkwoó**ki=hn**óó tee-khanahltv yi-tee-iinii-alkoóna
 seven=CN DST-hill IRR-DST-1A.DU-arrive.first:IMM

‘We will see who gets to the seven hills first,’ (Montgomery-Anderson 2015:426)

In (74), the /h/ moves from the stem initial position before /n/ to follow the obstruent /k/. After /h/ moves, it is realized as aspiration on the obstruent: [k^h]. However, in (75), the /h/ does not move from the clitic-initial position. The laryngeal /h/ is realized as

¹⁴Dealing with the issue of forming verbs in the morphology and syntax is outside the scope of this dissertation. Considering the fact that Cherokee verbs include arguments as morphemes, a morphological theory which treats morphemes as syntactic terminal elements may be preferable to a lexicalist account, however, the full argument for that view is not fully elaborated here.

voicelessness on the resonant and the obstruent is unaspirated: [kiŋ̥]. Since /h/ doesn't move in (75), there must be a phonological boundary that /h/ cannot cross. This pattern of metathesis provides further justification for the morphological word mapping to a prosodic word.

Therefore, for Cherokee, the morphosyntactic word maps to a phonological word (ω). WFVD targets the right edge of this phonological word, deleting the final vowel (or syllable, see the next section §4.4.1).

4.4.1 What's going on with laryngeals?

The second observation that needs to be accounted for is the fact that final vowels are not the only segment to delete. As shown in §4.3, when a word ends in a hV or $?V$ syllable, the whole syllable is deleted. Previous descriptions of this process have either treated as the same unit that can be targeted for WFVD (see Scancarelli 1987; Uchihara 2013). Other works have described deletion of $hV/?V$ as the vowel deletion (so now the word ends in a laryngeal), and then the preceding laryngeal also is dropped (see Feeling 1975; Montgomery-Anderson 2015).

The details of these two possible accounts (delete word-final V and $hV/?V$, and delete word-final V s, then $h/?$) haven't been spelled out in any previous work, but I think it is worth discussing the theoretical implications of these two approaches. Starting with the conception that both V and $hV/?V$ are targeted by WFVD: if both V and $hV/?V$ are targeted for WFVD, it would make sense that V and $hV/?V$ form a natural class, and pattern together elsewhere in the language.

When morphemes concatenate, a vowel-final morpheme before a vowel-initial morpheme results in deletion (76a) or coalescence (76b).

- (76) a. *ù̀̀nadaátlóosv*
 uunii-ataátlóo-s-vv(ʔi)
 3B.NS-win-PFT-EXP
 ‘[They] won.’ (Montgomery-Anderson 2015:239)
- b. *dvvgóówhiisgvʔi*
 ta-a-koohw(a)th-iisk-vvʔi
 CIS-3A-see-IMPF-EXP
 ‘He was seeing it (facing the speaker).’ (Pulte & Feeling 1975:253, Uchihara 2013:129)

In (76a) the final vowel [ii] of the morpheme *uunii* ‘set B third person nonsingular’, is deleted when prefixed to the vowel-initial stem *-adaátlóo-* ‘win’. In (76b), the vowels of the cislocative and set A third person singular morphemes (both /a/) coalesce to become *vv*. However, when vowel deletion occurs between morphemes, *hV* syllables don’t delete/coalesce. In (77a), the vowel of the distributive prepronominal prefix *dee-* deletes before the ‘set B third person singular’ morpheme *uu-*. However, when the ‘set A second person singular’ prefix *hi* appears, it does not cause the vowel of *dee-* to delete¹⁵.

- (77) a. *dù̀̀sgwáalohnv*
 tee-uu-skwáala-ohn-vv(ʔi)
 DST-3B-break: CMP-TRM: CMP-EXP
 ‘[He] broke [them].’ (Montgomery-Anderson 2015:109)
- b. *deehígoohwtíha*
 tee-hi-koohw(a)th-ih-a
 DST-2A-see-PRS-IND
 ‘You see them.’ (Montgomery-Anderson 2015:103)

If *hV* syllables are not deleted in word-medial vowel deletion environments, it seems unlikely that they would form a class with *V* that could be the target for WFVD. It seems more

¹⁵Sometimes the vowel of *hi-* does delete (see examples 6a and 6b in Montgomery-Anderson 2015:105). However, this alternation may be conditioned by other factors, and it is outside the scope of this dissertation

likely that word-final vowels delete across the board, and the resulting final [h] or [ʔ] does not surface due to some other mechanism.

Phonologically, laryngeals could be illegal word-final codas. As mentioned above, it is not necessarily the case that wellformed words are made up of wellformed syllables. However, considering the fact that WFVD results in otherwise illegal word-final consonants and consonant clusters, it seems odd that laryngeals wouldn't appear as word-final codas strictly for phonotactic reasons.

[example here]

One way to think about laryngeal deletion after WFVD is as the result of lenition. As discussed above, Dyck (1990) argues that in Cayuga laryngeals (and /s/) are always realized as release features on the preceding segment. Therefore, “[p]ostvocalic laryngeals syllabify in the preceding nucleus [and] postconsonantal laryngeals syllabify as either full parsed onset segments ... or as underparsed secondary articulations to other segments” (Dyck 2009:579). In her explanation of the syllabification of laryngeals, /h/ and /ʔ/ only surface as onsets word-initially (78a), or when they can't be realized on the preceding segment (78a). Otherwise, they attach to the laryngeal node of the preceding segment, whether that is a vowel (78b) or a consonant (78c).

- (78) a. **haʔ.hó:tiʔ**
‘he threw it’
b. **oh.áʔk.taʔ**
‘soot’
c. **teh.ɛ.nat.k^{hw}aʔ**
‘they (m.) dance’
(Dyck 2009:579-580)

If Cherokee laryngeals are also realized as release features on vowels (and there is evidence from aspiration and voiceless stops that at least /h/ behaves this way with regard to neighboring consonants), contemporary *hV/ʔV* deletion could be the result of lenition

over time. As discussed in §2.6.1, glottal stops were lost in some words, and a lowfall tone and creak replaced them. I have yet to find any creak in contemporary Cherokee, but it could have been present in the speech of speakers 30-40 years ago. If post-WFVD word-final [h] in [ʔ] did appear as release features at one time (breathy voice and creak, respectively), it makes sense that they would also be lost, like the word-medial creak. This is all speculation, but it can account for the lack of word-final laryngeals, even after WFVD.

The literature on word-final laryngeals in the world’s languages is very sparse, and it’s hard to tell if word-final [h] and [ʔ] are typologically usual or unusual, or phonetically usual or unusual. Further research is needed on the phonetics of laryngeals in Cherokee to provide a more complete analysis. However, even without a complete analysis, this account (final vowels delete, then a final laryngeal deletes for other reasons) seems more likely than an account where V and $hV/ʔV$ pattern together for the purpose of deletion. As I’ve shown, there’s no reason to believe that V and $hV/ʔV$ form a natural class, and/or behave similarly in other phonological processes.

4.5 WFVD with Clitics

As discussed in §4.4, the Cherokee morphological word maps to a prosodic word, and WFVD targets that prosodic word, such that word-final vowels of stems and suffixes are deleted. However, if a word ends in a clitic, the final vowel doesn’t delete.

(79)

- a. walóósiju ~ *walóósij
 walóósi=ju
 frog=CQ
 ‘frog?’ (DS, DC, Apr 2015)
- b. walóósike ~ *walóósik
 walóósi=ke
 frog=AQ
 ‘frog?’ (DS, DC, Apr 2015)

If the final vowels of clitics are deleted, as shown in (79) with the question clitics =*ju* and =*ke*, the resulting form is ungrammatical. However, the attachment of a clitic does not necessarily block WFVD from occurring. When a clitic appears on a word, WFVD can still occur; it just deletes the final vowel of the host word:

- (80) *jaduulíhaju* ~ *jaduulíju*
 ca-tuulí-h-a=ju *ca-tuulí-(h-a)=ju*
 2B-want.PRS-IND=CQ
 ‘You want it (right)?’ (DS, DC, Apr 2015)

In (80), the word can appear in a full form as *jaduulíhaju*, or without the final *hV* syllable of the host word: *jaduulíju*. Additionally, Uchihara (2013:61) claims that “word-final vowels are obligatory when a clitic is attached, even for speakers for whom deletion of the final vowels is the norm” when a consonant-final form is produced. However, in elicitation, speakers I have worked with say that WFVD can still occur before a clitic:

- (81)
- a. *svúktajù* ~ *svúktjù*
 apple=CQ
 ‘apple?’ (DC, Aug 2017)
- b. *yoónajù* ~ *yoónjù*
 bear=AQ
 ‘bear?’ (DC, Aug 2017)
- c. *daksijù* ~ *daksjù*
 terrapin=cq
 ‘terrapin/turtle?’ (DC, Aug 2017)

Therefore, this pattern of deletion on the host word and not the clitic suggests that a phonological boundary exists on the right edge of the word, and clitics are outside that boundary. This is schematized in (82):

$$(82) \quad [\text{jaduulíha}]_{\omega} \text{ ju} \xrightarrow{\text{WFVD}} [\text{jaduulí}]_{\omega} \text{ ju}$$

4.5.1 The Status of the Yes/No Clitic =*sgo*

The only instance in which there is some discrepancy phonologically among the clitics is whether or not their final vowel can be deleted. For most clitics, the final vowel cannot be deleted¹⁶, with the notable exception of =*sgo*. The yes/no clitic =*sgo* frequently is pronounced as just =*s*. The allomorph =*s* (or even =*sg*) are pronounced more frequently than the plain form =*sgo*. While this initially appears to be problematic for an analysis of word-final vowel deletion, there are a few reasons as to why I consider =*sgo* outside the domain of WFVD, and why =*sgo* must be a clitic rather than an affix.

The production of =*sgo* as =*s* is potentially problematic, because as I have shown in §4.5, final vowel of affixes can be deleted, while the final vowel of clitics *cannot* be deleted. If =*sgo* is targeted by WFVD, then it might be the case that =*sgo* is an affix, since affixes can have their final vowels deleted.

However, when =*s* is attached to a host, it is still possible to delete the final vowel/syllable of the host word, as seen with other clitics.

$$(83) \quad \begin{array}{ll} \text{hiigòðhwéés} & \text{jají} \\ \text{hii-kóów(h)-éé(?i)=s(go)} & \text{ca-ci} \\ \text{2A-see-NXP=Q} & \text{2B-mother} \end{array}$$

‘Did you see your mother?’ (LP, August 2017)

¹⁶Montgomery-Anderson (2015) includes some examples from texts in which the final vowel of a clitic is deleted, but I have not been able to replicate this in my fieldwork. The speakers I have worked with have never spontaneously produced a clitic without its final vowel (except for =*sgo*), and they do not pronounce Montgomery-Anderson’s (2015) examples with the clitic vowel deleted.

- (84) *hiigòòw?éékè* *gúúnà*
 hii-kóów?-éé(?i)=khe k'vna
 2A-see-NXP=AQ turkey

‘Did you see the turkey?’ (DC, August 2017)

In both (83) and (170), the final ?*V* syllable of *hiigòòw?éé?i* is deleted, regardless of whether =*ke* or =*s* is attached to the end of the word. This indicates that there is still an prosodic word that excludes =*s*, similar to the other clitics.

Additionally, as Haag (1997) notes, =*sgo* can attach to many different kinds of hosts (nouns, verbs, adjectives, pronouns, and potentially even other clitics), and must be the second element in an utterance (as shown in 85)¹⁷.

- (85) a. *ayasgo* *agwenusdi jaduli*
 1.PRON=Q 1B-go 2B-want
 ‘Do you want me to go?’ *Pronoun*
- b. *wesasgo jakaha* *utana*
 cat=Q 2B-have.something.living big
 ‘Is this your big cat?’ *Noun*
- c. *jalvgwisdisgo jisdu disjaysdo*
 2B-like=Q rabbit shoot
 ‘Do you like to hunt rabbits?’ *Verb*
- d. *naasgo sakonige anawo dajikluni ahani gasgilohi*
 that=Q blue cloth put.on here table
 ‘Shall I put the blue cloth on the table?’ *Determiner*

As shown in (85), the question clitic =*sgo* always appears attached to the first word of the utterance, and it is not selectionally restricted as to its hosts. As will be discussed in §5, these are criteria used to diagnose clitic-hood; if =*sgo* were an affix, it would only appear on certain parts of speech, and would not be bound by the positional requirement to appear

¹⁷Haag (1997) doesn’t mark tone or vowel length, so rather than guessing at what the tone/vowel length likely is, her examples are reproduced as they appear in her paper.

following the first word. Therefore, *=sgo*, and its reduced form *=s*, appear to meet criteria for classification as a clitic, rather than an affix.

While no other Cherokee clitic has a reduced form without its final vowel, it is unlikely that *=sgo* is in the domain of word-final vowel deletion, and therefore a target of that process. Montgomery-Anderson (2015) claims that this clitic *=sgo* is the most common of the clitics, and this high overall frequency could be explanation for the phonological reduction of *=sgo*. As observed by Pierrehumbert (2002) and others, highly frequent words are more likely to undergo lenition over time. It is unsurprising that some sound change, such as reduction, might have occurred. Therefore, *=sgo* is pronounced *=s* not because is in the domain of word-final deletion, but rather that it has likely undergone some phonological reduction over time.

4.6 Summary

Scancarelli (1987) described WFVD as process that deletes word-final vowels and *hV* or *?V* syllables, everywhere except the ends of utterances. In this chapter, I addressed the the important aspects in her definition: what deletes, the domain, and where in an utterance. While WFVD may be more frequent in non-utterance-final position, WFVD still can occur on utterance final words. There may be a preference to not delete utterance-final vowels, but there does not appear to be an absolute rule or constraint that will predict when WFVD occurs in an utterance. Therefore, WFVD can be best characterized as an optional fast speech process.

As an optional fast speech process, this deletion can cause otherwise illegal word-final codas and coda clusters to surface. However, not all word-final vowels can be deleted. While most words end in */i/* or */a/*, if a word ends in */e/* or */u/*, the vowel is less likely to be deleted. Scancarelli (1987) explains that certain vowels do not delete because they are underlyingly long, but that does not explain the coincidence that these non-deleting vowels

are often certain qualities. However, without further investigation into these vowels that do not delete, Scancarelli's (1987) underlying long vowels explanation will suffice for this dissertation.

Additionally, not all possible word-final codas are attested. While any obstruent, resonant, or cluster seem to be allowed as a word-final coda after WFVD, laryngeals /h/ and /ʔ/ are not allowed. Word-final laryngeals are also deleted with WFVD occurs. This issue needs additional research, but at this point, I assume that laryngeals have been lost over time, and this has been phonologized as *hV/ʔV* deletion. Laryngeals have special phonological and phonetic behavior in all Iroquoian languages—metathesis, grade alternations, realization as aspiration, etc. Word-final laryngeal codas also seem to be typologically rare.

The domain of WFVD is the prosodic word. I argued that the prosodic word maps to the morphological word in Cherokee—any stem, plus possible suffixes. WFVD can delete the final vowels of stems and suffixes, but not clitics. In chapter §5, I discuss how clitics are linearized to their position and attach to words. Cherokee clitics do not attach through morphological processes, but rather prosodic ones. Therefore, clitics are not included in the morphological word, and when the morphological word maps to the prosodic word, clitics are excluded. Their exclusion from this mapping puts them outside the domain of WFVD (but not outside the domain of the boundary tone §6).

The morphological word mapping to a prosodic word (excluding clitics) is also motivated by phonological processes and tonal phonology. Tones won't spread from the morphological word to the clitic, and segmental processes like Metathesis do not cross over from a word-final morpheme to a clitic.

Identifying and justifying the prosodic word is important for the next two chapters on clitics and the boundary tone. Both clitics and the boundary tone make reference to the prosodic word, and a full account the prosodic word is necessary to analyze the six minimally distinct word forms shown at the beginning of the chapter.

CHAPTER 5

CLITICS

5.1 Introduction

Clitics' inherent non-isomorphism between morphological word and phonological word has made them fertile ground for researchers interested in prosody and the syntax-phonology interface. Clitics and their behavior syntactically and phonologically can provide insight into the hierarchical structures of phonology and syntax, wordhood, and how words group together to form phrases.

While most Cherokee scholars agree that there is a category conventionally called clitic in Cherokee, there has been little empirical work on that has investigated why these morphemes are clitics and how they fit into the phonological and morphosyntactic systems of the language, save for three papers by Marcia Haag (1997; 1999; 2001). Haag (1999) claims that Cherokee clitics lack syntactic or semantic uniformity. Clitics serve a variety of functions, such as question markers, focus markers and connectors, and therefore “a morphological primitive clitic is not discernable in Cherokee” (Haag 1999:33). It is perhaps for that reason that Montgomery-Anderson chooses to call this category of morphs ‘post-fixes’ instead of ‘clitics’ in his 2015 grammar.

However, in this chapter I will show that these word-final morphemes do show a number of typical clitic behaviors and they are unified in their syntactic function and phonological behavior. I will also discuss how clitics linearize to their position in an utterance, evaluating several different approaches.

5.2 Cherokee clitics

There are twelve Cherokee enclitics (Montgomery-Anderson 2008) as shown in Table 34. All twelve are function words, that fit into three broad categories: question markers, focus markers and clause connectors. The list found in the table below (and the English glosses) is adapted from Montgomery-Anderson (2008). Following Montgomery-Anderson (2008, 2015), clitics are set off with =, to distinguish them from affixes, which are separated by -.

Table 34: Cherokee Clitics

	CLITIC	IPA	GLOSS	FUNCTION
Question Cl	=ju	[dʒu]	Conducive question (CQ)	‘Right?’–yes/no Qs
	=s(go)	[sko] or [s] or [sk]	Information question (Q)	yes/no Qs
	=ke	[k ^h e]	Alternative question (AQ)	Choice between two alternatives, ‘or not?’–yes/no Qs
	=ka	[k ^h a]	Tag question (TQ)	?
	=gi	[ki]	Echo question (EQ)	?
Focus Cl	=(s)gwu	[sk ^w u] or [k ^w u] or [ɣu]	Delimiter (DT)	‘only, just’, Emphasis
	=dvv	[tã:]	Focus (FC)	Emphasis
	=na	[na]	Focus2 (F2)	Emphasis
	=hv	[hã] or [kã]	Contrastive (CT)	‘but’–after Q words and =sgo
	=le	[le]	Potential (PO)	‘maybe, possibly’ or ‘or’
	=hnóó	[no:]	Conjunction (CN)	Connects utterances, NP connector
	=sginii	[skini:]	Concessive (CS)	‘but’, ‘I wonder...’

There is some overlap in the function of these clitics. As noted above in the Table, the clitics =ju, =sgo, and =ke can all be used for yes/no questions. Montgomery-Anderson (2008) identifies different meanings for these three clitics (=ju, =sgo, =ke), but the speakers that I have consulted can use all three of these question clitics relatively interchangeably.

This could also be a sign that the distinct functions of these clitics are no longer part of their primary use. There is also overlap in function for the two focus clitics *=dvv* and *=na*, and the delimiter *=sgwu*. All three of these clitics can be used for emphasis, though *=dvv* and *=sgwu* are more frequent.

Potentially, three of these clitics are no longer used, or just very infrequent. The tag question clitic *=ka* and the echo question *=gi* are only found in Lindsey (1985). In my fieldwork, I have been given only a few tokens of *=ka* (and never under elicitation) and the speakers I have worked with have never produced *=gi*. Montgomery-Anderson (2015) also notes that these two clitics are less common than the other ten. It could be the case that these are not used in contemporary Cherokee, or only appear in fossilized expressions, as one example with *=gi* appears in the Cherokee English Dictionary by Feeling (1975). The concessive clitic *=ginii* is known by the speakers I consulted, but it doesn't seem to be as productive as it might once have been—I have yet to collect a text where it was used. Speakers indicated that it might be archaic, saying it sounded like something they would find in the Cherokee language version of the Bible.

Montgomery-Anderson (2008) claims that the potential clitic *=le*, the second focus clitic *=na*, and the contrastive clitic *=hv* might be less productive or part of fossilized expressions (especially with *=hv*), but I was able to elicit all three from speakers. However, they do not appear as frequently in texts as the delimiter clitic *=sgwu*, the first focus clitic *=dvv* or the conjunction clitic *=hnóó*.

In this dissertation, I mostly refer to examples with the question clitics (*=ju*, *=sgo*, *=ke*), focus clitics (*=dvv*, *=na*, *=sgwu*), and the connector *=hnóó*.

5.2.1 Distribution of Cherokee Clitics

Cherokee clitics are found attached to the first word of the utterance (i.e. in second position), regardless of the part of speech of the first word. The following examples show several different clitics in second position, attached to various parts of speech (86).

- (86) a. *haadlvsginii* *dùùhwasgo* *juusuulo*
 haatl_v=skinii tee-uu-hwa-sk-o(ʔi) ti-uu-asuulo
 where=CS DST-3B-buy-IMPF-HAB DST-3B-pants
 ‘I wonder where he buys his pants.’ (Feeling 1975:180, Montgomery-Anderson 2015)
- b. *hiigòòwʔéékë* *gúvna*
 hii-kóówʔ-éé(ʔi)=khe kúvna
 2A-see-NXP=AQ turkey
 ‘Did you see the turkey?’ (DC, August 2017)
- c. *jíisdvvnahnóó* *kilawiyú*
 jíisdvvnah=hnóó kilawiyú(ʔi)
 crawdad=CN at.that.moment
 ‘(And) the crawdad at that moment ...’ (Montgomery-Anderson 2008:551)
- d. *jajeelijü* *giihli*
 ca-ceeli=ju kiihli
 2B-POSS=CQ dog
 ‘Is it your dog?’ (DC, March 2018)

In (86a), the clitic =*sginii* follows the first word, a wh-expression *haadlv*. In (86b), the clitic =*ke* follows a verb and in (86c), the clitic *hnóó* follows a noun. In (86d), the clitic =*ju* intervenes between the possessive *jajeeli* and possessee *giihli* ‘dog’. The example in (86d) shows that the clitic must follow the first word, even if doing so breaks up a constituent (see §5.5.1).

Though Haag (1997) calls Cherokee clitics simple clitics, there is evidence that they are in fact special clitics (§5.3.1). Cherokee clitics occur in a fixed position (second position) and not in the same position as their nonclitic counterparts.

Additionally, there are cases when the clitic isn't in second position (87).

- (87) *aséehno wahya nawu wúdelhoose*
aséehno wahya na=(sk)wu uu-atelhoo-s-e(ʔi)
however wolf that=DT 3B-find.out-PFT-NXP

'But the wolf found out' (lit. 'but the wolf, it found out') (Montgomery-Anderson 2015:429)

Though the clitic doesn't attach to the first word of the utterance, its position is still predictable, though this will not be addressed in detail in this dissertation.

5.3 Defining 'clitic'

The theoretical notion of a 'clitic' can be difficult to pin down. In the broadest sense, a clitic is some morpheme that is neither an affix nor an independent word. Morphologically, clitics distinguish themselves from affixes by "[exhibiting] a low degree of selection with respect to their hosts" (Zwicky & Pullum 1983:503). Clitics can attach to a number of different parts of speech, while affixes can only attach to one (e.g. verbal affixes, nominal affixes, etc.). Phonologically, clitics are also distinct from independent words because they lack the weight to stand alone. For example, clitics cannot bear accent, while independent words can (Zwicky 1985). Zwicky (1995) also notes that the umbrella term 'clitic' encompasses morphemes which have very different functions, such as bound words in Tagalog and phrasal affixes in English.

However, from language to language, the function and attachment of clitics can vary widely. The most discussed class of clitics are those seen in Romance languages (see Perlmutter 1971; Zwicky 1977), a class of pronominal enclitics that attach to the end of the verb. Clitics most often can be either proclitics (appearing at the beginning of words) or enclitics (at the ends of words), but mesoclitics (between the stem and affix) and endoclitics (within the stem) have also been argued for (Halpern 1995). Clitics also vary as to their linear

position. Second-position clitics (Wackernagel’s position) are well-documented (Anderson 1993; Halpern 1995), but clitics can also appear in relation to verb phrases, complementizer phrases, and phonological phrases (Zec & Inkelas 1991).

Two criteria must be met in order for a morph to be classified as a clitic (Inkelas 1990). First, clitics are always function words—“i.e. determiner, conjunction, pronoun, complementizer, preposition, etc” (Inkelas 1990:234). Klavans (1982) notes that lexical verbs or lexical nouns are not found as clitics. Second, clitics do not meet minimal word requirements; clitics are “idiosyncratic, lexically listed bound forms” (Inkelas 1990:236). Clitics’ phonological deficiency has led them to be called ‘obligatory leaners’ (Zwicky 1995). Since clitics do not have enough phonological material (whether they are deficient in weight or accent), they cannot form a phonological word on their own. Therefore, they must ‘lean’ on another word and form a phonological word with a host. Therefore, clitics are syntactic terminal elements that meet the specifications for morphological or syntactic wordhood, but not phonological wordhood.

5.3.1 Simple and Special Clitics

Zwicky (1977) identifies two classes of clitics: simple and special clitics. Simple clitics appear at the same position in the syntax as their nonclitic counterparts, and phonological reduction may be stylistic. In English, simple clitics can be phonologically reduced function words in unstressed positions in casual speech, such as ‘her’ and ‘him’ in (88).

(88)		<i>Full Form</i>	<i>Cliticized Form</i>
	He sees her	[hi siz hɹ]	[hi sizɹ]
	She met him	[ʃi mɛt hm]	[ʃi mɛrm]

As shown in (88), the cliticized form still appears in the same syntactic position as the full form: after the verb, where direct objects are found in English. Anderson assumes that “a

simple clitic is merely a lexical item whose phonological form does not include assignment to a prosodic unit at the level of ‘word’ (or some other appropriate unit that constitutes an essential domain of stress assignment)” (1992: 201). This assumption is confirmed when looking at discourse context for simple clitics. The full form of simple clitics ([hɪ] and [hm]) can appear in any discourse context, but the cliticized forms ([ɪ] and [m]) cannot appear when emphasized—as in ‘she met *him*’—or as the answer to a question. Simple clitics cannot appear when the lexical item would be stressed; in these contexts, only the full form may appear.

Special clitics “occupy positions which we would not expect based on the distribution of other words or phrases with similar function” (Halpern 1995:33). Their position within (or relation to) some phrasal unit is determined by “principles other than those of non-clitic syntax” (Anderson 1992:201-202). Special clitics typically have a fixed position in an utterance, determined by non-syntactic rules.

Inkelas (1990) operationalizes the phonological deficiency of clitics by using subcategorization frames. Clitics have a prosodic subcategorization frame which selects for some prosodic constituent to the right or to the left of the clitic—(89) shows what an enclitic prosodic subcategorization frame would look like. In this configuration, the clitic must combine with a phonological constituent to form another phonological constituent¹.

$$(89) \quad [[]_{p---}]_p$$

As I will discuss in §5.5.5, the subcategorization requirement that a clitic be to the right of a phonological phrase may be in conflict with the order of elements generated by the syntax. For special clitics—specifically second-position clitics—it may be the case that a clitic

¹Inkelas (1990) assumes a recursive structure, violating the Nonrecursivity design principle of the Prosodic Hierarchy. However, many researchers (such as Ito & Mester 1992; Selkirk 1996; Elfner 2015) have provided evidence that prosodic domains can be recursive. In this dissertation, I assume that there is some recursivity in prosodic domains.

is clause initial, but appears in second position because the clitic must attach phonologically to material on its left.

5.4 Clitics in Northern Iroquoian languages

While other Iroquoian languages have clitics, there is not a one-to-one correspondence between the class of clitics seen in Cherokee, and the clitics in Northern Iroquoian languages. Northern Iroquoian languages such as Oneida and Seneca both have clitics that act as augmentatives, characterizers, diminutives, locatives, and others (Michelson & Doxtator 2002; Michelson et al. 2016; Chafe 2015). These clitics of Oneida and Seneca do have some hallmarks of clitics: they can attach to multiple parts of speech, they close off the word to any additional affixation, and they don't take affixes themselves. However, they appear to scope over just the word they attach to, and are often found in fossilized or lexicalized forms.

In addition to simple clitics, Northern Iroquoian languages also appear to have second position clitics. Like Cherokee, Mohawk and Oneida have a question particle *kʌ*, while Cayuga has a second person pronominal clitic *nɪs*. These particles appear in second position, though their distribution is a little different than that of Cherokee second position clitics.

5.4.1 Northern Iroquoian Simple Clitics

Unlike Cherokee, there are clitics in Northern Iroquoian languages that are predominantly for word derivation, and are not restricted to second position. For example, the word for the endonym for the Seneca people includes the characterizer clitic (90).

- (90) a. *Onödowága:ʔ*
'Seneca' (lit. 'characterized by a great hill') (Chafe 2015) Characterizer *-ga:ʔ*

- b. *gá'ga:go:wa:h*
 'raven' (cf. *gá'ga:* 'crow') (Chafe 2015) Augmentative *-go:wa:h*

The example below (91) shows that a clitic can appear later in the utterance than second position—the clitic is bolded.

- (91) a. *Da:h o:nëh ëgátonyá:nö:'*,
 ë-k-athrory-a-hnö-:'
 FUT-1.SG.AGT-tell.about-LK-DIST-PUN
 so now I will tell about things
- b. *heh nijáwësdáhgöh,* *shagojowéhgo:wa:h...*
 ni-t-yaw-ë-st-a-hk-öh shako-atyowe-h-**kowa:h**
 PART-CIS-N.SG.PAT-happen-CAUS-LK-INST-STA M.SG.AGT/3.PAT-defend-HAB-**aug**
 how it happened the great defender
- 'So now I will tell about things, how it happened, the false face ...' (story told by Solon Jones, Chafe 2015)

In Oneida, the characterizer clitic and the augmentative clitic (among others) are used for word-formation, similar to Seneca (92).

- (92) a. *kanata?kékha?*
 ka-nat-a?=ke=kha?
 N.SG.AGT-town/village/place-NOUN.SUFF=LOC=CHAR
 'sparrow' (Michelson & Doxtator 2002) Characterizer *-kha?*
- b. *ona?kátkó'*
 'badger' (cf. *oná'kat* 'groundhog') (Michelson & Doxtator 2002) Augmentative
 -kó'

These simple clitics do not have the positional restrictions seen in Cherokee clitics, but they are still clearly clitics; they attach to multiple parts of speech and cannot be produced in isolation. However, these are not the only clitics found in Northern Iroquoian languages.

5.4.2 Northern Iroquoian Special Clitics

A class of word-like elements called particles, which are often hard to translate, are frequently found in Northern Iroquoian languages. These particles can appear in multiple positions in the utterance, and are often discourse connecting elements, translated roughly to ‘then’, etc. Some particles have more prosodic independence than others; Barrie et al. (2014) define particles as “any small form without internal morphological structure”. Though not all particles require phonological hosts, some show clitic-like behavior. In this group of particles, there are question markers (in at least Mohawk, Oneida, and Cayuga, but not in Seneca) and pronominals (in Cayuga), which are distributed like 2P clitics.

Baker (1996) claims that the yes/no question particle $k\Lambda$ in Mohawk appears after the first constituent of the utterance.

- (93) *Uwári akó-skare’* **$k\Lambda$** *wa’-t-huwa-noru’kwányu-’?*
 Mary FEM.S.POSS-friend Q FACT-DUP-FEM.SG.SUBJ/MASC.SG.OBJ-kiss-PUNC
 ‘Did she kiss Mary’s boyfriend?’ (Baker 1996:46)

In (93), the particle $k\Lambda$ follows the constituent *Uwári akó-skare’* ‘Mary’s boyfriend’. In (94), $k\Lambda$ follows both the subject and the object. Since the subject+object does not form a constituent, the example in (94) is ungrammatical.

- (94) **Án Λ akw-atyá’tawi* **$k\Lambda$** *wa’-e-nóhare-’?*
 Anne 1.SG.POSS-dress Q FACT-FEM.SG.SUBJ-wash-PUNC
 ‘Did Ann wash my dress?’ (Baker 1996:46)

In Mohawk, in a possessive construction, the particle $k\Lambda$ follows the first constituent *Uwári akó-skare’* ‘Mary’s boyfriend.’ Oneida, the Iroquoian language most closely related to Mohawk, has a similar yes/no question particle: $k\Lambda$. Like Mohawk, it appears in the second position (following the first constituent)—whether that is following a single word or multiple

words, though it's unclear how the particles *ok* and *kati?* are folded into the phonological representation (95).

- (95) a. *ihselhe?* **kΛ** *aétene?*
 i-hs-elh-e? kΛ
 EPEN-2.SG.AGT-want-STV Q
 ‘Do you want to go with me?’ (Norma Kennedy, Michelson et al. 2016:389)
- b. *úhka?* *ok* **kΛ** *náhte?* *tho* *yakawΛheyú*
 úhka? ok kΛ náhte? tho yakaw-Λheyu
 someone Q what there FEM.SG.PAT-die[STV]
 ‘Someone died there?’ (Norma Kennedy, Michelson et al. 2016:389)
- c. *sniha·wí’* *kati?* **kΛ** *thok* *náhte?* *akowá* *yeksáh*
 sni-hawi-? kati? kΛ thok náhte? ako-awΛ yeksá’
 2.DU.AGT-carry-STV then Q something 3.FEM.POSS-belonging girl
 ‘Did you bring some belonging of the little girl’s?’ (Mercy Doxtator, Michelson et al. 2016:389)

In Cayuga, Barrie et al. (2014) argue that the fusion of two particles (*ne?*, a nominal particle related to specificity, and *i:s* ‘you’) creates a special 2nd person pronominal clitic *ni:s*. This clitic appears as far to the left as possible, but never in first position. Additionally, this clitic *ni:s* can appear in a position that is not available to other phrasal material. In Cayuga, the word *de?ho?de?* ‘what’ is made up of two particles: *de?* and *hode?*. The fused pronominal clitic *ni:s* can appear between these two particles (96a), but full NPs (as well as other XPs, 96b) and particle clusters cannot appear in that position (97c).

- (96) *Gwe:* *de?* **ni:s** *ho?de?* *e-swa-hni:nø-?*
 so what ne.you what FACT-2.PL.AGT.buy-PUNC
 ‘So, what did you (pl.) buy?’ (Barrie et al. 2014:14)

- (97) a. **Gwe:* *dɛʔ* (*neʔ*) *John hoʔdɛʔ a-ha-hni:nɔ-ʔ*
 so what ne John what FACT-3.MASC.AGT.buy-PUNC
 ('So, what did John buy?')
- b. **Gwe:* *dɛʔ neʔ i:s hoʔdɛʔ e-swa-hni:nɔ-ʔ*
 so what ne you what FACT-2.PL.AGT.buy-PUNC
 ('So, what did you (pl.) buy?') (Barrie et al. 2014:15)

To explain this distribution, Barrie et al. (2014) argue that this special clitic *ni:s* is linearized to the second position via Prosodic Inversion (§5.5.5), an operation only available to clitics. Since XPs and particle clusters cannot undergo Prosodic Inversion, they cannot appear between the particles *dɛʔ* and *hoʔdɛʔ*. The clitic *ni:s* therefore trades places with the first prosodic word of an intonational phrase.

However, this argument for Cayuga is unusual, both in the typology of 2P clitics, and Iroquoian languages. As shown in this chapter, question markers are special clitics in Cherokee, Mohawk, and Oneida. Pronominal forms may be clitics in Iroquoian languages (and are often called particles), but there is no evidence from related languages that pronominals must appear in second position. Furthermore, the position where *ni:s* appears is only available to *ni:s*, and Barrie et al. (2014) does not show if *ni:s* can appear in second position without the particles *dɛʔ* and *hoʔdɛʔ*. A 2P clitic should attach to the first word or phrase of an utterance, no matter what word/phrase it is.

5.5 Linearization

As shown in the previous sections (§5.2 and §5.4), Cherokee clitics are strict 2P clitics. Researchers (going back to Wackernagel in 1892) have long been interested in pinning down the mechanism(s) that linearizes clitics to the second position in an utterance, or following the first element (whatever that element may be).

An analysis of second position clitics in Cherokee has to account for several typological peculiarities. First of all, Cherokee clitics follow the first element of an utterance, which is almost always a prosodic word, not a syntactic constituent. Secondly, since clitics attach to the first prosodic word, they can break up the linear order of multi-word syntactic constituents. Thirdly, topicalization of phrases can cause the clitic not to appear as the second element of the utterance. Finally, the first element of an utterance isn't always a prosodic word. There is at least one proclitic, the determiner *na=*, and when it is the first element of an utterance, enclitics attach to *na=*.

In this section, I will discuss the surface order of clitics, showing that Cherokee clitics are second word (2W), rather than second daughter (2D) clitics (5.5.1). In order to evaluate potential analyses, I will also need to propose a model of how clitics are generated in the syntax (§5.5.2). I will then show why a strongly syntactic approach (§5.5.3) and a strongly phonological approach (§5.5.4) to linearization fail to capture these patterns of Cherokee clitics. I will also evaluate the hybrid approach of Prosodic Inversion (§5.5.5) as proposed by Halpern (1995).

5.5.1 Second Position Clitics: 2W and 2D

Second position clitics are observed in many languages. Halpern (1995) shows that in Serbo-Croatian, all word orders are possible, provided that any clitic is in the second position (98):

- (98) a. Čovek =je voleo Mariju.
 man.NOM =AUX loved Mary.ACC
 'The man loved Mary'
- b. Čovek =je Mariju voleo.
- c. Voleo =je Mariju čovek.
- d. Voleo =je čovek Mariju.

- e. Mariju =**je** čovek voleo.
- f. Mariju =**je** voleo čovek.

Example (98) shows that the nonclitic words of the utterance ('the man', 'loved', and 'Mary') can all be arranged in various orders, but the meaning is not affected. However, Halpern (1995) notes that if the clitic appears anywhere other than second position, the utterance would be ungrammatical.

A similar pattern is found in Cherokee; words can appear in a number of sequences, provided that the clitic remains in second position, and the meaning is the same (99).

- (99) a. *deejágoohéékë* *júútaanà* *dààdaaneél'v'ǵi*
tee-ca-kooH-éé(ǵi)=khe ti-uuatana dee-aadaaneelvǵi
DST-2B-see-:PFT-NXP=AQ DST-big DST-building
- ‘Did you see the big houses (lit.where s/he lives)?’ (DC, June 2017)
- b. *júútaanakë* *dààdaaneél'v'ǵi* *deejágoohééǵi*
- c. *dààdaaneél'v'ǵikë* *júútaanà* *deejágoohééǵi*

Like in Serbo-Croatian, in Cherokee (99), the words *deejágoohéé(ǵi)* ‘you see (pl objects)’, *júútaana* ‘big (pl)’, and *dààdaaneél'v(ǵi)* ‘houses’ all can appear ordered in multiple ways. However, the question clitic =*ke* can only appear following the first word of the utterance.

2P clitics may either attach to the first word (2W) or the first constituent/daughter of the clause (2D). Bošković (2001) and others have noted that 2W is uncommon typologically, especially since it often breaks up the first phrase of an utterance. Since Cherokee, and other polysynthetic languages, can have a single word as a constituent, we might expect that the difference between 2W and 2D is not relevant in Cherokee. However, Cherokee can have multi-word constituents that are ‘broken up’ by a clitic (100).

- (100) a. *jajeeli gihli*
 ca-ceeli kiihli
 2B-POSS dog
 ‘Your dog’ (DC, March 2018)
- b. *jajeelijü gihli*
 ca-ceeli=ju kiihli
 2B-POSS=CQ dog
 ‘Is it your dog?’ (DC, March 2018)

In (100), the clitic =*ju* intervenes between the words of the constituent *jajeeli gihli* ‘your dog’. This clitic attaches to the first word of the constituent *jajeeli*, a possessor, rather than to the end of the constituent (i.e. after *gihli* ‘dog’).

Cherokee clitics can intervene in more than just DPs—other two-word constituents (adverbial phrases and verb phrases) can be broken up by a clitic (101-102). In (101), the conjunction clitic =*hnóó* appears between the words *saagwu* ‘one’ and *iyúwáákdi* ‘time’. In (102), the potential clitic =*le* appears between the main verb *yaniisdeéla* ‘it should help them’ and the copula *yigi*.

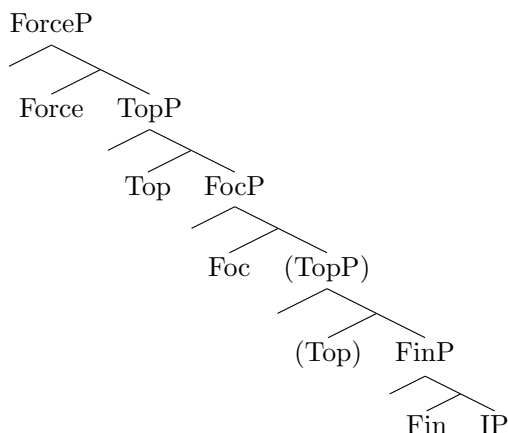
- (101) *saagwùhnóó iyúwáákd*
 saakwu=hnóó iyúwáákht(i)
 one=CN time
 ‘One time...’ (DC, 2018) *Adverbial Phrase*
- (102) *yaniisdeélale yigi*
 yi-anii-steél-a=le yi-ki
 IRR-3A.NS-help:IMP-IND=PO IRR-be
 ‘Or it should help them’ (LS, 2014) *Verb Phrase*

Examples (100-102) show that clitics (in these examples, =*ju*, =*hnóó*, and =*le*) do not appear following the first constituent, but the first word; therefore Cherokee is a 2W, rather than 2D language.

5.5.2 Clitic Syntax and the Expanded CP

As noted in §5.2, Cherokee clitics are all function words, and seem to fit into the categories of the operator-like elements. Of the ten clitics I've examined², three are question markers (*=ju*, *=s(go)* and *=ke*); five are focus, or focus-like, markers (*=(s)gwu*, *=dvv*, *=na*, *=le* and *=hv*); and two have some clause-level property (*=sginii* and *=hnóó*). Haag (1999) notes that at least the question and focus clitics she examined—*=hv*, *=(s)gwu*, *=ju*, *=na*, *=s(go)*, *=ke*, and *=le*—are clearly functional heads. Given that one of the clitics she didn't analyze (*=dvv*) is also a focus marker, I think it is not a stretch to claim that *=dvv* can also be included in the class of functional heads.

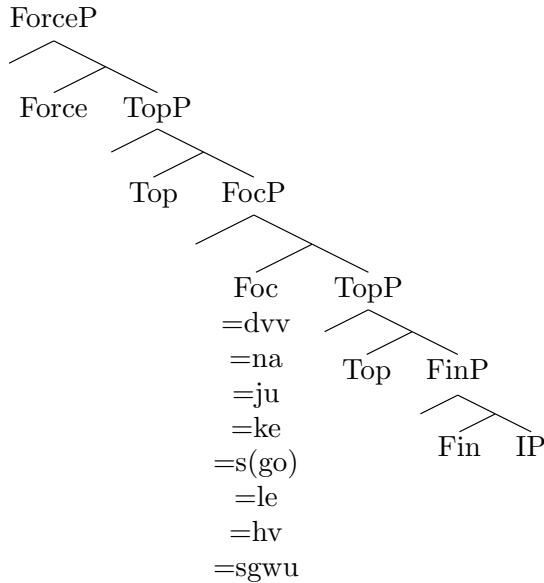
Rizzi (1997) examines operator-like elements that are found in the left periphery—interrogative and relative pronouns, topics, and focused elements. Following work on expanding the Inflectional Phrase, or IP (see Pollock 1989), and the Verb Phrase, or VP (see Kayne 1984), he argues that the Complementizer Phrase (CP) also needs additional functional projections. Using examples from Italian, French, and English, Rizzi (1997) shows that the CP can be exploded into the following structure³:



²I exclude *=ka* and *=gi* since their status in contemporary Cherokee is unclear.

³Rizzi (1997) claims that in addition to a TopP above FocP, a lower TopP is necessary to account for Italian. In this dissertation, I only assume the higher TopP, because I'm not sure Cherokee needs the lower TopP at this time.

Rizzi (1997) shows that *wh*-elements are moved to FocP, therefore, we might imagine that Cherokee question markers and focus (and focus-like) markers are base generated in FocP:



The two other clitics Haag (1999) didn't examine (*=hnóó* and *=sginii*) are not focus-like morphemes, but instead seem to have a clause-level function. The conjunction clitic *=hnóó* and the concessive clitic *=sginii* both seem to introduce types of clauses by being a kind of overt complementizer. Overt complementizers like *that* or *which* don't exist in Cherokee, but are instead expressed through subordinate or relative clause inflectional morphology (or morphophonology) on the verb, or maybe expressed by placing two clauses next to each other without any over complementization whatsoever. However, the clitics *=hnóó* and *=sginii* express some discourse-level information about the clause they are in; something expected of elements found in ForceP, which serve as the interface between clauses (Rizzi 1997).

The concessive clitic *=sginii* can express the speakers doubt about the utterance (103) or can connect the utterance to a previous utterance with a 'however' or 'but' (104); Montgomery-Anderson (2015) claims *sginii* is usually translated as 'but'.

- (103) *haadlvsginii dùùhwasgo juusuulo*
 haatl_v=skini_i tee-uu-hwa-sk-o(?i) ti-uu-asuulo
 where=CS DST-3B-buy-IMP_F-HAB DST-3B-pants

‘I wonder where he buys his pants.’ (Feeling 1975:180, Montgomery-Anderson 2015)

- (104) *aséésginii hla vsgi yinuudúúneelé?i*
 asée=skini_i hla vsgi
 however=CS NEG that

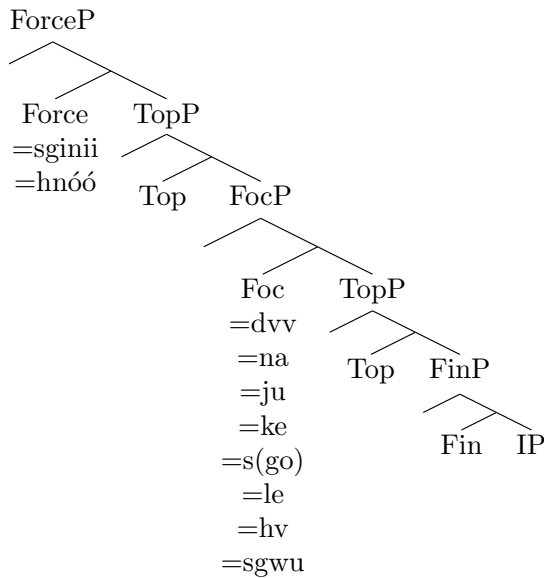
‘... but he didn’t do it.’ (Feeling 1975:12, Montgomery-Anderson 2015)

The conjunction clitic =*hnóó* can also connect utterances, and can be used to indicate that the speaker is continuing from a previous point; it’s used in stories as a kind of ‘and then’ between events in the story (105).

- (105) *di?úúluhjhóó dùùhwahtvhe*
 ti-ii-uu-lu-hc-?i)=hnóó tee-uu-hwaht-vvh-e(?i)
 CIS-ITR-3B-arrive-PFT-EXP=CN DST-3B-find-PFT-NXP

‘And when he came back, he found ...’ (*Cherokee New Testament*, Montgomery-Anderson 2015:208)

Therefore, since these two clitics =*sginii* and =*hnóó* have the ability to connect clauses, it makes sense to posit that these clitics are ForceP projections.



By examining the function of Cherokee clitics, all elements can be said to be found in the left periphery. Though syntactically clitics are generated on the left edge, they surface in second position. In the following sections (§5.5.3-5.5.5), I evaluate various syntactic and phonological mechanisms that could potentially move the clitic from the left edge to the second position.

5.5.3 Syntactic approaches to linearization

As discussed in §5.5.2, the syntactic position of Cherokee clitics does not correspond to the linear surface order. Therefore, a syntactic account of Cherokee clitics would have to assume some movement of clitics in the syntax to second position.

However, for a syntactic operation to apply to a clitic, there must be a syntactically defined class ‘clitic’ which is the target of this movement rule (see Pullum 1981). As discussed in §5.3, special clitics are morphosyntactically *words*. There is nothing which defines clitics morphologically or syntactically distinct from other terminal nodes. Furthermore, I think that adding a syntactic feature to clitics undermines the general observation (for both simple and special clitics) that clitics are complete words, from a morphological and syntactic

perspective. If there is no feature [+clitic] (or something like this), then any syntactic approach to clitic linearization is problematic, because a syntactic approach would “[require] syntax to execute operations which are not triggered by purely syntactic considerations such as, e.g., feature evaluation” (Pancheva 2005:122).

A syntactic approach taken by Tomić (1996) (following Anderson 1992) treats clitics as affixed to a clause. In her approach, clitics cluster to a specified syntactic position (for Serbo-Croatian, the complementizer), which surfaces as second position clitics. However, in Cherokee, clitics must attach to the first word of an utterance, even if that first word is part of a multi-word constituent. It’s unclear how a clustering analysis would account for a clitic intervening between parts of a syntactic constituent.

Therefore, to explain the surface position of clitics in Cherokee, it is necessary to evaluate non-syntactic analyses.

5.5.4 A strong phonological approach to linearization

A purely phonological approach to clitic linearization argues that the syntactic approach breaks down when the mapping from syntax to phonology is not one to one, such that the first element of the utterance is larger than a prosodic word, but not necessarily a syntactic constituent.

Chamorro, an agglutinative Austronesian language, has 2P enclitics like Cherokee, though in Chamorro those clitics are phonologically reduced pronouns. Like Cherokee clitics (and other 2P clitics), these weak pronouns are special clitics—their surface position is different from nonclitic pronouns and non-pronominal DPs. So some mechanism is required to explain why these clitics appear in a surface position that is unexpected. Chung (2003) argues that a phonological analysis of clitic placement can best account for weak pronouns in Chamorro. She claims that weak pronouns appear not after a syntactic constituent, but a phonological one.

As discussed in §4.4, phonological constituency is crucial to the idea of a the Prosodic Hierarchy (Selkirk 1978; Nespor & Vogel 1986; Hayes 1989). In this hierarchy, there are constituents smaller than a word (mora, syllable, foot), the size of a word (prosodic word), and larger than a word (phonological phrase, intonational phrase, utterance phrase). Chung (2003) assumes a hierarchy with just four constituents (prosodic word, phonological phrase, intonational phrase and utterance) is relevant for explaining the distribution of weak pronouns in Chamorro. These units are mapped to syntactic structures⁴, but are often “insensitive to many hierarchical relations in syntactic structure” (Chung 2003:572). This non-isomorphism between phonological structure and syntactic structure is key for Chung’s analysis; weak pronouns do not follow the first morphological word or syntactic constituent, but the first phonological phrase in an utterance.

Additionally, constraints on prosodic domination in the Prosodic Hierarchy were defined, which regulate parsing strings into prosodic domains and how prosodic domains are grouped into larger domains: Layeredness, Headedness, Exhaustivity and Nonrecursivity (Selkirk 1978, 1996). Layeredness requires that smaller units do not dominate larger units—e.g. a syllable cannot dominate a foot. Headedness and Exhaustivity don’t allow skipping of prosodic units, so phonological phrases dominate prosodic words, prosodic word dominate feet, and feet dominate syllables (though syllables do not have to dominate moras). Nonrecursivity doesn’t allow a unit to dominate that same unit; a prosodic word cannot dominate a prosodic word.

For her analysis of weak pronouns in Chamorro, Chung (2003) adopts Inkelas’ Generalized Strict Parsing Condition, which replaces Layeredness and Exhaustivity (106).

⁴Selkirk notes that the fundamental syntactic constituents (clause, phrase, word) “are each identified with a distinct corresponding type of prosodic constituent in phonological representation: (clause, [IntP]), (phrase, ϕ), (word, ω) (1996:21).

(106) *Generalized Strict Parsing Condition*

Parsing algorithms must group all phonological constituents of type *i - 1* into constituents of type *i*. (Inkelas 1990:271)

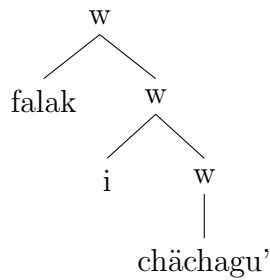
This condition means that prosodic words must be grouped into phonological phrases, which in turn must be grouped into intonational phrases, and so on. Additionally, the edges of these domains will align, so that the left edge of a prosodic word will also be the left edge of the phonological phrase that contains that prosodic word; higher domains cannot have their edges within, and not aligned to, a lower domain.

One type of data that Chung (2003) provides to show that Chamorro weak pronoun placement must depend on phonological domains rather than syntactic constituents is the behavior of weak pronouns when a proclitic is the first element in an utterance. Proclitics, like enclitics, do not have enough phonological material to be considered prosodic words on their own; they therefore must form a prosodic word with a sufficient host. The Chamorro verb *falak* ‘go to’ is not a prosodic word on its own. It cannot be reduplicated to realize progressive aspect; instead, reduplication happens on the first word of the goal of the verb, which is also the prosodic host of the proclitic *falak* (107a). In (107b), both the verb *falak* and the definite article *i* are proclitics.

- (107) a. *Falak tátatti.*
go.to back.PROG
‘Be going (i.e. keep on going) back!’
- b. *Falak i chächagu’ na guma’*
go.to the far.PROG L house
‘Be going (i.e. keep on going) to the farthest house!’ (Chung 2003:581)

Therefore the prosodic structure of the first word of (107b) would look like the following:

(108)



In (108), *chächagu'* 'far (PROG)' is a prosodic word on its own, but it also forms a prosodic word with the proclitics *i* 'the' and *falak* 'go.to', neither of which are prosodic words on their own. A weak pronoun clitic must therefore appear after the first phonological phrase *falak i chächagu'*, and cannot appear after only the verb *falak*. If it appeared after the verb, this would violate the Generalized Strict Parsing Condition. A phonological phrase must respect the integrity of prosodic words, and if a clitic appeared after *falak*, it would intervene in the middle of a prosodic word. This prediction is borne out in (109):

- (109) a. **Malak yu' i snack bar.*
AGR.go.to I the snack bar
- b. [*Malak i snack bar*] *yu'*
AGR.go.to the snack bar I
- 'I went to the snack bar.' (Chung 2003:582)

The example in (109a) is ungrammatical because the clitic appears after the proclitic 'go.to', which would mean that a phonological phrase has been parsed to interrupt a prosodic word (the prosodic word being *malak i snack bar*). In the grammatical (109b), the weak pronoun *yu'* follows the entire prosodic word (which is contiguous with a phonological phrase in this utterance).

To adapt Chung's approach for Cherokee, Cherokee clitics would follow the first prosodic word, rather than the first phonological phrase. Unlike the purely syntactic approach, this

phonological approach does not have the problem where a clitic intervenes between parts of a syntactic constituent, since a prosodic word is a phonological constituent on its own.

However, the real weakness of this approach for Cherokee is that it fails to capture the generalization that Cherokee clitics are found syntactically on the left edge. Chung (2003) rejects a hybrid syntax-phonology analysis because the syntactic movement necessary to trigger Prosodic Inversion (§5.5.5) in Chamorro is illegal. For Cherokee, this is not a problem. Cherokee special clitics are generated in the left periphery, so they are always the first syntactic element of an utterance.

Cherokee enclitics can also appear later than the second element when a phrase is topicalized.

- (110) *aséehno wahya nawu uúdelhoose*
 aséehno wahya na=(sk)wu uu-atelhoo-s-e(ʔi)
 however wolf that=DT 3B-find.out-PFT-NXP
 ‘But the wolf found out’ (lit. ‘but the wolf, it found out’) (Montgomery-Anderson 2015:429)

In (110), the delimiter clitic *=(sg)wu* attaches to the third word, *na=*, instead of the first. In a purely phonological approach, the clitic should always follow the first phonological phrase (or prosodic word in the case of Cherokee). However, in this example, the clitic is the second element in a non-initial phonological phrase⁵.

- (111) [*aséehno wahya*]_ϕ [*nawu uúdelhoose*]_ϕ

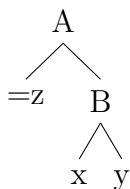
Therefore, neither a purely syntactic nor purely phonological analysis can completely account for the patterns seen in Cherokee. In the next section, I will evaluate a hybrid approach, Prosodic Inversion.

⁵In (111, the phrase *aséehno wahya* ‘however the wolf’ is topicalized.

5.5.5 Prosodic Inversion

Prosodic Inversion (PI) is an operation which reverses the linear order of a clitic and an adjacent phonological constituent (prosodic word, phonological phrase). It assumes a syntactic structure like (112), where $=z$ is some enclitic, and x and y are syntactic terminal elements. This structure surfaces as (113), with the clitic in second position.

(112)



(113) $x=z y$

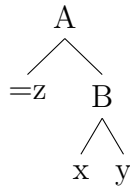
Halpern (1995) claims that the difference between simple and special clitics is one of syntactic attachment. Simple clitics appear in the same syntactic position as their nonclitic counterparts, but special clitics are adjoined to some maximal projection (CP, IP, VP, NP). Since 2P clitics are special clitics, they can adjoin to a CP (or an IP), which puts them in first position. Then the clitic (specifically an enclitic) may undergo PI to generate the surface linear order seen in (113).

A crucial aspect of this analysis is that PI applies *only* to clitics. Halpern notes that “we don’t find entire phrases, nor generally open class (lexical category) words, undergoing PI” (1995:62). In §5.5.2, I discussed that one of the shortcomings of a syntactic approach to 2P clitics is that in order for a syntactic transformation to apply just to clitics, ‘clitic’ must be a meaningful syntactic category, and there is no reason to think that this is the case. Therefore, there must be some other reason that clitics are targeted for this process. ‘Clitic’ is also not a meaningful prosodic category—there is no prosodic constituent called ‘clitic’ since clitics are prosodically deficient and cannot stand on their own. Clitics must be

incorporated into the prosodic structure by combining with other material to form a prosodic constituent.

Therefore, Halpern (1995) doesn't identify clitics as some syntactic or prosodic constituent, but as a phonologically deficient element. This phonological deficiency drives PI—PI occurs because the phonological requirement for a clitic to have a prosodic host to its left overrides the syntactic order of elements. In (114), a clitic is syntactically the first element of an utterance—Halpern (1995) shows that PI requires that 2P clitics be domain-initial (whether that domain is CP, IP, etc.). However, though the clitic is domain-initial, an example like (114b) is not wellformed because the clitic *must* attach to the right edge of a prosodic constituent, and this clitic has no host. It therefore cannot be incorporated into the prosodic structure.

(114) a.



b. * =z [x]_ω [y]_ω

In order for this utterance to be wellformed, the linear order of the clitic and first prosodic domain must be reversed so that the clitic now has an adequate prosodic host (115).

(115) [[x]_ω =z]_ω [y]_ω

A Prosodic Inversion analysis for Cherokee could explain why clitics follow the first prosodic word, rather than first syntactic constituent. If a Cherokee clitic inverts with the first prosodic word, there is no need to explain syntactically why a Cherokee clitic can intervene in the middle of a syntactic constituent. Additionally, a PI analysis allows for the

generalization that Cherokee enclitics are all function words generated in the left periphery, and can appear following the third or fourth word of the utterance.

However, neither the purely phonological approach nor PI can account for the fact that enclitics invert with proclitics. Both approaches require that second position clitics attach to a prosodic constituent, and the determiner proclitic *na=* and the negative proclitic *TLA=* are not prosodic constituents on their own. In the next section, I discuss how enclitics linearize with respect to these proclitics *na=* and *tla=*.

5.5.5.1 The Problem with *na=*

Both the phonological approach and Prosodic Inversion predict that Cherokee enclitics would follow prosodic words, and prosodic words can consist of a proclitic plus another prosodic word. Cherokee does have (at least) two proclitics: *na=* and *tla=*⁶. The determiner *na=* functions as a definite and a demonstrative, and can be translated as ‘the’ or ‘that’, and *tla=* is a negative marker. Neither the determiner *na=* nor negative marker *tla=* meet the two mora minimal word requirement.

Therefore, if Cherokee enclitics follow the first prosodic word, it should be the case that they would follow a proclitic+noun DP. However, this is not what’s attested. Instead, the clitic attaches to the proclitic⁷.

- (116) a. *naasgo sakonige anawo dajiklvni ahani gasgilohi*
 that=Q blue cloth put.on here table

‘Shall I put the blue cloth on the table?’ (Scancarelli 1987)

⁶This negative proclitic is pronounced as [ʔa] or [tʰa]. Speakers often pronounce *tl* as [ʔ] in Oklahoma Cherokee (Uchihara 2013).

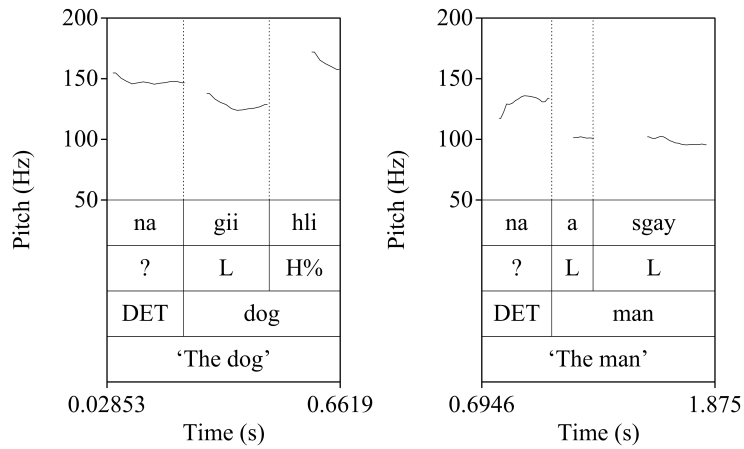
⁷Haag (1999) claims that *na=* also lengthens to *naa* to be an adequate host for the clitic, but I have yet to confirm this in my fieldwork.

- b. *najü* *achúúj* *yoónà* *wugoohé*
na=ju achúúca yoóna uu-kooh-é(ʔi)
that=CQ boy bear 3A-see:PFT-NXP
‘Did that boy see the bear?’ (DC, March 2018)
- c. *tlas* *hyèèlúsgó*
tlha=s(ko) yi-hi-èèl-íisk-ó(ʔi)
NEG=Q IRR-2A-think-IMPF-HAB
‘Don’t you think so?’ (Montgomery-Anderson 2008:146)

In order for either Chung’s (2003) approach or PI to work for Cherokee, it would be necessary to assume that *na=* is a prosodic word, since Cherokee enclitics attach to the first prosodic word. However, it is difficult to say that *na=* or *tlha=* is its own prosodic word; neither meets the two mora minimal word requirement. The other potential diagnostic (other than minimal word requirement) that could be useful to determining whether or not these proclitics are prosodic words is the boundary tone. If *na=* can bear a boundary tone, it is likely a prosodic word, but if it cannot, it is likely *not* a prosodic word. Dyck (2009) claims that in Cayuga, single particles can be prosodic words, as they can bear word-level stress. Therefore, word-level intonation could be useful in diagnosing a very short prosodic word.

However, the pitch traces of *na=* are somewhat inconclusive. It is unclear if *na=* has an inherent high tone or if it does bear the boundary tone. While the boundary tone usually appears as a level H or a falling H, the tone on *na=* looks like either a level H or a rising tone.

Figure 15: The pitch of *na=*



In the pitch trace for *na giihli* ‘the dog’, the pitch of *na=* is higher than the following low syllable, the first syllable of *giihli*. This is also the case in *na asgay(a)* ‘the man’—the pitch of *na=* is higher than the following low syllable, the first syllable of *asgay* ‘man’. While the boundary tone can be a level H, the pitch on *na=* in *na asgay* is rising. A rising pitch is never seen on syllables with the boundary tone. Therefore, it’s unlikely that the higher pitches on *na=* in Figure 15 are examples of the boundary tone. Taken with the fact that *na=* does not meet the minimal word requirement, it seems that *na=* forms a prosodic word with the following word. This macro prosodic word can then bear the boundary tone (117).

$$(117) \quad na= [\sigma \dots \sigma]_{\omega} \rightarrow [na= \sigma \dots \sigma]_{\omega}$$

If *na=* forms a larger prosodic word with its host, then Cherokee enclitics should attach to the maximal prosodic word, but this is unattested. Instead, enclitics attach to the right edge of *na=* (118).

- (118) *najù* *achúúj* ...
 na=ju *achúú(c)a* ...
 DET=CQ boy

‘Did the boy ...?’ (DC, March 2018)

So the question remains: if *na* is not a prosodic word for minimal word requirement or boundary tone assignment, then how can it be a host for 2P clitics? I will discuss below three possible accounts: 1) PI in Cherokee inverts the enclitic with the first syllable of the utterance, 2) *na=* can be considered a prosodic word for PI and PI alone, and 3) clitics must appear next to each other in a single prosodic word.

The first account (Cherokee inverts the enclitic with the first syllable of the utterance) can be immediately rejected. While a syllable is a prosodic unit, the enclitic only inverts with a single syllable when that syllable is *na=*⁸. There is never a case when the enclitic inverts with the first syllable of a polysyllabic word.

The second account—*na=* is a prosodic word only for PI—is also not motivated by the data. One could make an argument that *na=* is marked diacritically for enclitic attachment, but I’ve already discussed in §3.3.2 why a diacritic analysis is not satisfactory. All other diagnostics (minimal word requirement, boundary tone) suggest that *na=* is *not* a prosodic word, so there is no independent motivation for treating *na=* as a prosodic word.

The third account is the most plausible at this time. In this account, I propose that enclitics attach to proclitics due to a language-specific requirement that clitics in proximity of each other form clusters, and these clusters can form a prosodic word. These ideas aren’t unusual for clitics. Clitic clusters have long been discussed for Romance languages (see Perlmutter 1971), and require certain configurations of pronominal clitic placement and ordering. Though (some) pronominal clitics can appear as proclitics or enclitics in Italian,

⁸It is also possible to invert with a single syllable when the first word of the utterance has undergone word-final vowel deletion, and therefore is only one syllable. However, this isn’t very common, and it makes more sense to think of that sequence as a prosodic word, even after deletion.

when multiple clitics are present, they cluster either before or after the verb (Cardinaletti 2007). Additionally, certain Italian clusters form their own prosodic words independent of the verb (Cardinaletti 2007). Both of these facts seem to be also true for Cherokee. Cherokee doesn't allow a prosodic word host to have both a proclitic and enclitic (119a). However, an enclitic may follow a proclitic, and together form a prosodic word independent of the prosodic word (*achúúj(a)* 'boy') that would otherwise be the host for *na=* (119b).

- (119) a. *[[*na=achúúj(a)*]_ω =*ju*]_ω
 b. [*na=jù*]_ω [*achúúj(a)*]_ω

The combination of the proclitic and enclitic (*na=j(u)* in this example) must be its own prosodic word because the boundary tone appears on =*ju*. If *na=* and =*ju* both attached to the front of following prosodic word, the boundary tone would not appear on =*ju*, but rather at the end of the host word. Therefore, the proclitic and enclitic can join to create their own prosodic word. In the following example (120), I show all the logical possibilities for clitic linearization and parsing into prosodic words, with the conducive question enclitic =*ju* standing in for all enclitics. I've also shown in these examples where the boundary tone (or boundary tones) appear.

- (120) Prosodic word configurations with the proclitic and enclitics, attested and unattested
- a. [*na=* [σ ... δ]_ω]_ω
 b. [[σ ... σ]_ω =*jù*]_ω
 c. [*na=jù*]_ω [σ ... δ]_ω
 d. *[*na=* σ ... σ =*jù*]_ω
 e. *[*na=j(u)=* σ ... δ]_ω
 f. *[σ ... δ]_ω [*na=jù*]_ω

In §7, I show how OT can handle the clustering of *na=* and =*ju*, and why *na=jù achúúj(a)* is grammatical, but **na=achúúj(a)=ju* is not.

5.6 Summary

In this chapter, I have shown that Cherokee enclitics are strict 2W clitics, following the first prosodic word. Linearization to this position depends on the phonological deficiency of clitics, and their syntactically generated position in the left periphery. Both a phonological and PI analysis can account for the attachment of enclitics to the first prosodic word; however, PI takes into account the syntactic position of Cherokee enclitics, and does not generate unattested forms when phrases are topicalized. However, neither a phonological nor PI analysis can accurately capture the typologically unusual attachment of enclitics to proclitics. Under both analyses, the enclitic should attach to the first prosodic word, but a proclitic is not a prosodic word.

In §7, I show that constraints on prosodic mapping and the inherent phonological deficiency of clitics can both account for clitic attachment to host words, as well as second position linearization. By using a Stratal OT framework, mapping of clitic to a prosodic word can happen late in a derivation, and thus explain the grammaticality of enclitic attachment to a proclitic.

CHAPTER 6
BOUNDARY TONE

6.1 Introduction

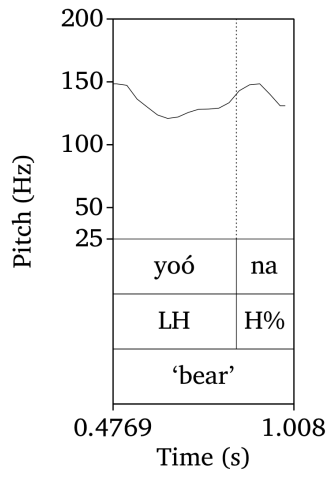
As discussed in §4, there are six patterns of boundary tone placement to account for¹:

(121)

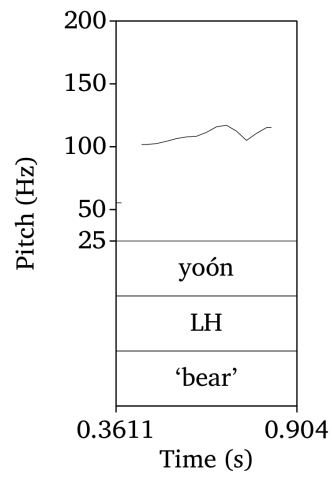
	NO WFVD	WFVD
NO CLITIC	a. $CV(V)C\check{V}$	b. $CV(V)C$
CLITIC, NO UNDERLYING TONE	c. $CV(V)CV=C\check{V}$	d. $CV(V)C=C\check{V}$
CLITIC, UNDERLYING TONE	e. $CV(V)C\check{V}=C\acute{V}$	f. $CV(V)C=C\acute{V}$

Pitch traces for these forms are provided below for the words *yoóna* ‘bear’, *nohji* ‘pine’, and *daksi* ‘terrapin’ (DC, Aug 2017):

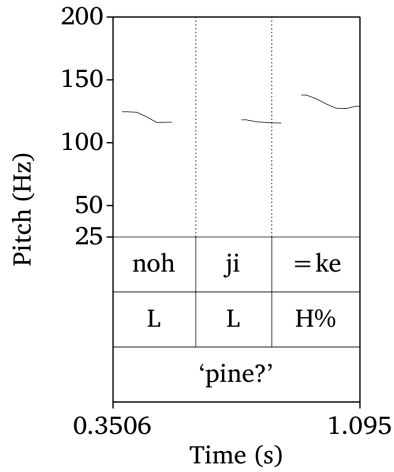
¹In (121), C stands for any consonant, or any permissible cluster, and the acute accent diacritic on the vowel (\acute{V}) represents either low or high underlying tone.



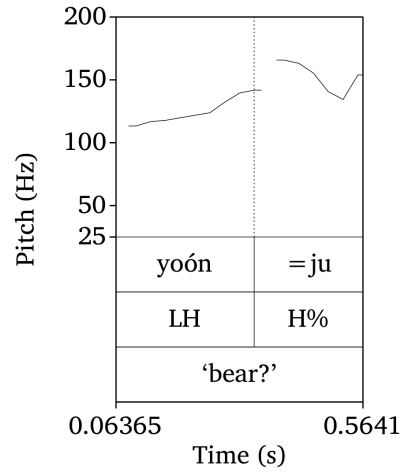
(a) CVVCV̇



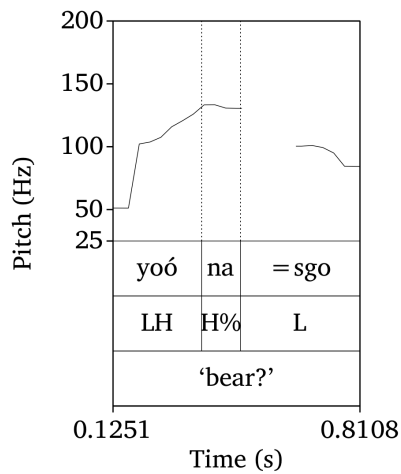
(b) CVVC



(c) CVCV=CV̇

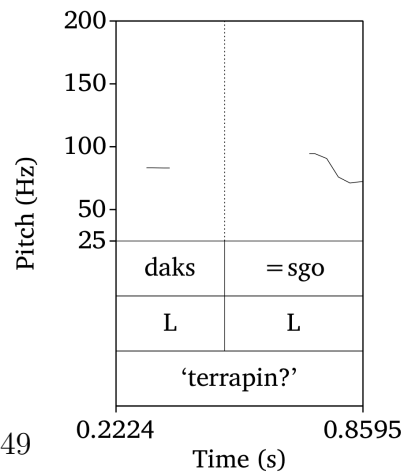


(d) CVVC=CV̇



(e) CVVCV̇=CV̇

149



(f) CVC=CV̇

In these six minimally distinct forms, only three have a boundary tone in the expected, word-final position (a, c and d). In two of the above forms, there is no boundary tone at all (b and f), and in one, the boundary tone appears on the penultimate syllable (e).

In this chapter, I will start to build an account for this distribution of the boundary tone, building on the crucial factors discussed in the previous chapters: mapping of prosodic words, and clitic attachment. In §4, I show that the morphosyntactic word (stem plus any affixes) maps to the prosodic word—a claim bolstered by evidence from the behavior of tone spreading and laryngeal metathesis. In §5, I show that second position clitics have a subcategorization frame that selects for prosodic words. Following Inkelas (1990), I assume that second position enclitics combine with a prosodic word to recursively form another prosodic word. In this chapter, I show the distribution of the boundary tone, which is conditioned by the factors discussed in those previous chapters.

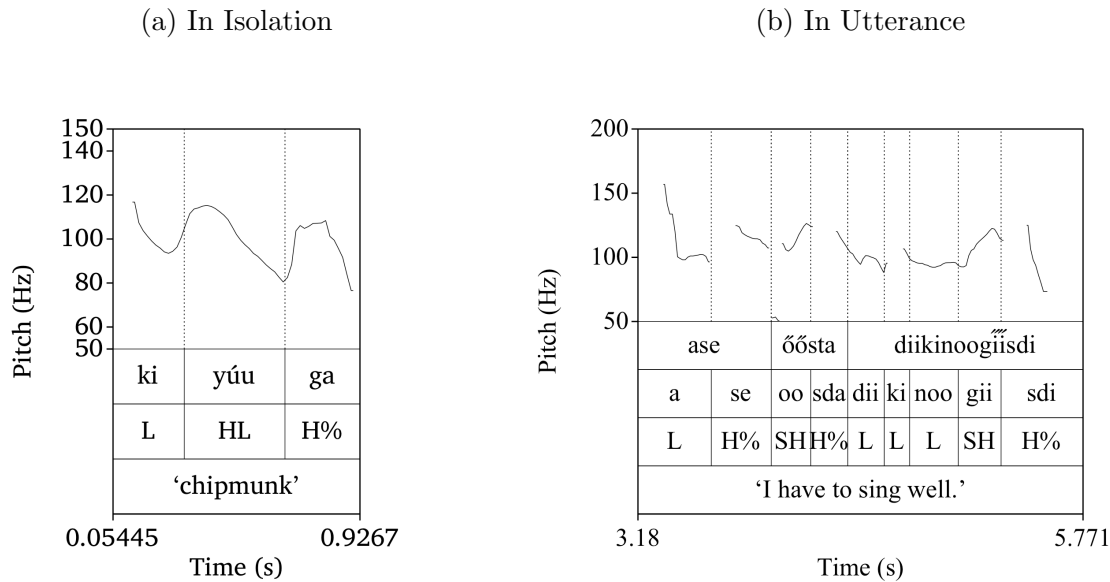
Data from this chapter comes from a number of recording sources, including my own fieldwork. However, all pitch traces are produced by me, so citations of data in this chapter indicate the source of recordings, and the speaker if known.

6.2 The Boundary Tone

As discussed in §2.3, the boundary tone is a pitch that only appears on word-final syllables. Though Feeling (1975:xi-xii) doesn't mark this tone, he notes that “the ordinary pitch for a final syllable is a falling pitch beginning at level 4, or a falling pitch beginning at level 3 in those instances in which there is a level 4 pitch on the preceding syllable.” Haag (1999:35) has a similar definition: the boundary tone is “a ‘falling superhigh’ ... unless preceded by a superhigh, in which case it is a normal high.” Lindsey (1985) additionally notes that this final pitch is optionally higher than the preceding pitch, and “downslur” is not always present.

Boundary tones appear on the final syllable of words, whether the words are produced in isolation or within an utterance (DF, Montgomery-Anderson 2015).

Figure 17: Boundary Tone in Isolation and in Utterance

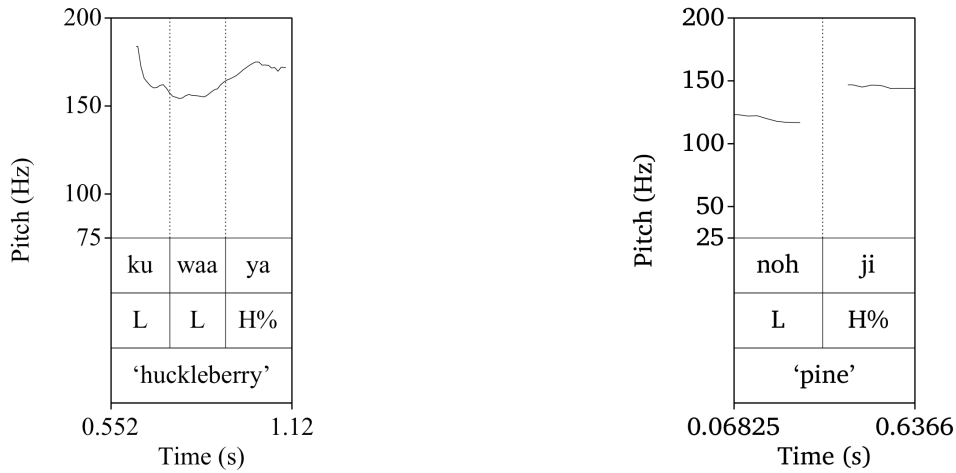


In Figure 17a, the boundary tone appears on the third and final syllable of the word *kíyúuga* ‘chipmunk’. This boundary tone starts a little lower than the high peak of the previous syllable, and falls. In Figure 17b, boundary tones appear on the word-final syllables of all three words *ase* ‘must’, *óósta* ‘good’, and *diikinoogüü'sdi* ‘to sing (1sg)’. The boundary tone on *ase* starts above the L of the previous syllable and falls, while the boundary tones on *óósta* and *diikinoogüü'sdi* start about at the level of the superhigh on the preceding syllable, and fall.

However, the boundary tone does not always appear as a falling pitch. Frequently, the boundary tone will simply be a higher pitch on the final syllable, without a large pitch excursion. Examples of level boundary tones are shown in Figure 18².

²In this Figure, ‘huckleberry’ was produced by LS, Apr 2014; ‘pine’ by DC, June 2017.

Figure 18: Boundary Tone, H level



The pitch traces in Figures 17 and 18 show that the boundary tone is a high pitch on the final syllable of the word. The final pitch can start at about the level of a H (see Figure 17a), or SH (see Figure 17b), though, like observed by Lindsey (1985), the fall of the final pitch (which he called “downslur”) is not always present (Figure 18).

6.2.1 H% v. HL%

Since the boundary tone does not always fall, both H% and HL%³ have been used to denote this boundary tone. Haag (2001) and Johnson (2005) use both H% and HL% to denote two different boundary tones, which they argue are conditioned by discourse context and morphological category. Haag (2001) argues for three classes of morphological categories of clitics, which produce three different kinds of boundary tones: “Truncated High” and a “Highfall” and “Spread Highfall”. Haag (2001) claims that when words are produced in an elicitation setting (in isolation) the final syllable has a “true” highfall boundary tone (HL%),

³Strictly speaking, % marks a phrasal boundary (see Pierrehumbert & Hirschberg 1990). However, since this notation of % for a word-level boundary tone has been used for over thirty years for Cherokee (since Lindsey 1985), I will follow the convention and mark word-level boundary tones with %

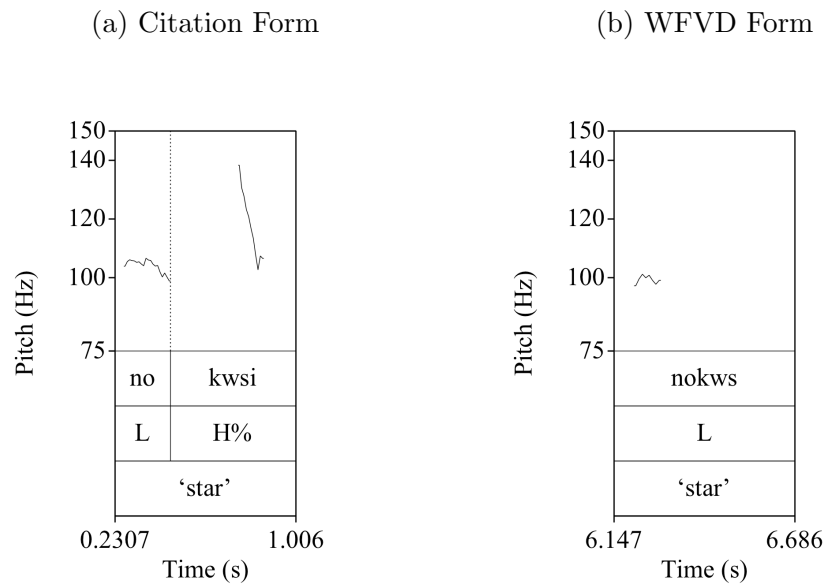
Additionally, accent in Northern Iroquoian languages is also dependent on position within an utterance (Gordon 2014). In Onondaga, non-final words in an utterance are accented on the last syllable, but final words have penultimate accent, unless certain morphemes move the accent to the antepenult or final syllable (Chafe 1970). This is also the case in Cayuga (Foster 1980; Michelson 1988; Doherty 1993; Dyck 2009; Gordon 2014) and Seneca (Chafe 1977; Gordon 2014): non-final words in an utterance have a high pitch accent on final syllables, while utterance-final words have a low pitch on the final vowel.

Therefore, I think it is possible that the realization of Cherokee boundary tone, as a level tone or a falling tone, is sensitive to utterance position. If the falling realization of the tone occurs before pauses (as claimed by Haag 2001 and Johnson 2005), this could indicate that HL% is the “utterance-final” form of the boundary tone. However, this is orthogonal to the issues presented in this chapter. For the sake of simplicity, I will use only H% to indicate the boundary tone, whether or not there is a phonetic fall in pitch.

6.3 The Boundary Tone and WFVD

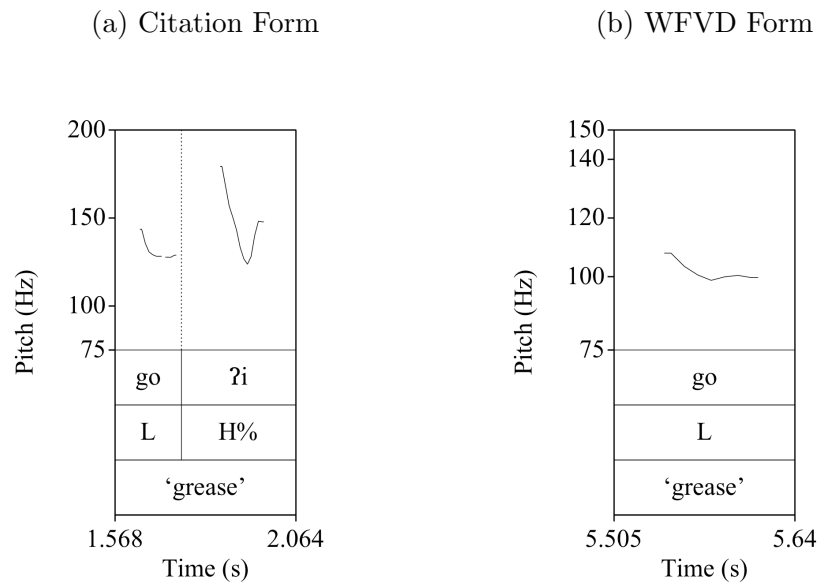
Though the boundary tone marks the right edge of words, when WFVD occurs, no boundary tone surfaces. In Figure 19 (DC, Aug 2017), two forms of the word *nokwsi* ‘star’ are presented: one in citation form (a), and one with the final vowel deleted (b). In Figure 19a, there is a low pitch on the first syllable, and the boundary tone on the second syllable. In Figure 19b, a L surfaces on the only syllable [nok^ws]. No boundary tone appears on the (b) form.

Figure 19: Boundary Tone and WFVD, Consonant-Final forms



The boundary tone also does not appear on WFVD forms when the resulting final segment is a vowel (JR, Aug 2017).

Figure 20: Boundary Tone and WFVD, Vowel-Final forms



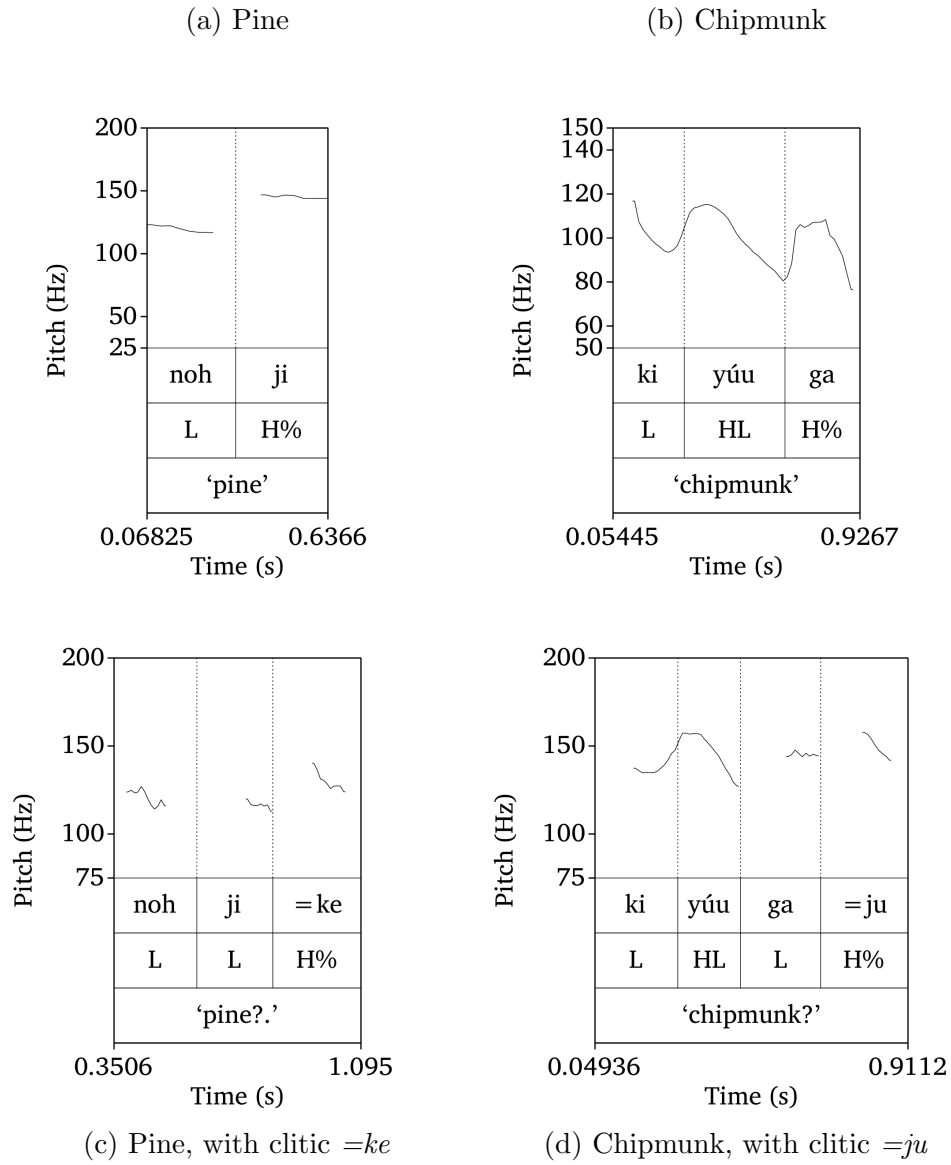
In Figure 20a, the word appears in citation form: *goʔi* ‘grease’. In this form, a L appears on the first syllable [go], and the boundary tone appears on the final syllable of the word, [ʔi]. However, when the final V is deleted, or in this case, final *ʔV* syllable, the boundary tone does not appear on the new final syllable. Instead, the syllable [go] still surfaces with a low tone, and a boundary tone does not surface at all.

Like *nokwsi* in the Figure 19, the word *goʔi* is two syllables, and both have a short low initial syllable. However, in neither case does the boundary tone appear on the resulting final syllable, after WFVD occurs. That is, forms like *nökws* and *gö* are not attested.

6.4 The Boundary Tone and Clitics

In his characterization of clitics, Montgomery-Anderson (2015) claims the boundary tone will appear on word-final suffixes, but not on clitics. He assumes that the tone on a clitic is “a short low tone unless otherwise marked” (Montgomery-Anderson 2015:235). However, in my fieldwork (as well as work done by Haag (1999) and Johnson (2005)) shows that the boundary tone does appear on the final syllable of the clitic.

Figure 21: Boundary Tone with and without clitics



In Figure 21 footnote In this Figure, 'pine', 'pine?' and 'chipmunk?' were produced by DC, Aug 2017; 'chipmunk' by DF, Montgomery-Anderson 2015., the words words *nohji* 'pine' and *kíyúuga* 'chipmunk' are presented with and without the question clitics =*ke* and =*ju* attached. In Figure 21a, the first syllable of *nohji* has a low tone, but the second (and

final) syllable has a higher pitch consistent with the boundary tone. Compare this to Figure 21c—the first and second syllables of *nohji* (the syllables of the host word) have low pitches, and the boundary tone appears on the clitic. The same pattern can be observed for (b) and (d). In Figure 21b, the first syllable of *kíyúuga* ‘chipmunk’ is low, the second syllable is HL, and the third syllable also has a high falling pitch H%. In Figure 21d, the final syllable of the host word *kíyúuga* has pitch at the same level as the L in the first syllable. The high falling pitch is now on the vowel of the question clitic =*ju*.

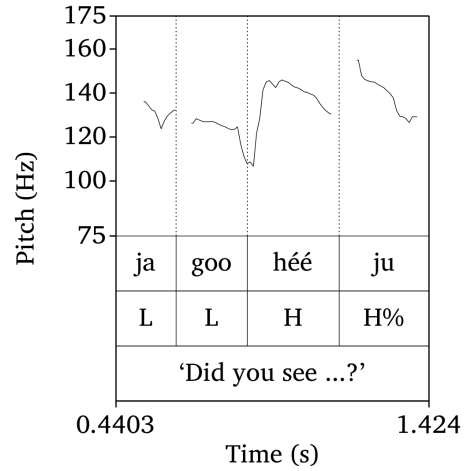
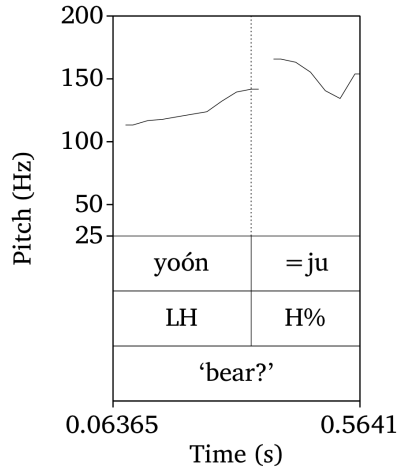
These examples in Figure 21 show that if the host word is in citation form, a L tone appears on the final vowel of the host word, and the boundary tone appears on the clitic. When the host word is in WFVD form, the boundary tone now appears on the clitic—see (123) and pitch traces in Figure 22.

- (123) a. yoónjù
yoón(a)=ju
bear=CQ
‘bear’ (DC, August 2017)
- b. jagoohéjù
ca-kooH-éé(ʔi)=ju
2B-see:PFT-NXP=CQ
‘Did you see (him)...?’ (DC, August 2017)

Figure 22: Boundary Tone, WFVD host word

(a) Consonant-final host word

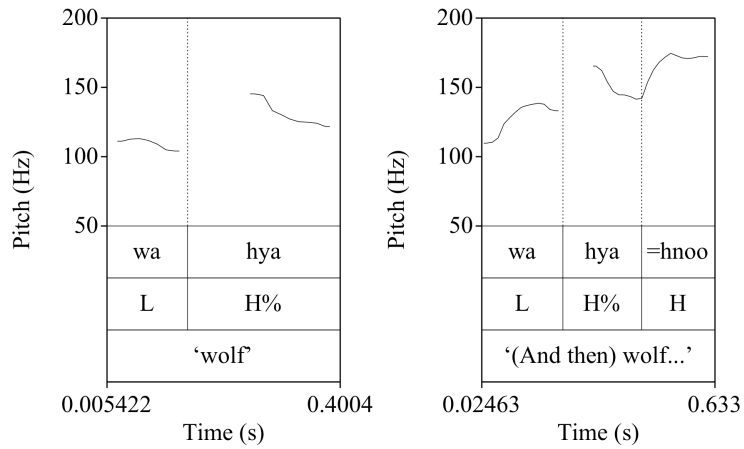
(b) Vowel-final host word



6.4.1 Boundary Tone Alignment and Clitics with Underlying Tone

Of the twelve enclitics discussed in §5, I argue in this section that there are two that have an underlying tone: the yes/no question clitic *=sgo* and the connector *=hnóó*. Since the other ten clitics are underlyingly toneless, the boundary tone can appear on the clitic vowel. For *=sgo* and *=hnóó*, the underlying tone prevents the boundary tone from appearing on the clitic vowel. This is demonstrated below: when *=hnóó* is attached to *wahya* ‘wolf’, *=hnóó* surfaces with a high tone, but the preceding syllable does not have a low tone, as seen when other clitics attach.

Figure 23: Alignment of Boundary Tone with =hnóó

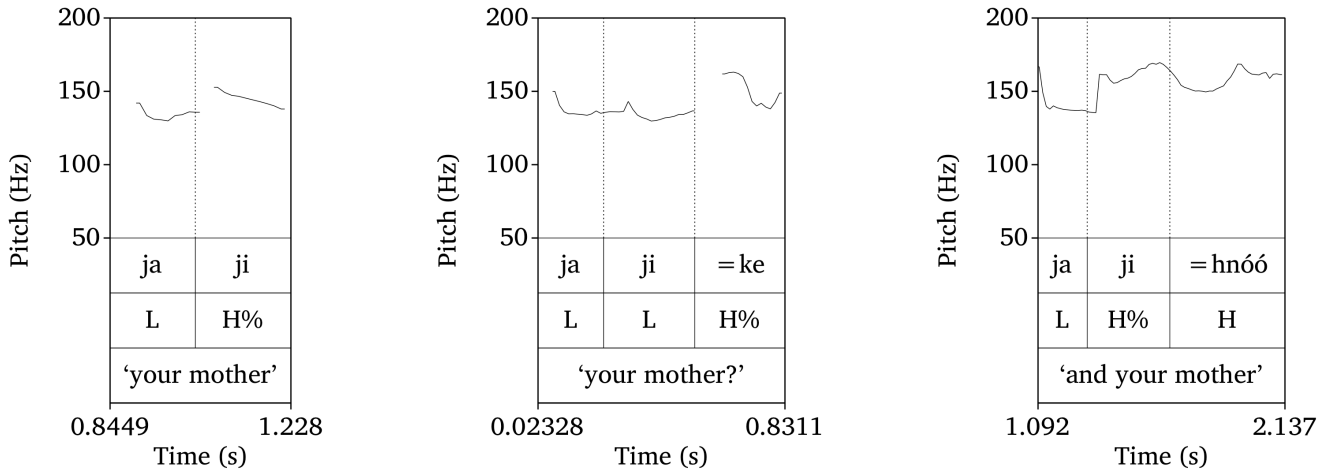


In Figure 23⁴, when the word *wahya* ‘wolf’ is pronounced without a clitic, there is a low tone on the first syllable, and a falling boundary tone on the final syllable. When *wahya* appears with the conjunction clitic =hnóó, the first syllable of *wahya* still has a low tone, the final syllable still has a falling pitch, and the conjunction clitic =hnóó has a high level tone.

This effect that =hnóó has on the alignment of the boundary tone can also be seen with the following example, contrasting *jaji* ‘your mother’ with *jajike* ‘your mother?’ and *jajihnóó* ‘and your mother’.

⁴Data in this example is from a recording of a text made by Brad Montgomery-Anderson. A transcription of this story, *The Wolf and the Crawdad* can be found in his grammar (2015).

Figure 24: Alignment of Boundary Tone: No Clitic, =*ke* and =*hnóó*



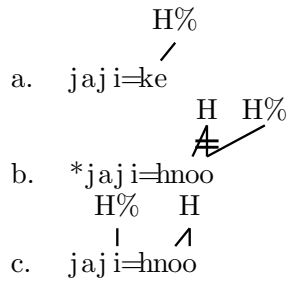
In Figure 24a⁵, the first syllable of *jaji* has a low tone and the final syllable has a falling boundary tone. When the question clitic =*ke* is attached to *jaji* (Figure 24b), both syllables of the host word *jaji* have a low tone, and the clitic =*ke* has a falling boundary tone. However, when the conjunction clitic *hnóó* is attached (Figure 24c), the host word *jaji* doesn't have a low tone on the second syllable, as when =*ke* is attached. Instead, the second syllable [ji] has a higher pitch, and there is also a higher pitch on =*hnóó*. Comparing these forms to the forms seen in Figure 23, it appears that a high tone on the clitic =*hnóó* causes the boundary tone to appear on the final syllable of the host word rather than on the clitic.

The fact that the boundary tone associates to the vowel in clitic =*ke*, but not to the vowel in =*hnóó* suggests that there is an underlying tonal distinction between these two clitics. I argue that =*hnóó* has an underlying H tone, while =*ke* is underlyingly toneless. If the vowel in =*ke* is underlyingly toneless, then the boundary tone can associate to that TBU, and the expected pattern (boundary tone on final syllable of clitic) surfaces. However, if

⁵'you mother' and 'your mother?' were produced by DC, August 2017; 'and your mother' by LP, August 2017.

the clitic *=hnóó* has an underlying H tone, the boundary tone can't associate to that vowel, because it would have to delete the underlying tone. The boundary tone can't associate to a TBU that already has a tone specified, so it associates to the nearest TBU.

(124)



In (124a), the H\% boundary tone can associate to the final syllable, the vowel of the clitic *=ke*, because the clitic is underlyingly toneless. However, when the clitic is *=hnóó* (124b), the boundary tone cannot associate to the vowel of the clitic, because the clitic has an underlying H tone. Therefore, the boundary tone appears on the last syllable of the host word, and a H tone on the clitic (124c).

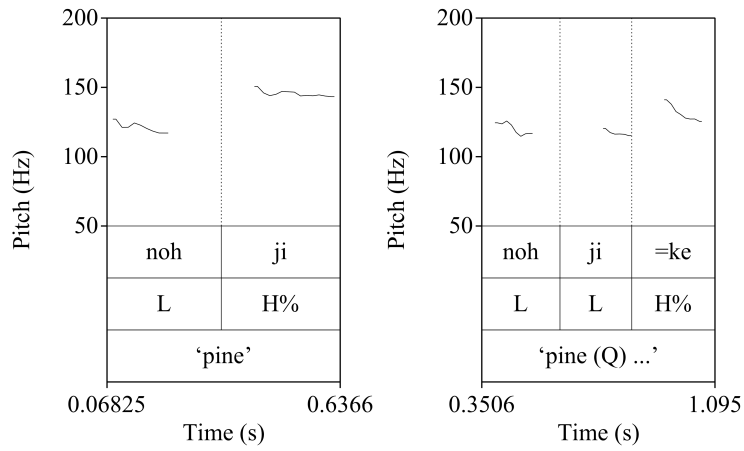
The conjunction clitic *=hnóó* is not the only clitic that can cause the boundary to appear on the host word. Haag (1999) observes that when the yes/no clitic *=sgo*⁶ attaches to a word, the boundary tone also does not associate to the vowel of the clitic. Instead, the final syllable of the host word surfaces with the boundary tone, and the clitic *=sgo* surfaces with a low tone.

In Figure 25⁷, the boundary tone appears on the final syllable of the prosodic word. When the word *nohji* ‘pine’ is pronounced in isolation, the boundary tone appears on the last syllable [ji]. When the alternative question clitic *=ke* attaches to *nohji*, the boundary tone now appears on the clitic, and the final syllable of the host word is realized with a low tone.

⁶see §4.5.1 for evidence that *=sgo* is in fact a clitic, and not some other morph.

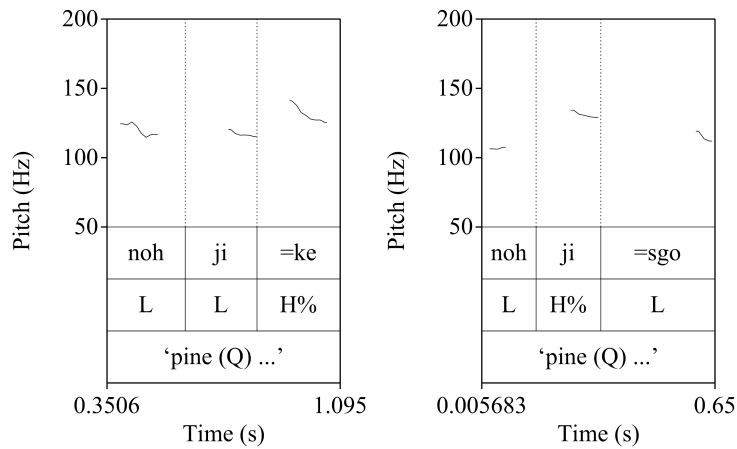
⁷(DC, August 2017)

Figure 25: Alignment of Boundary Tone without and with clitic =ke



However, when the yes/no question clitic =sgo⁸ is attached, the boundary tone does not appear on the clitic. The boundary tone appears on the final syllable of the host word, and a reliably low pitch surfaces on the clitic (Figure 26).

Figure 26: Alignment of Boundary Tone with =ke and =sgo

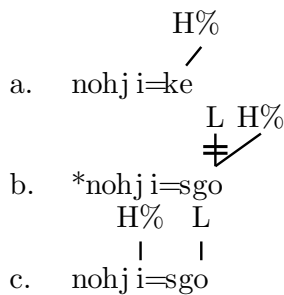


⁸(DC, August 2017)

This pattern indicates that there is a specified tone on *=sgo*—an underlying L tone. The low pitch that surfaces cannot be the result of a default L, because that would mean that *=sgo* is toneless phonologically. If *=sgo* were toneless, we would expect that the boundary tone could appear on *=sgo*, as it does on *=ke*. However, since the tone on *=sgo* is always low, and there is a boundary tone on the final syllable of the host word (as with *hnóó*), the L must be there in the underlying representation of *=sgo*.

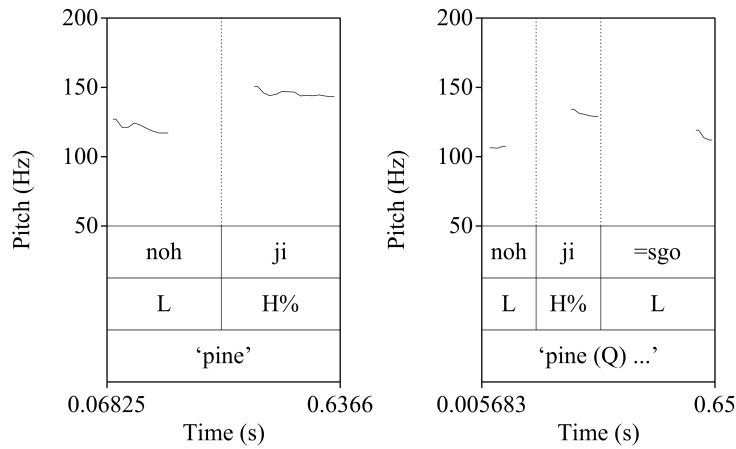
The fact that underlying tones faithfully surface in Cherokee predicts that a specified L would block the association of a boundary tone. This is what is attested with *=sgo*—there is no form where the boundary tone appears on the clitic *=sgo*.

(125)



The form in (125a) shows the expected pattern—the boundary tone occurs on the final vowel of the word on the clitic *=ke*. The form in (125b) is unattested; H% doesn't associate to the vowel of *=sgo*. Instead, in (125c), the yes/no clitic *=sgo* surfaces with a low tone, and the preceding syllable, the final syllable of the host word, has a higher pitch. If we compare *nohji* in isolation to *nohjiso*, the highest pitch is on the same syllable for both words (Figure 27).

Figure 27: Alignment of Boundary Tone without and with clitic =*sgo*



Potentially, this difference in placement of the boundary tone between =*ke* and =*sgo*/=*hnóó* could be a difference of prosodic domain—the clitics =*sgo* and =*hnóó* are just not part of the domain of the boundary tone—rather than tonal phonology. If it were the case that these two clitics are outside the domain of the boundary tone, it would be odd that =*sgo* and =*hnóó* then do not have the same tone. If they do not get tone from the lexicon or from the boundary tone, they should both be low, having gained a default L tonal target at the phonetics/phonology interface (see §3.2 for a discussion of different types of low pitches). However these two clitics surface with two different tones, L for =*sgo* and H for =*hnóó*, suggesting that they are not toneless, but have a tone (either L or H) as part of their phonological representation.

Therefore, these clitics are still in the domain of the boundary tone, as all other clitics are, but their underlying tones force the boundary tone to appear before the final syllable. This analysis of underlying L and H on =*sgo* and =*hnóó* respectively is preferable to one where they are outside the domain of the boundary tone, because the distribution of the

boundary tone with respect to these clitics can be accounted for with previously motivated properties of lexical tone in Cherokee.

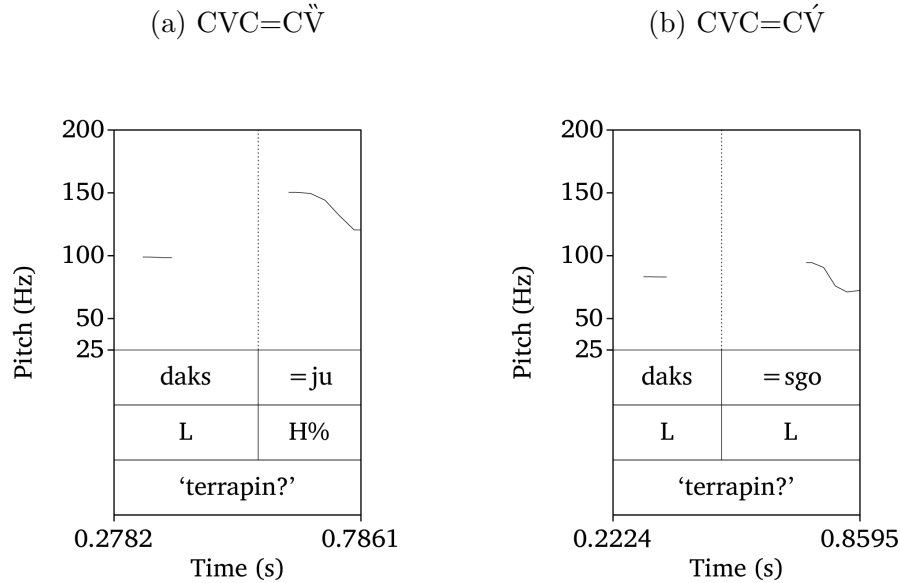
Similar behavior of a boundary tone with respect to a lexical tone has been argued for in Roermond Dutch. Gussenhoven (2000) argues that lexical tones can surface to the left of a right-edge phrasal tone. Yip (2002:282) notes that this example from Roermond Dutch illustrates “the mobility of phrasal tones in response to the overall phonology of the language”. Therefore, the boundary tone appearing one syllable from the right edge can be considered another example (in addition to Roermond Dutch) of a phrasal tone being affected by lexical tones.

6.4.2 WFVD and Clitics =*sgo*/=*hnóó*

When clitics with tone are attached to WFVD host words, a boundary tone does not appear (126).

- (126) a. *daksjü*
dakhs(i)=ju
terrapiin=CN
‘terrapiin?’ (DC, August 2017)
- b. *dakssgo*
dakhs(i)=sko
terrapiin=Q
‘terrapiin?’ (DC, August 2017)

Figure 28: Boundary Tone with WFVD, Clitics with and without Tone

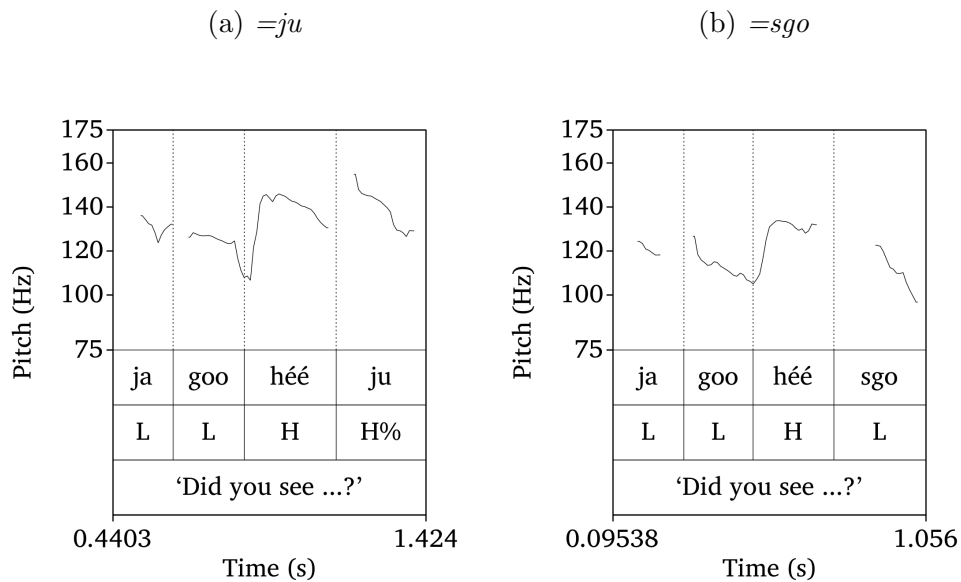


In Figure 28, the host word *daksi* ‘terrapi?’ appears in WFVD form with a clitic attached: *=ju* in Figure 28a and *=sgo* in Figure 28b. In 28a, there is a low tone on the vowel of the host word, and the higher pitch on the vowel of the clitic *=ju*. However, when *=sgo* is attached to *daks*, both syllables have a low pitch. If the boundary tone should mark the right periphery of words, it is odd that no boundary tone appears at all in cases like CV(V)C and CV(V)C=C \check{V} .

Additionally, it is clear that WFVD conditions the absence of a boundary tone. While it might be expected that a low tone can push the boundary tone to the rightmost available TBU (as seen with examples like *nohj \check{i} sgo* and *wahy \check{a} hn \acute{o}* in the previous section), when WFVD produces vowel-final forms, the boundary tone doesn’t move to a toneless syllable. Compare the pitch traces of the following word, one with *=ju* and one with *=sgo*.

- (127) a. *jagoohéé*
 ca-kooh-éé(ʔi)
 2B-see:PFT-NXP
 ‘You saw (him).’
- b. *jagoohééjü*
 ‘Did you see (him)...?’
- c. *jagoohéésgo*
 ‘Did you see (him)...?’ (DC, August 2017)

Figure 29: ‘Did you see ...?’ with =*ju* and =*sgo*



In (127a), the host word appears without the final *ʔV* syllable, and the boundary tone appears on the clitic vowel. This is the expected pattern, and it is shown in Figure 29a. However, in (127b), the host word again appears without the final *ʔV* syllable, but the clitic attached is =*sgo*, which has an underlying L tone. The boundary tone does not align to final syllable of the host word, or to any other TBU (Figure 29b).

(128)

- a. jagoohee=ju
 H H%
 / /
 H L
- b. jagoohee=sgo
 / |
- c. *jagoohee=sgo
 H L H%
 / \
- d. *jagoohee=sgo
 H H% L
 / \
- e. *jagoohee=sgo
 | / |

The examples in (128) show the attested and possible alignments of the boundary tone with respect to lexical tones, both on the host word and the clitic. In (128a), the boundary tone appears on the clitic, as shown in the pitch trace above (Figure 29a). In (128b), the boundary tone does not appear on either the clitic or the host word (Figure 29b).

Examples (128c-e) are all potential alignments of the boundary tone but none are attested. The form in (128c) does not occur because the boundary tone cannot associate to a TBU that already has a tone. If this form (c) were attested, we might see a rising pitch on the vowel of =sgo, but as shown in Figure 29b, the pitch on that syllable actually falls. There is a lexical H tone on the nonexperienced past morpheme -*ééʔi*, so the boundary tone cannot associate to this TBU, as in (128d). However, if the boundary tone can be pushed into the word, it's unclear why (128e) is not attested. If the boundary tone can be pushed in, as in *jajìhnoó*, it might be expected that something like *jagoðhéésgo* is possible. In the next chapter, I show that boundary tone alignment takes into account both the clitic edge and the edge of the host word; in forms like *jagoðhéésgo*, it is preferable for a boundary tone to not appear at all, than to appear on a non-final segment.

6.5 Summary

In this chapter, I have shown the six patterns of boundary tone placement:

(129)

	NO WFVD	WFVD
NO CLITIC	a. $CV(V)C\check{V}$	b. $CV(V)C$
CLITIC, NO UNDERLYING TONE	c. $CV(V)CV=C\check{V}$	d. $CV(V)C=C\check{V}$
CLITIC, UNDERLYING TONE	e. $CV(V)C\check{V}=C\acute{V}$	f. $CV(V)C=C\acute{V}$

Forms like (a), (c), and (d) all have a word final boundary tone, while forms like (e) have a non-final boundary tone, and forms (b) and (f) have no boundary tone at all. To explain this distribution, there are two major generalizations to account for.

The first generalization is that boundary tones can appear on toneless clitics, but not on clitics with underlying tone. As seen in §2 and §3, it is more important for underlying tones to surface than for spreading to occur. It is possible that in the case of the boundary tone as well; faithfulness is more important than alignment or realization of a boundary tone.

The second generalization is that WFVD appears to bleed boundary tone alignment, unless there is a toneless clitic for the boundary tone to appear on, as in (d). However, if a clitic with an underlying tone attaches to a host word in WFVD form, no boundary tone appears. Therefore, it is necessary to explain both why no boundary tone appears on words in WFVD form, and why if a host word is in WFVD, a boundary tone only appears if the clitic attached to it is toneless.

In the next chapter, I provide an analysis for all edge phenomena discussed in the previous chapters: WFVD and syllabification, clitic attachment and linearization, and the presence and positioning of the boundary tone.

CHAPTER 7

ANALYSIS AND CONCLUSION

7.1 Introduction

I this chapter, I will account for the six patterns of boundary tone placement¹:

(130)

	NO WFVD	WFVD
NO CLITIC	a. $CV(V)C\check{V}$	b. $CV(V)C$
CLITIC, NO UNDERLYING TONE	c. $CV(V)CV=C\check{V}$	d. $CV(V)C=C\check{V}$
CLITIC, UNDERLYING TONE	e. $CV(V)C\check{V}=C\acute{V}$	f. $CV(V)C=C\acute{V}$

There are three factors which condition the distribution of the boundary tone: 1) whether or not the final vowel is deleted (WFVD), 2) whether or not there is a clitic attached, and 3) whether or not that clitic has an underlying tone. Therefore, an analysis of the boundary tone distribution has to account for three observations from the previous chapters. First of all, the boundary tone alignment and WFVD do not always target the same domain. As shown in §4 and §6, WFVD does not delete the final vowels of clitics, but the boundary tone can appear on the clitic vowel. Secondly, if a word-final vowel is deleted, no boundary tone appears. However, if the word in WFVD form is followed by a toneless clitic, the boundary tone appears on the clitic vowel, unless a clitic with underlying tone is attached. Thirdly, the boundary tone can be pushed in from the edge of the word by a clitic with an underlying tone. Therefore, the boundary tone can appear on the host word-final TBU (when the host is

¹In (130), C stands for any consonant, or any permissible cluster, and the acute accent diacritic on the vowel (\acute{V}) represents either low or high underlying tone for this schematization.

in citation form). However, the boundary cannot appear on a TBU other than the host-final TBU—it cannot be pushed any further into the word.

To address these observations, I propose an analysis which relies on basic principles of Lexical Morphology and Phonology (LMP) and Stratal Optimality Theory (Stratal OT), such as modularity, stratification, and cyclicity. I argue that surface forms arise due to interactions between morphosyntactic and phonological domains (modularity), that rules apply at different points of interface (stratification), and some rules can apply cyclically as the word is built up morpheme by morpheme, but some rules only apply once (cyclicity). A basic outline of my analysis is proposed below (131); in the rest of this chapter, I will motivate the three stages of this analysis.

(131)

Stage 1: ‘Lexical’ Processes
Lexical Phonological Processes (metathesis, etc.)
Map Morphological Words to Prosodic Words
WFVD
Stage 2: ‘Post-lexical’ Processes
Parse Remaining Material (i.e. clitics) into Prosodic Words
Align Boundary Tone
Stage 3: ‘Clean Up’ (Phonetics/Phonology Interface)
Assign Default L Tones

The first stage of this analysis corresponds to the point at which lexical rules happen (which is actually two strata per Kiparsky 2015). At this stage, morphemes are added to the stem, and with the addition of each morpheme, phonological processes (e.g. Laryngeal Metathesis) occur. I will argue that this is the stage where a first mapping of prosodic word to morphosyntactic word occurs, as well as the optional WFVD. The second stage is the post-lexical stratum: at this point, clitics are folded into prosodic words, and the word-level boundary tone is assigned to a prosodic word domain. The third stage in this analysis captures what happens in the phonetics/phonology interface. At this point, syllables that

are still toneless after rules apply in the above strata gain low tonal targets—i.e. default L tones are inserted.

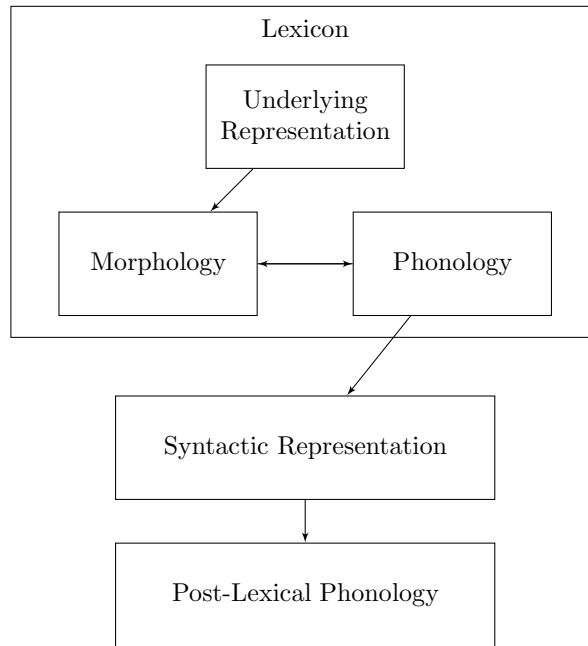
7.2 A Stratified Phonology

A stratified grammar has several advantages over a non-stratified one. A stratified phonology has been used to account for problems of opacity, cyclicity, derived environment effects, differential behavior of roots and affixes, and more. The history of analyses that use a stratified phonology goes back to the Cycle (Chomsky et al. 1956) in which phonological rules apply once to a constituent, but may apply again to a larger constituent, and then again to an even larger constituent. In this approach, rules apply from the innermost constituent outwards until the last constituent is reached. In this framework, rules cannot “return to earlier stages of the cycle after the derivation has moved to larger, more inclusive domains” (Chomsky 1973:243, Mascaró 1976:1). Mascaró (1976) notes that certain kinds of phonological rules may only apply to derived environments, a major problem for the notion that rules apply from the smallest constituent to the largest constituent.

Lexical Phonology and Morphology (Pesetsky 1977; Kiparsky 1982; Mohanan 1982) can account for this asymmetry observed by Mascaró. LPM use the idea of levels (strata) to explain why some affixes trigger certain phonological processes, while others do not. In the Lexical Phonology framework, there are lexical rules, which apply as a word is built up in the lexicon, and post-lexical rules, which apply once a word has access to phrasal/syntactic material. Therefore, a “lexical phonological rule applies as soon as either morphology or phonology has created a form that meets the requirements of its structural description” (Booij & Rubach 1987:2) and cannot cross word boundaries. However, a post-lexical rule can apply to whole phrases, and across word boundaries. LPM also exploits the notion that prosodic rules, at the time of development of the theory primarily syllabic and metrical rules (see Kahn 1976; Liberman & Prince 1977), do not function the same way that segmental

rules do. Segmental (lexical) rules then may happen cyclically (over and over again every time a morpheme is added), but prosodic (post-lexical) rules apply only once. LPM assumes a model that looks like the following:

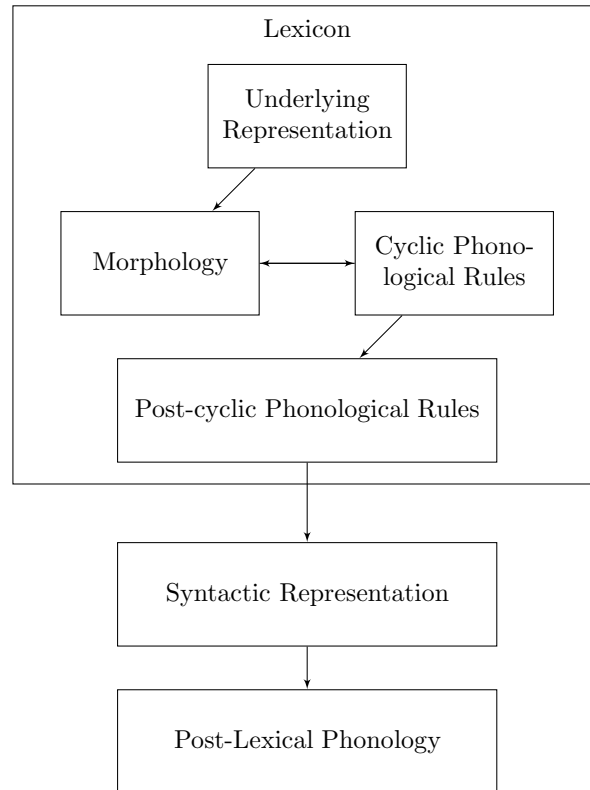
Figure 30: LPM Model



Though lexical rules are traditionally considered to be cyclic and post-lexical rules to be non-cyclic, Booij & Rubach (1987) argue that there is a difference between post-cyclic and post-lexical rules. They instead divide lexical rules into two subcategories: cyclic and post-cyclic. Cyclic apply every time a relevant morphological structure is created, but post-cyclic rules apply only once and do not interact with the morphology. In LPM, cyclic rules are subject to the Strict Cyclicity Condition (Kiparsky 1982, 1985; Rubach 1984; Halle & Mohanan 1985)—the SCC requires that rules only apply across morpheme boundaries, as the addition of morphemes creates conditioning environments. Abstractness and underspecification in underlying forms are restricted by the SCC, so cyclic rules generally do not apply

to non-derived environments (Kaisse & Shaw 1985). However, post-cyclic rules are not subject to the SCC and “apply freely both inside morphemes and across morpheme boundaries” (Booij & Rubach 1987:4). Therefore, Booij & Rubach (1987) propose the following modified model:

Figure 31: LPM Model, Booij & Rubach (1987)



In this model, there is now an additional block in the lexicon, separate from morphological and phonological rules. While these post-cyclic rules do not make reference to the morphology, they also do not take into account any syntactic structure, so they are still considered lexical, rather than prosodic rules.

In recent years, the tenets of LPM have been adopted for new theories: Cophonology (Orgun 1996; Inkelas et al. 1997; Antilla 2002; Inkelas & Zoll 2007) and Stratal OT

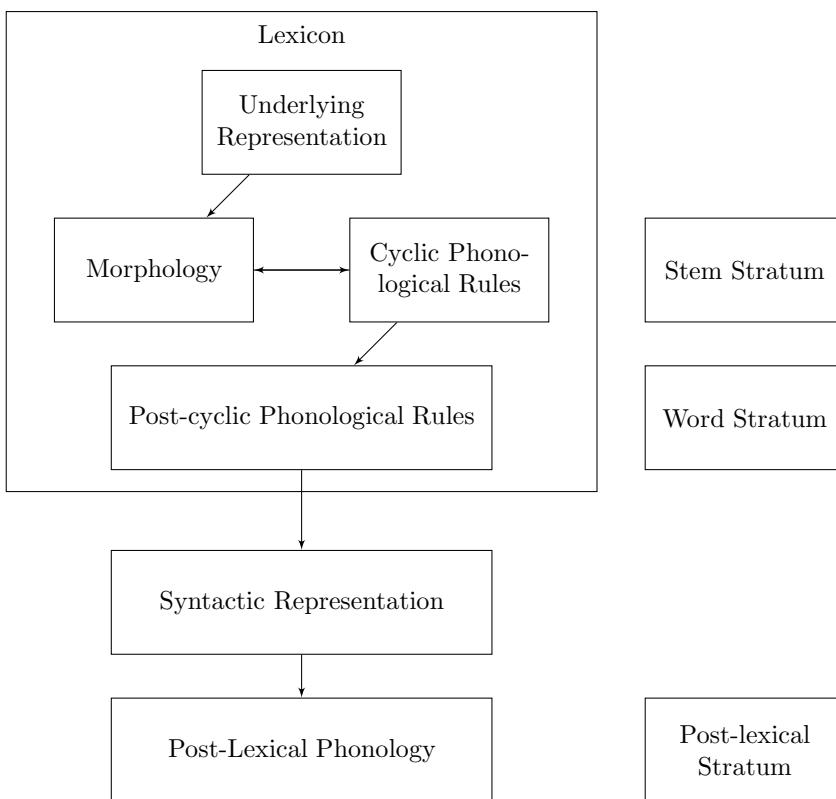
(Kiparsky 2000, 2008; Bermúdez-Otero 2011). The Cophonology approach assumes that every morphological structure is associated with its own phonological grammar, so that every time a morpheme is concatenated, it can force a different constraint ranking. One advantage to Cophonology (and the related Morpheme-Specific Phonology—Pater 2010) is that it can account for process morphology, or cases when inflection (or derivation) is only marked by phonological change.

Stratal OT (the basic framework of which will be used in this chapter) has several assumptions about the structure of the phonological grammar: the grammar is modular, and the modular components of the grammar interface in the following ways (Kiparsky 2015:4):

- (132) a. *Stratification*: phonology and morphology are organized into STRATA (also known as LEVELS, each constituting a parallel constraint system.
- b. *Level-ordering*: each of the cross-categorical domains *stem*, *word*, *phrase* corresponds to a morphosyntactic and phonological stratum.
- c. *Cyclicity*: stems and words must satisfy the applicable stem and word constraints at every stage.

Therefore, the LPM model can be modified again. Instead of blocks of rules, Stratal OT uses strata (or levels):

Figure 32: Stratal OT Model



For this dissertation, this model shows roughly how the strata in Stratal OT correspond to the blocks in LPM. In the stem stratum, constraints evaluate strings occur across morpheme boundaries, but not across word boundaries. The word stratum corresponds to the post-cyclic block from Booij & Rubach (1987). In this stratum, constraints capture phenomena that occur only once in the word. Constraints can target phonological material that is either morpheme-internal or that crosses a morpheme boundary (see §7.3.2 for a discussion of how this idea operates with WFVD). The third level is the post-lexical stratum. This is the stratum of prosodic processes—anything that makes reference to syntactic bracketing.

Additionally, as the name suggests, Stratal OT approach uses the constraint-based Optimality Theory (Prince & Smolensky 1993; McCarthy & Prince 1993) to capture phonological processes. Specifically, Stratal OT assumes that the ranking of constraints may be

different in different strata, and the only constraints necessary are input-output and markedness constraints, since the output of one stratum becomes the input of the next stratum. Output-output faithfulness constraints, base-reduplicant constraints, etc. are unnecessary; there is never an output-output relationship. In §7.6, I show why Stratal OT is the best framework to handle Cherokee data.

In this dissertation, when I use ‘lexical’ to refer to a phonological process, I am using the typical jargon of LPM and Stratal OT to refer to a set of rules which do not cross word boundaries, generally cyclic, etc., rather than an instance of phonology occurring in the lexicon.

7.3 Stage 1: ‘Lexical’ Phonological Processes

The first stage of my analysis is the phonological strata which contains ‘lexical’ phonology. This is the point where constraints evaluate candidates as morphemes are added to build up the word. The processes in the chart below (133) can all be considered ‘lexical’ because they do not make reference to syntactic or phonological domains larger than the word.

(133)

Stage 1: ‘Lexical’ Processes
Lexical Phonological Processes (metathesis, etc.)
Map Morphological Words to Prosodic Words
WFVD

Though a number of phenomena are all lumped together in (133), in this section, I will show that they are actually in two different strata—the first stratum (stem stratum) being the level where traditional, cyclic lexical processes occur, and the second (word stratum) where post-cyclic and optional processes occur.

(134)

Stage 1: ‘Lexical’ Processes	
Stem Stratum:	Lexical Phonological Processes
Word Stratum:	Map Morphological Words to Prosodic Words WFVD

7.3.1 Stem Stratum

In the stem stratum, constraints are evaluated for every relevant sequence in the word. So if a language has a constraint that prohibits voiceless obstruents intervocalically, the optimal candidate would have voiced obstruents for every obstruent that appears between vowels in the word. In Cherokee, this can be seen with a process called Vowel Deletion (see Flemming 1996; Uchihara 2013). Vowel Deletion occurs when there is a sequence CVhC/V, where C is any obstruent, V is a short vowel, *h* is the segment /h/, and C/V is any obstruent or vowel. In the following example (135), there are a CVhV sequence, and a CVhC sequence, both of which are resolved in the surface form by vowel deletion:

- (135) *hwikti*
wi-hi-kahthi → whikhti
TRN-2A-head.to:PRS:IND
‘You’re heading there.’ (Montgomery-Anderson 2015:219)

The CVhV sequence /wihi/ (translocative prepronominal prefix and second person singular prefix) surfaces as [w̥i], where the first short /i/ has been deleted. The CVhC sequence /kaht/ later in the word (part of the inflected stem) surfaces as [kht]. This process can therefore be considered to happen in the stem stratum—the process occurs at multiple points as the word is built up. I expect that other segmental processes, like Closed Syllable Shortening (see Uchihara 2013 for a discussion of various other segmental processes), as well as tonal processes would occur in this stratum.

7.3.1.1 Syllabification

In addition to the phonological processes mentioned in the previous section, I assume that syllabification occurs in the stem stratum. There are three reasons why I assume syllabification happens so early: 1) other processes make reference to syllables, 2) syllabification doesn't cross word boundaries, or the boundary between a host word and a clitic, and 3) WFVD produces word-final sequences that are not found word-medially.

As briefly discussed in the previous section, Uchihara (2013) claims that a coda following a long vowel will condition Closed Syllable Shortening. In order for this process to target a tautosyllabic CCV sequence (using Uchihara's constraint $*VVC]_{\sigma}$), candidates must include syllabification. Therefore, if Closed Syllable Shortening (CSS) occurs in the stem stratum, syllabification must also take place in the stem stratum.

While this argument is based on my assumption that CSS is a stem stratum process, there is other evidence that syllabification happens before the word and post-lexical strata. Syllabification must precede the post-lexical stratum because there is no syllabification across word boundaries in Cherokee. In Cherokee, a word ending in a vowel followed by a word beginning with a vowel does not condition vowel deletion or resyllabification. Instead, the vowels remain in hiatus.

- (136) a. *ùùduulísgééjù* *ùùdeehloogwààsdì*
 uu-tuulí-sk-éé(ʔi)=ju uu-deehlo(h)kwaa-st-i
 3B-want-PFT-NXP=CQ 3B-learn-INF-NOM
 'Did he want to learn?' (DC, June 2017)
- b. *na asgay* *ùùgoohéé* *gihlì daasuhwisgúʔì*
 na=askay(a) uu-kooh-ééʔi kihli d-aa-asuwhi-sk-úʔi
 DET=man 3B-see:PFT-NXP dog DST-3A-bark-PFT-NXP
 'The man saw the barking dog.' (DC, June 2017)

The example in (136a)² shows that when one word ends in a vowel and the next word begins with a vowel, the vowels are pronounced in hiatus:

- (137) ùùduulísgééjũ **uudeehloogwààsdi**
 ‘Did he want to learn?’ (DC, June 2017)

In (136b), when a proclitic ends in a vowel and the next word begins with a vowel, the vowels are also produced in hiatus:

- (138) *na* *asgay*
 na=askay(a)
 DET=man

The example in (136b) also shows that when a word appears in WFVD form (*asgay* ‘man’) before a word that begins with a vowel (*ùùgoohéé* ‘he saw it’), the final consonant doesn’t become the onset of the next word.

- (139) a. na a.sgay úú.goo.héé
 b. *na a.sga yúú.goo.héé

The lack of syllabification across word boundaries indicates that syllables are not formed in the post-lexical stratum, or that there isn’t resyllabification in the post-lexical stratum.

Evidence from WFVD shows that syllables are not formed in the word stratum either, since WFVD creates forms that are phonotactically illicit. As discussed in §4.3, words that have undergone WFVD show a larger number of possible word-final than word-medial codas. In order to have a small set of allowed medial-codas, but a large number of final-codas after WFVD, syllabification must occur before WFVD. If candidates are evaluated for syllable wellformedness constraints in the stem stratum (the stratum before the word stratum), but

²For the words in these examples with the perfective morpheme (PFT), the speaker I consulted uses -sk, but Uchihara (2013) identified the morpheme as -s. I think this is just an issue of variation in Oklahoma dialects.

not evaluated for these same constraints in the word stratum, word-final consonants that are otherwise not attested will surface.

Therefore, I assume that syllabification, as the evaluation of well-formed syllables, occurs in the stem stratum, and words are not resyllabified in subsequent strata. To capture general principles of syllabification in Cherokee, I use the following constraints:

- (140) SONORITY SEQUENCING PRINCIPLE (SSP) (Blevins 1995:210; Uchihara 2013:115):
Between any member of a syllable and the syllable peak, a sonority rise or plateau must occur.
- (141) *hC (Flemming 1996:28³):
Ill-formed clusters:
 hC.
 .hC
- (142) NOOBSCODA (Broselow & Xu 2004:137):
No obstruent codas.
- (143) *COMPLEX (Kenstowicz 1996a):
No complex onsets⁴.

I also posit the following constraint:

- (144) *ʔC:
The following sequences are ill-formed:
 .ʔC
 ʔC.
 .Cʔ
 Cʔ.

Uchihara (2013) notes that, aside from clusters with /s/⁵ which I do not address in this dissertation, Cherokee onset and coda clusters follow the SSP. The SSP requires that less

³Flemming (1996) includes .*Ch* and *Ch*. in his list of ill-formed *h*-clusters.

⁴Kenstowicz (1996a) uses this constraint for both complex onsets and codas, but the distribution of codas in Cherokee is captured with other constraints.

⁵Cross-linguistically, this is not unusual (Blevins 1995).

sonorous segments are found on the edges of syllables, and segments become more sonorous the closer they are to the nucleus. Uchihara (2013) uses the following sonority hierarchy (from Clements 1990:286; Blevins 1995:211) for Cherokee, where the most sonorous segments are on the left, and the least sonorant on the right:

- (145) Sonority hierarchy
vowels > glides > liquids > nasals > fricatives > oral stops

A violation of SSP would be any sequence that does not rise or plateau in sonority as it gets closer to the nucleus, or does not fall or plateau in sonority as it gets closer to the syllable boundary.

Flemming (1996) posits the constraint *hC to prevent tautosyllabic /h/-consonant clusters. While he uses it to explain Laryngeal Metathesis and Vowel Deletion, it is useful in accounting for the syllabification of /h/ more generally. A candidate would incur a violation for this constraint for every *hC* sequence at the edge of a syllable. I posit the constraint *ʔC to account for the ungrammaticality of onset and codas clusters with a glottal stop. Violations of this constraint are also counted for every *ʔC* or *Cʔ* sequence at a syllable edge.

The constraint NOOBSCODA prevents obstruents from appearing in the coda, because as shown in §4.2.3, no stop, fricative, or affricate consonants can appear in word-medial codas. This constraint is violated for every obstruent in a coda position. Canonical codas /h/ and /ʔ/ violate this constraint, but surface due to the higher ranked constraint *hC and *ʔC. Examples in (146) and tableaux in (147) show how laryngeals surface as codas.

- (146) a. *chuh.ga*
cuhka
‘flea’ (JR, DC, August 2017)
- b. *a.woó.háʔ.li*
awoóháʔli
‘eagle’ (Feeling 1975:62; Uchihara 2013:135)

(147) a.

Input:	/cuhka/	SSP	*hC	NoOBSCODA
a.i	<i>cu.hka</i>	*!		
☞ a.ii	<i>cuh.ka</i>			*
a.iii	<i>cuhk.a</i>		*!	**

b.

Input:	/awoóháʔli/	SSP	*ʔC	NoOBSCODA
b.i	<i>a.woó.há.ʔli</i>		*!	
☞ b.ii	<i>a.woó.háʔ.li</i>			*
b.iii	<i>a.woó.háʔl.i</i>	*!	*	**

The tableaux in (147) show that laryngeals surface word-medially to avoid *hC* and *ʔC* sequences. Candidates (a.iii) and (b.i) have fatal violations of the constraints **hC* and **ʔC*, respectively, and candidates (a.i) and (b.iii) violate SSP. Laryngeals then must be parsed as word-medial codas, even though they are not sonorants.

However, /h/ does not always surface in a word-medial coda when followed by a consonant. The following examples in (148) show that when /h/ is followed by a resonant, it is parsed as part of the onset. In (148), the words *wahga* ‘cow’ and *wahya* ‘wolf’ only differ by one segment; this difference in one segment results in a difference in syllabification (syllabification of these examples comes from Feeling’s 1975 dictionary).

- (148) a. wah.ga
 wahka
 ‘cow’
- b. wa.hya
 wahya
 ‘wolf’

In (148a), the /h/ is the coda of the first syllable, while in (148b), the /h/ is part of the onset of the second syllable (and surfaces as voicelessness on the resonant). To account for the syllabification of these words, two additional constraints are needed:

- (149) IDENT-IO[s.g.] (Flemming 1996:28)⁶:
 A feature [+spread glottis] in the input should appear associated to the same position in the output.
- (150) *PRESASP (Flemming 1996:28)
 Don’t have a preaspirated stop.

The constraint IDENT-IO[s.g.] requires that the [+spread glottis] feature appear on the same segment in the input and the output. This is violated when an underlying /h/ is not realized as a consonant, but as a feature on the neighboring segment (aspiration on an obstruent, voicelessness on a resonant). The constraint *PREASP prevents preaspirated stops from surfacing; this constraint is violated if an input sequence hC is hC in the output.

The following tableaux in (151) show that the constraints already discussed, plus IDENT-IO[s.g.] and *PREASP, generate the correct syllabification for both words.

⁶Flemming (1996) calls this constraint ‘Parse Association’ and refers to any feature.

(151)

a.

Input:	/wahka/	SSP	*PREASP	*hC	*OBSCODA	IDENT-IO[s.g.]	*COMPLEX
a.i	wa.hka	*!		*			*
☞ a.ii	wah.ka				*		
a.iii	wahk.a			*!	**		
a.iv	wa. ^h ka		*!			*	

b.

Input:	/wahka/	SSP	*PREASP	*hC	*OBSCODA	IDENT-IO[s.g.]	*COMPLEX
b.i	wa.hya			*!			*
b.ii	wah.ya				*!		
b.iii	wahy.a	*!		*	*		
☞ b.iv	wa. ^h ya					*	

In tableau (151a), candidate (a.ii) violates NOOBSCODA by having *h* in the coda of the first syllable, but candidates (a.i) and (a.iii) violate the higher ranked constraints SSP and *hC, respectively. Candidate (a.iv) has realized /h/ as preaspiration on the consonant /k/, and therefore fatally violates *PREASP. In (151b), candidate (b.ii) violates NOOBSCODA by parsing the laryngeal as part of the coda. Candidates (b.i) and (b.iii) both parse the /hy/ sequence as a cluster: (b.i) fatally violates *hC and candidate (b.iii) fatally violates SSP. However, candidate (b.iv) doesn't incur a violation of *hC because the [+s.g.] feature of the /h/ has moved to the following resonant; it is no longer a cluster. This matches the generalizations in §4, which showed that /h/-resonant sequences don't actually surface as clusters.

One issue that arises with Cherokee phonology in an OT framework is the claim by Scancarelli (1987) that all Cherokee words are underlyingly vowel-final. OT assumes Richness of the Base (Prince & Smolensky 1993): the input to the grammar should not be subject to any language-specific restrictions. Therefore, the claim that all Cherokee words have underlying final-vowels is problematic for the core assumptions of OT. The idea that all words are vowel-final is also questionable because some final vowels alternate (/i/ and /a/), and some final vowels don't seem to delete under WFVD (/e/). This different behavior of

final vowels could suggest that some vowels are underlying, and some are added by epenthesis. While this issue needs further research, my constraints (plus MAX and DEP⁷) and constraint ranking can account for the attested forms, whether the input has or does not have a final vowel.

(152) a.

Input:	/wahk/	SSP	*hC	NoOBSCODA	*COMPLEX	MAX	DEP
a.i	wahk		*!	**			
a.ii	wa.hka	*!	*		*		*
☞ a.iii	wah.ka			*			*
a.iv	wahk.a		*!	**			*

b.

Input:	/wahka/	SSP	*hC	NoOBSCODA	*COMPLEX	MAX	DEP
b.i	wahk		*!	**		*	
b.ii	wa.hka	*!	*		*		
☞ b.iii	wah.ka			*			
b.iv	wahk.a		*!	**			

The tableaux in (152) show that whether there is a final vowel or not in the input, the same candidate (a.iii, b.iii) is optimal, because the faithfulness constraints are ranked lower than SSP and markedness constraints. Though the attested form can be generated whether the input has an underlying or epenthetic vowel, in the rest of my examples I use an input with an underlying vowel for ease of exposition.

7.3.2 Word Stratum

The output of the stem stratum is now the input for the word stratum, which includes all lexical tone associations and wellformed strings of segments. Though forms in this stratum are the output of the stem stratum, phonological processes that occur in the word stratum are still ‘lexical’, i.e. they don’t make reference to any syntactic notions. For Cherokee, I associate the word stratum with post-cyclic rules (per Booij & Rubach 1987). At the word

⁷MAX: Don’t delete; DEP: Don’t epenthesize (see Kager (1999)).

stratum, the morphological word is mapped to the (minimal) prosodic word, and WFVD optionally occurs.

(153)

Stage 1: ‘Lexical’ Processes	
Word Stratum:	Map Morphological Words to Prosodic Words WFVD

As discussed in §4, the morphosyntactic word maps to the prosodic word. This relationship is captured with the constraint $\text{MATCH}(\text{WORD}, \omega)$ (Selkirk 2011):

- (154) $\text{MATCH}(\text{WORD}, \omega)$:
 The left and right edges of a word in the input syntactic representation must correspond to the left and right edges of a prosodic word (ω) in the output phonological representation.

Mapping of morphosyntactic word to prosodic word must occur in the word stratum, since processes in this stratum do not interact with the morphology. WFVD also occurs in the word stratum. As defined in §4, WFVD is an optional process that occurs often in fast or informal speech, where some word-final element is deleted.

- (155) No Deletion Word-Final Vowel Deletion
 iinada ~ iinad
 ‘snake’ (DC, Oct 2014)

Mascaró (1976) and other early LPM discussions (Kiparsky 2008; Mohanan 1982; Kaisse & Shaw 1985) argue that optionality is incompatible with lexical rules. However, Kiparsky (1987) argues that in Chamorro, umlaut and destressing processes are optional, and in a separate stratum from the other obligatory stress-assigning rules. This stratum where optional rules are allowed corresponds to the word stratum (Kiparsky 2015), the same stratum where I argue WFVD occurs in Cherokee.

The optionality of WFVD can be captured in Stratal OT with two constraints.

- (156) a. $*V]_{\omega}$
 No prosodic word-final vowels.
 b. MAX-V-IO (Kager 1999:178)
 Input vowels must have output correspondents.

I propose the constraint $*V]_{\omega}$, which prohibits vowels at the right edge of a prosodic word. A candidate violates this constraint if a) it is parsed into a prosodic word, and b) has a vowel on the right edge of the prosodic word. A violation of the constraint MAX-V-IO⁸ is any output that lacks a word-final (or any) vowel from the input.

In OT, constraints are ranked in a strict hierarchy, and therefore “the grammar is *deterministic*, in the sense that each input is mapped onto a single output” (Kager 1999:404). However, with optional rules or free variation, a single input is mapped onto two (or more) equally grammatical outputs. One way to deal with this problem is to argue that some constraints are not crucially ranked with regards to each other. In the case of Cherokee, it is the case that these two constraints $*V]_{\omega}$ and MAX-V-IO in the word stratum are freely ranked; thus, there are two subhierarchies, each which can select an optimal output (Kager 1999). There is one subhierarchy where $*V]_{\omega} \gg$ MAX-V-IO, and another where MAX-V-IO \gg $*V]_{\omega}$. This is shown in tableau (157) with the word *iinada* ‘snake’:

(157)

Input:	iinada	MAX-V-IO	$*V]_{\omega}$
☞ a.i	[iinada] _ω		*
a.ii	[iinad] _ω	*!	
		$*V]_{\omega}$	MAX-V-IO
b.i	[iinada] _ω	*!	
☞ b.ii	[iinad] _ω		*

⁸This constraint is used by Flemming (1996) in his analyses of Laryngeal Metathesis and Vowel Deletion, though he calls it PARSE V.

For the (a) ranking ($\text{MAX-V-IO} \gg *V]_{\omega}$) the optimal candidate is the citation form *iinada*, while the optimal candidate for the (b) ranking ($*V]_{\omega} \gg \text{MAX-V-IO}$) is *iinad*. By not crucially ranking these two constraints with respect to each other, both the citation and WFVD forms can be output, thus modeling the optionality of this process.

Additionally, the syllabification constraints from the stem stratum must be ranked lower than the WFVD constraints in the word stratum.

(158)

a. Stem Stratum:

Input:	/wahka/	SSP	*hC	NoOBSCODA	MATCH(WORD, ω)	*V] $_{\omega}$	MAX-V-IO
a.i	wahk		*!	**		*	
a.ii	wa.hka	*!	*		*		*
a.iii	wah.ka			*			*
a.iv	wahk.a		*!	**			*

b. Word Stratum:

Input:	wah.ka	MATCH(WORD, ω)	*V] $_{\omega}$	MAX-V-IO	SSP	*hC	NoOBSCODA
b.i	[wahk] $_{\omega}$			*		*	**
b.ii	[wah.ka] $_{\omega}$		*!				*
b.iii	wahk	*!		*		*	**
b.iv	wah.ka	*!					*

In (158a), the syllabification constraints (SSP, *hC, NoOBSCODA, and *COMPLEX) are ranked higher than the MATCH(WORD, ω) and WFVD constraints *V] $_{\omega}$ and MAX-V-IO. While candidate (a.i) violates MAX-V-IO and candidates (a.ii), (a.iii), and (a.iv) violate *V] $_{\omega}$, those violations are irrelevant because the non-optimal candidates are knocked out by much higher ranked constraints. In (158b), candidate (b.ii) is eliminated because it violates the highly ranked *V] $_{\omega}$ constraint. While candidate (b.i)⁹ violates MAX-V-IO, that constraint is ranked lower than *V] $_{\omega}$. All four candidates violate the syllabification constraints,

⁹I don't know if [k], which is part of the input onset, really is resyllabified as a coda. While I call word-final consonant sequences after WFVD 'word-final codas', there is no way at this time to definitively say that they are codas, or just onsets with a silent nucleus (which is what Harris & Gussmann (1998) argue for all world-final consonants in English). I treat them as codas in this dissertation, but acknowledge that this treatment is potentially problematic.

but those syllabification constraints are ranked lower than the WFVD constraints in this stratum.

By ranking the syllabification constraints lower than the mapping and WFVD constraints in the word stratum, the unexpected word-final consonants after WFVD can be explained. When WFVD occurs, strings are no longer being evaluated for well-formed syllables. Therefore, what would be an ill-formed syllable in the stem stratum can be generated as the output of the word stratum, provided it satisfies the mapping and WFVD constraints.

7.3.3 What About Clitics?

There are two major questions regarding how clitics operate in a Stratal OT framework: 1) In what stratum are clitics relevant? 2) How are clitics represented? That is, how are they targeted by constraints so that they attach and linearize correctly?

To address the first question, previous work with special clitics in a Stratal OT framework disagree on where clitics are incorporated into the phonological representation, i.e. in what stratum cliticization occurs. Anderson (2005) views clitics as “phrasal affixes” which attach in the post-lexical stratum, and effects of cliticization are due to Stray Adjunction. Bermúdez-Otero (2006) argues against this view for Catalan, citing that boundaries between host words and clitics are transparent to lexical phonological processes.

In the following examples from §4.4, the underlying CVhR sequence metathesizes to ChVR in (159) but doesn’t metathesize in (160). These examples show that Laryngeal Metathesis occurs across morpheme boundaries, but cannot occur across a word-clitic boundary.

(159) Metathesis: CVhR /kihn/ → ChVR [k^hin]

àà*ki*naalúʔi

aki-hnaal-úʔi

1B-angry:PRS-EXP

‘I am angry.’ (Flemming 1996:23)

(160) No Metathesis: CVhR /kihn/ → CVhR [kiŋ]

gahlgwoó*gihn*óó deekánahltv yidéenalgoóna

kahlkwoó*ki=hn*óó tee-khanahltv yi-tee-iiiii-alkoóna

seven=CN

DST-hill

IRR-DST-1A.DU-arrive.first:IMM

‘We will see who gets to the seven hills first,’ (Montgomery-Anderson 2015:426)

Since Laryngeal Metathesis of the /h/ in the connector clitic =*hnóó* is blocked, clitic attachment cannot happen in the same stratum as Laryngeal Metathesis. Cherokee clitics must also *not* be incorporated into the word in the word stratum because they cannot have their final vowels deleted (WFVD). Therefore, cliticization for Cherokee must occur in the post-lexical stratum (as argued for by Anderson 2005).

While clitic attachment may happen in the post-lexical stratum, if clitics are morphosyntactic words, they should be subject to processes in the stem and word strata just like other nonclitic morphosyntactic words. With a clitic like =*hnóó*, H tone spreads to span two moras, a process that occurs in the stem stratum.

(161)

Input: $[[]_{\omega} \text{hnoo}]_{\omega}$	OCP	MAX-T	DOM BIN	*ASSOC
a. $[[]_{\omega} \text{hnoo}]_{\omega}$			*!	
b. $[[]_{\omega} \text{hnoo}]_{\omega}$				*
c. $[[]_{\omega} \text{hnoo}]_{\omega}$	*!		*	
d. $[[]_{\omega} \text{hnoo}]_{\omega}$		*!		*

In (161), candidate (b) is optimal because the H tone spreads leftward from the final mora¹⁰. If the connector clitic =*hnóó* were not evaluated in this stratum, either it would not surface with a long H tone (which it does), or these tone constraints would still be highly ranked in subsequent strata. Since tonal phonology does not cross word boundaries or the boundary between the host word and the clitic, it is unlikely that the constraints which condition spreading are still highly ranked in the word or post-lexical strata.

Therefore, if clitics are being evaluated for wellformedness in the stem and word strata, then the clitic should map to a prosodic word in the word stratum—the constraint MATCH(WORD, ω) requires morphosyntactic to prosodic faithfulness. Therefore, faithfully representing the morphological structure in the prosodic structure would result in clitics parsed as their own prosodic words.

¹⁰I include the constraint *ASSOCIATE (Yip 2002:79): Do not insert new association lines. This constraint prevents spreading, but if it is ranked lower than DOM BIN, H tones will spread to span two moras, and not be penalized for adding an association line.

(162)

	H ∧ Input: [[] _ω hnoo] _ω	MATCH(WORD,ω)	MAX-V-IO	*V] _ω
☹ a.	H ∧ [[] _ω hnoo] _ω	*!		
☛ b.	H ∧ [hnoo] _ω			*
☛ c.	[hn] _ω		*	

In (162), the unattested candidates (b) and (c) are both generated (since MAX-V-IO and *V]_ω are optionally ranked)¹¹, since the clitic is mapped to a prosodic word. To prevent the mapping of clitics to prosodic words in the word stratum, I appeal to the phonological deficiency of clitics, as proposed by Inkelas (1990). She argues that clitics have a fully satisfied *morphological* subcategorization frame, but an unsatisfied *prosodic* subcategorization frame which selects for a phonological constituent:

(163) [[]_{p---}]_p

In (163), a lexical item selects for some phonological phrase; then, the lexical item plus the phonological phrase forms its own larger phonological phrase. A subcategorization frame is not produced by rule, but instead idiosyncratically defined by lexical items. Therefore, I think it's appropriate to claim that a prosodic subcategorization frame is part of the underlying representation of a clitic (and will be crucial for an OT account of clitics). The underlying form of the question clitic =*ju* is shown in (164).

(164) / [[]_ω ju]_ω /

¹¹The winning, but unattested candidate is shown with a bomb; the attested but eliminated candidate is shown with a sad face.

In this representation of $=ju$, the enclitic selects for a prosodic word host which crucially must be on the left of the clitic. Together, the prosodic word selected and the clitic form a larger prosodic word. The inclusion of a subcategorization frame drives linear positioning of enclitics. The subcategorization frame dictates to which side of a host the clitic will attach; a prosodic subcategorization frame which requires a host to the left cannot be satisfied by attachment to the right side of a host (165).

- (165) a. $[[]_{\omega} \text{cl}]_{\omega} [\text{host}]_{\omega} \longrightarrow [[\text{host word}]_{\omega} \text{cl}]_{\omega}$
 b. $[[]_{\omega} \text{cl}]_{\omega} [\text{host}]_{\omega} \longrightarrow *[\text{cl} [\text{host word}]_{\omega}]_{\omega}$

Including the subcategorization frame in the UR is preferable to previous treatments of clitics in OT because it does not diacritically mark a clitic as something in a class ‘clitic’. Anderson (1996) uses the ranking of constraints like $\text{NON-INITIAL}(\text{cl}_i)$ and $\text{EDGEMOST}(\text{cl}_i, \text{L})$ to capture positioning of second position enclitics. In order for this analysis to work, clitics must be specially marked in the lexicon so that they may be targeted by these constraints. Similarly, Woolford (2001) and Bresnan (2001) use a constraint $*\text{CLITIC}$; again this constraint would require that clitics be marked as such in the grammar. However, I don’t think that this is representative of how clitics are stored and operate in the grammar. If a clitic is a full morphological word, there’s no reason for the grammar to classify it as anything but a *word* for syntactic purposes. If clitics were diacritically marked as ‘clitics’, it is suspicious that clitics have a very limited range of possible phonological forms—clitics are not more than one (or maybe) two syllables. Therefore, I do not think that a $[+\text{clitic}]$ feature (or however it might be formalized) is the best way to build an analysis.


In the analysis presented in this dissertation, the constraints for cliticization do not target a clitic feature, but instead the prosodic properties of clitics already argued for: a “completeness” in terms of morphology and an unsatisfied prosodic subcategorization frame. When representing clitics in the UR, I will include the subcategorization frame.

Therefore, to avoid mapping of clitics to prosodic words in the word stem, I propose an additional highly ranked constraint at the word level: SUBCAT.

- (166) SUBCAT
Satisfy prosodic subcategorization frames to parse into prosodic words.

This constraint requires that prosodic subcategorization frames be satisfied when parsed. SUBCAT is violated if the subcategorization frame is not satisfied because there is not host word, or the host word is on the wrong side. If SUBCAT outranks MATCH(WORD, ω), then the optimal candidate will not be parsed into a prosodic word.

(167)

UR:	$[[]_{\omega} ju]_{\omega}$	SUBCAT	MATCH(WORD, ω)
a.	$[ju]_{\omega}$	*!	
 b.	$[]_{\omega} ju$		*

Candidate (a) has the question clitic =*ju* mapped onto it's own prosodic word. This violates the SUBCAT constraint because the subcategorization from the UR is not satisfied. Candidate (b) is not mapped to a phonological structure, and therefore violates MATCH(WORD, ω). By not mapping to a prosodic word, it does not violate SUBCAT. With the addition of the SUBCAT constraint, clitics will pass from the word stratum to the post-lexical stratum without being mapped to a prosodic constituent. As I will show in the next section, this allows them to combine with host words.

Therefore, a clitic in the 'lexical' stage can undergo tonal processes, but avoid getting mapped to a prosodic word:

(168) a.

Stem Stratum:

Input: $\begin{array}{c} \text{H} \\ \\ [[]_{\omega} \text{hnoo}]_{\omega} \end{array}$	OCP	MAX-T	DOM BIN	*ASSOC
a. $\begin{array}{c} \text{H} \\ \\ [[]_{\omega} \text{hnoo}]_{\omega} \end{array}$			*!	
b. $\begin{array}{c} \text{H} \\ \vdots \\ [[]_{\omega} \text{hnoo}]_{\omega} \end{array}$				*
c. $\begin{array}{c} \text{HH} \\ \\ [[]_{\omega} \text{hnoo}]_{\omega} \end{array}$	*!		*	
d. $\begin{array}{c} \text{HH} \\ \neq \\ [[]_{\omega} \text{hnoo}]_{\omega} \end{array}$		*!		*

b.

Word Stratum:

Input: $\begin{array}{c} \text{H} \\ / \\ [[]_{\omega} \text{hnoo}]_{\omega} \end{array}$	SUBCAT	MATCH(WORD, ω)	MAX-V-IO	*V] $_{\omega}$
a. $\begin{array}{c} \text{H} \\ / \\ [[]_{\omega} \text{hnoo}]_{\omega} \end{array}$		*		
b. $\begin{array}{c} \text{H} \\ / \\ [\text{hnoo}]_{\omega} \end{array}$	*!			*
c. $[\text{hn}]_{\omega}$	*!		*	

In (168), the winning candidate in the stem stratum tableau becomes the input for the word stratum tableau. In the word stratum (168b), the winning candidates from (162) are now eliminated by the SUBCAT constraint. Therefore, candidate (c), which is the hypothetical WFVD form of the clitic =*hnóó*, does not surface. Candidate (a) is not eligible for evaluation by the constraint *V] $_{\omega}$ because it is not parsed; therefore, a clitic will never have its final vowel deleted until WFVD.

7.4 Stage 2: ‘Post-Lexical’ Processes

After processes at both lexical strata have occurred, the word then moves to the next stage, where post-lexical processes occur. The output of the word stratum is now the input for the post-lexical stratum.

(169)

Stage 2: ‘Post-lexical’ Processes
Parse Remaining Material (i.e. clitics) into Prosodic Words
Align Boundary Tone

The post-lexical stratum is the only stratum that has processes that operate over domains larger than the word. Therefore, this stratum is where clitics are folded into the prosodic representation. As with the difference between the stem and word strata, the post-lexical stratum has a different constraint ranking. The two major processes to be discussed in this stratum are cliticization (attachment and linearization), and boundary tone alignment.

7.4.1 Cliticization

In the word stratum, SUBCAT outranks MATCH(WORD, ω), which allows for clitics to remain unmapped to a prosodic word as output, but clitics do not have access to any material that can satisfy their subcategorization frames. In the post-lexical stratum, SUBCAT still outranks MATCH(WORD, ω), but inputs have access to syntactic material, and therefore other prosodic words. Since clitics now are adjacent to prosodic words, their subcategorization frames can be satisfied by attaching to a neighboring prosodic word. This is demonstrated in the following tableau (171).

- (170) *hiigòòwʔéékë* *gúvna*
 hii-kóówʔ-éé(ʔi)=khe kʷvna
 2A-see-NXP=AQ turkey
 ‘Did you see the turkey?’ (DC, August 2017)

(171)

Input:	$[]_{\omega}$ ke + [hiigòòwʔéé] $]_{\omega}$	SUBCAT	MATCH(WORD, ω)
a.	[[hiigòòwʔéé] $]_{\omega}$ ke $]_{\omega}$		*!
b.	[ke $]_{\omega}$ [hiigòòwʔéé $]_{\omega}$	*!	
c.	[$]_{\omega}$ ke [hiigòòwʔéé $]_{\omega}$	*!	*
☞ d.	[[hiigòòwʔéé] $]_{\omega}$ [ke $]_{\omega}$ $]_{\omega}$		

In tableau (171), candidates (a) and (c) violate MATCH(WORD, ω)—neither candidate maps the clitic to its own prosodic word. Candidates (b) and (c) fatally violate SUBCAT because the subcategorization frame of the question clitic =ke is not satisfied. Candidate (d) has no violations: SUBCAT is not violated because =ke forms a prosodic word with a prosodic word host, and MATCH(WORD, ω) is not violated because the morphosyntactic word =ke is also mapped to a prosodic word. At the post-lexical stage, there is no need to think that a clitic doesn't map to its own prosodic word (provided that its subcategorization frame is also satisfied). Functionally, candidates (a) and (d) are indistinct in this form, and the only phonology that targets a prosodic word in this stage is the boundary tone, which I show in §6 can appear on the final vowel of the host word or the clitic. However, the optimality of candidate (d) helps explain why a proclitic and enclitic can form a prosodic word together, as shown below.

In cases like the following (172), the question enclitic =ju attaches to the proclitic determiner na=.

(172) *najù* *achúúj* ...
na=ju achúúj(a) ...
DET=CQ boy

'Did the boy ...?' (DC, March 2018)

(173)

Input:	$[]_{\omega}$ ju + na	$[]_{\omega}$ + $[ach\acute{u}\acute{u}j]_{\omega}$	SUBCAT	MATCH(WORD, ω)
☞?	a.	$[[na]_{\omega} [ju]_{\omega}]_{\omega}$	$[[ach\acute{u}\acute{u}j]_{\omega}]_{\omega}$	
☞?	b.	$[[na]_{\omega} [ach\acute{u}\acute{u}j]_{\omega}]_{\omega}$	$[[ju]_{\omega}]_{\omega}$	

With just SUBCAT and MATCH(WORD, ω), both the attested form (a) and the unattested form (b) are optimal. By parsing the clitics into their own prosodic words and into larger prosodic words, both constraints are satisfied. MATCH(WORD, ω) is satisfied because clitics, which are morphosyntactic words, are mapped to prosodic words. SUBCAT is not violated because the subcategorization frames for =ju and na=, which require a prosodic word to form a larger prosodic word, are satisfied. However, candidate (b) is not attested.

The form $na=ach\acute{u}\acute{u}j(a)=j\ddot{u}$ is generated by the syntax, and phonological and PI theories of 2P clitic linearization predict that it should be grammatical. If an enclitic attaches to the first prosodic word, it should be possible the a proclitic plus a host word form an adequate prosodic word that an enclitic can attach to. Instead, Cherokee enclitic *do not* attach to a proclitic+host prosodic word, but to just the proclitic.

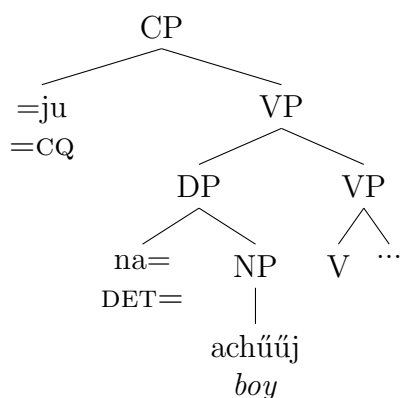
To account for the grammaticality of $na=j\ddot{u} ach\acute{u}\acute{u}j(a)$, an additional constraint, LINEARCORRESPONDANCE, is needed:

(174) LINEARCORRESPONDANCE (LINCORR): (Elfner (2011); Kayne (1994))

Given two syntactic nodes α and β , where α asymmetrically c-commands β , assign one violation mark for every terminal in β which precedes a terminal node α in the output.

In this constraint, syntactic order must be preserved in the phonological representation. If a terminal element moves so that the syntactic precedence is not maintained in the phonological linear order, that is a violation of this constraint. Additionally, the further away a terminal element is moved, the more violations it accrues. The syntax generates the following (simplified) structure for the output $na=j\ddot{u} ach\acute{u}\acute{u}j(a)$ ‘Did the boy ...?’:

(175)



This order of elements generated by the syntax in (175) is the input for the post-lexical constraints SUBCAT, LINCORR and MATCH(WORD, ω).

(176)

Input:	$[\]_{\omega}$ ju + na $[\]_{\omega}$ + [achúúj] $_{\omega}$	SUBCAT	LINCORR	MATCH(WORD, ω)
☞ a.	[[na] $_{\omega}$ [ju] $_{\omega}$] $_{\omega}$ [achúúj] $_{\omega}$		*	
b.	[[na] $_{\omega}$ [achúúj] $_{\omega}$] $_{\omega}$ [ju] $_{\omega}$] $_{\omega}$		**!	

In tableau (176), candidate (b) can be eliminated because moving =*ju* to follow *achúúj* puts =*ju* two positions away from its syntactically generated position at the left edge. Candidate (a), the attested form, only violates LINCORR once; therefore, candidate (a) is optimal.

Returning to the example (170) above, the inclusion of the new constraint LINCORR does not generate an unattested form.

(177)

Input:	$[\]_{\omega}$ ke + [hiigòòwʔéé] $_{\omega}$	SUBCAT	LINCORR	MATCH(WORD, ω)
a.	[[hiigòòwʔéé] $_{\omega}$ ke] $_{\omega}$		*	*!
b.	[ke] $_{\omega}$ [hiigòòwʔéé] $_{\omega}$	*!		
c.	[] $_{\omega}$ ke [hiigòòwʔéé] $_{\omega}$	*!		*
☞ d.	[[hiigòòwʔéé] $_{\omega}$ [ke] $_{\omega}$] $_{\omega}$		*	

Candidates (b) and (c) preserve syntactic precedence in the phonological linear order, but in doing so, they both fatally violate SUBCAT—neither candidate has a host to its left.

Candidates (a) and (d) have violations of LINCORR, but candidate (a) is eliminated because it violates MATCH(WORD, ω).

These tableaux (176-177) show that movement of a clitic from its syntactically generated position is optimal, provided that movement of said clitic satisfies the clitic's subcategorization frame. However, the grammar does not allow the clitic to be moved too far from its syntactic position; this captures the generalizations that Cherokee clitics are 2W clitics, as well as the attachment of enclitics to utterance-initial proclitics.

7.4.2 Boundary Tone Alignment

The post-lexical stratum is also where boundary tone alignment occurs. Theoretically, a boundary tone is some pitch which is realized at the edge of a phonological constituent—a boundary tone is not conditioned by the lexicon or metrical structure, but rather prosodic structure (Pierrehumbert 1980; Pierrehumbert & Beckman 1988; Gussenhoven 2000). Therefore, a boundary tone will be associated with a node—a phonological constituent—and be realized on a constituent-initial or constituent-final TBU, depending the language-specific rules. In Cherokee, the boundary tone appears on word-final syllables, and on the end of every word in an utterance (provided all words are in citation form). A high pitch at the end of every word (in citation form) suggests that the phonological constituent for H% is the prosodic word, rather than some larger phonological constituent.

The positioning of the boundary tone must be in the post-lexical stratum for two reasons. Firstly, the post-lexical stratum is where prosodic processes have been argued to occur (Kiparsky 2015). Secondly, if boundary tone alignment occurred in stage 1, a boundary tone would never appear on the final vowel of a clitic. Instead, the following form would be generated: CV(V)CV̇=CV. In this form, the boundary tone appears on the final vowel of the host word and the clitic vowel has a default L. However, this form is never attested.

Returning to the six minimally distinct patterns of boundary tone placement, I must account for the boundary tone appearing word-finally in (a), (c), and (d), and non-finally in (e). I also must account for the absence of a boundary tone in (b) and (f).

(178)

	NO WFVD	WFVD
NO CLITIC	a. CV(V)C \check{V}	b. CV(V)C
CLITIC, NO UNDERLYING TONE	c. CV(V)CV=C \check{V}	d. CV(V)C=C \check{V}
CLITIC, UNDERLYING TONE	e. CV(V)C \check{V} =C \acute{V}	f. CV(V)C=C \acute{V}

In §6.2, I showed examples like (178a)—a word in citation form will have a boundary tone on its final syllable. However, if the final syllable is deleted by WFVD (178b), the boundary tone does not move to an earlier syllable; instead it does not appear at all (§6.3). In §6.4, I showed that if a toneless clitic is attached to a word, the boundary tone will appear on the clitic, and not on the host word, whether the host word is in citation (178c) or WFVD form (178d). If a clitic with an underlying tone is attached (§6.4.1), the boundary tone appears on the final vowel of the host word, if the host word is in citation form (178e). However, if the host word is in WFVD form, there is no boundary tone (178f).

Words like (178a), (178b), and (178d) are the unproblematic cases; the boundary tone appears on the final TBU of the word, whether that final TBU is part of a stem, affix, or clitic. Examples like (178c) are problematic because the boundary tone is now non-final. Gussenhoven (2000) shows that, while typologically unusual, boundary tones in Roermond Dutch surface non-finally when the final mora has an underlying lexical tone. This is similar to the Cherokee data shown in the previous chapter: the boundary tone appears on a non-final TBU when the final TBU already has a lexical tone associated to it. Examples like (178b) and (178f) are also problematic; if the boundary tone appears on the final TBU, it is unexpected that no boundary tone appears at all.

7.4.2.1 Word-Final Boundary Tone

The presence of the boundary tone in (178a, 178c, 178d) can be accounted for with an alignment constraint that aligns a boundary tone to the rightmost TBU of a prosodic word.

- (179) ALIGN-R(H%, PRWD)¹² (ALIGN-R):
Align a high boundary tone with the right edge of a prosodic word.

For this constraint to be satisfied, a boundary tone must appear on the final vowel of a prosodic word. The following examples show that a boundary tone can appear on a word-final vowel, whether that final vowel is a stem/affix vowel (180a) or a clitic vowel (180b).

- (180) a. [yoónà]_ω
 ‘bear’
 b. [[yoóna]_ω [=jù]_ω]_ω
 ‘bear?’ (DC, March 2018)

A prosodic word can be either the constituent as mapped to a morphosyntactic word (§4.4), or unit that includes a prosodic word plus a clitic, assuming a recursive structure for prosodic words (§5.3.1). The example in (180a) shows that *yoóna* can be a prosodic word on its own, and the boundary tone appears on the final syllable of the word. In (180b), the question enclitic *=ju* has a prosodic subcategorization frame that can be satisfied by attaching to a prosodic word (in this case, *yoóna*). When *=ju* attaches, the host word plus clitic now forms a prosodic word, and the boundary tone appears on the clitic vowel.

Though the boundary tone can appear on right edge of a minimal prosodic word (the host word), the following forms are never attested:

¹²Based on the alignment constraints like ALIGN-R(H, PRWD) from Yip (2002).

- (181) a. *[[yoónà]_ω [=ju]_ω]_ω
 ‘bear?’
 b. *[[yoónà]_ω [=jù]_ω]_ω
 ‘bear?’

In (181a), the boundary appears on the final vowel of *yoónà*, and not on the clitic. In (181b), the boundary tone appears on both the host word (*yoónà*) and the clitic (=jù). Both alignments of the boundary tone in (181) could be possible given the alignment constraint (179). To produce the attested boundary tone distribution, an additional constraint is needed, which requires the boundary tone appear on the rightmost edge:

- (182) RIGHTMOST-H%¹³
 Associate a boundary tone H% to the rightmost prosodic word edge. Incur a violation for every prosodic word between the boundary tone and the rightmost edge.

The inclusion of this constraint prevents both the association of the boundary tone to a non-final prosodic word if another prosodic word is further to the right (181a), as well as the association of multiple boundary tones (181b).

(183)

Input: [[] _ω j u + [y o o n a] _ω		RIGHTMOST-H%	ALIGN-R
$\begin{array}{c} \text{LH} \\ \\ \text{a. } [[\text{y o o n a}]_{\omega} [\text{j u}]_{\omega}]_{\omega} \end{array}$			
$\begin{array}{c} \text{LH} \quad \text{H\%} \\ \quad \\ \text{b. } [[\text{y o o n a}]_{\omega} [\text{j u}]_{\omega}]_{\omega} \end{array}$	*!		
$\begin{array}{c} \text{LH} \quad \text{H\%} \quad \text{H\%} \\ \quad \quad \\ \text{c. } [[\text{y o o n a}]_{\omega} [\text{j u}]_{\omega}]_{\omega} \end{array}$	*!		

¹³As it has been previously used, the constraint RIGHTMOST requires that the right edge of the main stress syllable coincide with the right edge of the prosodic word (Kenstowicz 1996b).

In tableau (183), the boundary tone, H% is aligned to the last mora of a prosodic word—either the clitic (a), the host word (b), or both (c). Both unattested forms in (b) and (c) incur a violation of RIGHTMOST-H% because there is a boundary tone on the edge of a non-final prosodic word.

These two constraints can account for the unproblematic forms: CV(V)C \check{V} , CV(V)CV=C \check{V} , and CV(V)C=C \check{V} . All three have a boundary tone aligned to a prosodic word edge (whether that edge coincides with the host word or the clitic), and the boundary tone is associated to the rightmost edge.

However, these constraints cannot explain for the problematic forms: CV(V)C \check{V} =C \acute{V} , CV(V)C and CV(V)C=C \acute{V} . In the next section (§7.4.2.2), I show how the addition of the previously motivated tone constraint MAX-T accounts for the presence of a non-final boundary tone in forms like CV(V)C \check{V} =C \acute{V} . In §7.4.2.3, I show how the notion of ‘secondary association’ (Pierrehumbert & Beckman 1988) can explain why boundary tones don’t appear on forms like CV(V)C and CV(V)C=C \acute{V} .

7.4.2.2 Non-Final Boundary Tone

As discussed in §6.4.1, forms like CV(V)C \check{V} =C \acute{V} can be explained by the constraint MAX-T. The constraint MAX-T doesn’t allow the boundary tone to surface on a TBU that has an underlying tone. As shown in the following tableau, MAX-T prevents the boundary tone from associating to the clitic vowel¹⁴.

(184) *uktäsgo*
 ukhtha=sko
 seed=Q

‘seed?’ (DC, August 2017)

¹⁴A candidate not in this tableau is one where both the lexical tone and the boundary tone associate to the same TBU. I don’t include this candidate because contour tones on a single TBU are never attested in Cherokee; all rising and falling pitches are observed on long vowels. Therefore, a very highly ranked constraint like NOCONTOUR (Yip 2002) would eliminate such a candidate.

(185)

Input: $\begin{array}{c} L \\ \\ []_{\omega} s k o + [u k h t h a]_{\omega} \end{array}$	MAX-T	RIGHTMOST-H%	ALIGN-R
a. $\begin{array}{c} L H\% \\ \downarrow \\ [[u k h t h a]_{\omega} [s g o]_{\omega}]_{\omega} \end{array}$	*!		
b. $\begin{array}{c} H\% L \\ \\ [[u k h t h a]_{\omega} [s g o]_{\omega}]_{\omega} \end{array}$		*	
c. $\begin{array}{c} H\% L \\ \\ [[u k h t h a]_{\omega} [s g o]_{\omega}]_{\omega} \end{array}$		*	*!

In (185), candidate (a) is eliminated because it violates MAX-T. Candidates (b) and (c) both violate RIGHTMOST-H%, but (c) has a fatal violation of ALIGN-R since the boundary tone is not aligned to the edge of a prosodic word. Therefore, the optimal candidate is candidate (b); this shows that if a boundary tone cannot be aligned to the rightmost edge, it is optimal to align the boundary tone to another available prosodic boundary.

The fact that the boundary tone will still appear on an edge, even when pushed into the word by a lexical tone, is further demonstrated with the example in (186) and tableau in (187).

(186) *wahyǎhnóó*
 wahya=hnóó
 wahya=CN

‘(And the) wolf’ (Montgomery-Anderson 2015)

(187)

Input: $\begin{array}{c} \text{H} \\ \nearrow \\ []_{\omega} \text{h n o o} + [\text{w a h y a}]_{\omega} \end{array}$	MAX-T	RIGHTMOST-H%	ALIGN-R
a. $\begin{array}{c} \text{H H}\% \\ \nearrow \searrow \\ [\text{w a h y a}]_{\omega} [\text{h n o o}]_{\omega} \end{array}$	*!		
b. $\begin{array}{c} \text{H}\% \text{ H} \\ \searrow \nearrow \\ [\text{w a h y a}]_{\omega} [\text{h n o o}]_{\omega} \end{array}$	*!		*
c. $\begin{array}{c} \text{H}\% \quad \text{H} \\ \quad \nearrow \\ [\text{w a h y a}]_{\omega} [\text{h n o o}]_{\omega} \end{array}$			*

In (187), the boundary tone doesn't associate to the **final** mora of the connector clitic =*hnóó* (candidate a); this candidate is eliminated by MAX-T. The boundary tone also doesn't associate to the **first** mora of =*hnóó*, violating both MAX-T and ALIGN-R. Candidate (c) aligns a mora to a prosodic word edge, but it doesn't associate it to the rightmost edge, violating RIGHTMOST-H%. However, since it doesn't associate to a mora that already has tone, it is the optimal candidate. Again, this tableau shows that if the rightmost edge has tone, and is therefore unavailable, the boundary tone appears on the inner prosodic word edge.

However, having MAX-T highly ranked in this stratum cannot explain why the boundary tone doesn't appear at all on the forms, CV(V)C and CV(V)C=CV́. In the next section, I discuss 'secondary association' and how that allows me to account for the forms without a boundary tone.

7.4.2.3 Alignment vs. Association of Boundary Tones

The function of a boundary tone is to mark a phonological boundary, so it is typologically and theoretically odd that Cherokee boundary tones do not always appear where they are expected to appear. A simple definition of boundary tones is that they "are produced at the phonetic boundary of the node with which they are associated" (Pierrehumbert

& Beckman 1988:127). Therefore, there are two possibilities to explain why CV(V)C and CV(V)C=C[́] don't have a boundary tone. One possibility is that the boundary tone is deleted by WFVD. For this to be the case, boundary tone alignment would have to occur in the stem or word strata. However, if boundary tone alignment happened in one of these strata, forms like the unattested *yoónàju* and *yoónàjù* 'bear?' would be generated.

The second possibility is that the boundary tone is aligned to the edge of the prosodic word, but for some other reason, it is not pronounced. This second possibility is the one I will expand upon in this section.

Gussenhoven (2000) argues that boundary tones can be pushed into a word by lexical tones. He argues that "satisfaction of an alignment constraint for a tone can be achieved purely by the edgemoat location of the tone's target and not necessarily by the association of the tone to the edgemoat mora" (Gussenhoven 2000:149). Therefore, a boundary tone does not have to associate to an edgemoat position to still satisfy an alignment constraint.

In Cherokee, the effect of a boundary tone appearing non-finally is captured with RIGHTMOST-H%, ALIGN-R and MAX-T. The constraint MAX-T prevents the boundary tone from associating to a TBU that already has a tone (on a clitic with underlying tone), so the boundary tone appears on the final mora of the host word. When the boundary tone appears on the host word, the ALIGN-R constraint is still satisfied, even if the RIGHTMOST-H% constraint is violated. Therefore, non-final boundary tones in Cherokee align to a non-final edge position, and associate to the mora on that edge.

However, the difference between alignment and association can be useful to account for the absence of a boundary tone for CV(V)C and CV(V)C=C[́]. Pierrehumbert & Beckman (1988) claims that when a prosodic tone associates, it is doing so by 'secondary association', or simultaneous association of a tone to a prosodic node (higher constituent) and a TBU (lower constituent). The 'alignment' of a boundary tone is association to a higher constituent

(per Gussenhoven 2000), while ‘association’ of a boundary tone is association to a tone-bearing mora or syllable.

For example, I look at two words: *kóóg*, the WFVD form of *kóógà* ‘crow’, and *goog*, the WFVD form of *googi* ‘summer’ (DC, August 2017). At the stem level, the UR /*khooka*/ has a H tone aligned to the second mora of the first syllable, and H tone spreads to satisfy DOM BIN. The UR /*kooki*/ has no underlying tones.

- (188) a. $\begin{array}{c} \text{H} \\ \vdots \\ \text{hooka} \end{array}$
 b. *kooki*

This output [khóóka] becomes the input for the word stem. In the word stem, the morphological word maps to a phonological word and WFVD occurs. The following form in (189) is the output of the word stem:

- (189) a. $\begin{array}{c} \text{H} \\ \nearrow \\ \text{hook}_\omega \end{array}$
 b. $\begin{array}{c} \text{hook}_\omega \end{array}$

Once it reaches the post-lexical stratum, a boundary tone is aligned to the right edge of the prosodic word:

- (190) a. $\begin{array}{c} \text{H} \quad \text{H}^\% \\ \nearrow \quad \nearrow \\ \text{hook}_\omega \end{array}$
 b. $\begin{array}{c} \text{H}^\% \\ \nearrow \\ \text{hook}_\omega \end{array}$

The boundary tone aligns to the right edge, but it cannot associate to either the consonant, or the preceding vowel. The following constraint captures this generalization:

- (191) TBU=V (Downing 2005:203):
Associate a tone to a [-consonantal] mora.

I also propose the following constraint, which requires the boundary tone to associate to the lower constituent:

- (192) ASSOCIATE-H% (ASSOC-H%):
Associate a boundary tone to a TBU.

With the constraint TBU=V, a tone cannot associate to a consonant. This constraint must be very highly ranked, because a tone is never associated to a consonant. The constraints ALIGN-R and ASSOCIATE-H% capture the idea of ‘secondary association’. The ALIGN-R constraint captures the idea of association to a higher constituent, or alignment of a prosodic tone to a prosodic node, and the ASSOCIATE-H% constraint captures the association of a prosodic tone to a lower constituent, or association of a prosodic tone to a mora.

The following tableaux (193-194) shows the constraint ranking including this new constraint with MAX-T and ALIGN-R¹⁵:

¹⁵The RIGHTMOST-H% constraint is excluded in these tableaux for sake of clarity; all candidates satisfy RIGHTMOST-H% because the H% is associated to the prosodic word node. Satisfaction of RIGHTMOST-H% does not require ‘secondary association’ to the lower constituent.

(193)

Input: [khook] _ω	TBU=V	MAX-T	ALIGN-R	ASSOC-H%
a. $\begin{array}{c} \text{H} \\ \nearrow \\ \text{[khook]}_{\omega} \end{array}$	*!			
b. $\begin{array}{c} \text{H} \text{ H}\% \\ \nearrow \\ \text{[khook]}_{\omega} \end{array}$				*
c. $\begin{array}{c} \text{H} \text{ H}\% \\ \nearrow \\ \text{[khook]}_{\omega} \end{array}$		*!	*	
d. $\begin{array}{c} \text{H} \text{ H}\% \\ \nearrow \\ \text{[khook]}_{\omega} \end{array}$	*!	*	*	

Candidate (b) violates ASSOCIATE-H%, but it is the optimal candidate because it does not violate the higher ranked constraints on tone: TBU=V, and MAX-T. Candidate (a) and (d) are eliminated because association to a consonant violates TBU=V. Candidates (c) and (d) both violate MAX-T, due to association to the second mora of the first syllable, which already has a tone.

The following tableau (194) shows that association to a mora earlier in the word is still not optimal, even when the word does not have underlying tone.

(194)

Input: [kook] _ω	TBU=V	ALIGN-R	ASSOC-H%
a. $\begin{array}{c} \text{H}\% \\ / \\ [\text{kook}]_{\omega} \end{array}$	*!		*
b. $\begin{array}{c} \text{H}\% \\ \text{☞} [\text{kook}]_{\omega} \end{array}$			*
c. $\begin{array}{c} \text{H}\% \\ / \\ [\text{kook}]_{\omega} \end{array}$		*!	
d. $\begin{array}{c} \text{H}\% \\ / \\ [\text{kook}]_{\omega} \end{array}$	*!		

Tableau (194) shows that again (a) and (d) are eliminated because a tone cannot associate to a consonant (TBU=V). Candidate (c) violates the alignment constraint, by aligning and associating the boundary tone to a non-edge segment. Candidate (b) doesn't associate the tone to any TBU, violating ASSOCIATE-H%, but it satisfies the higher ranked constraints: TBU=V because it doesn't associate a tone to a consonant and ALIGN-R because it aligns a boundary tone to the edge of the prosodic word. Alignment of a boundary tone to a prosodic word edge satisfies ALIGN-R, even if the boundary tone isn't associated to the lower constituent. Therefore, the outputs of the post-lexical stratum for *goog* 'summer' and *kóóga* 'crow' do not have boundary tones.

This ranking of constraints also still works for forms like CV(V)C=CV': when a clitic with tone is attached to a host word in WFVD form, no boundary tone appears.

(195) *dakssgo*
 dakhs=sko
 terrapin=Q

'terrapiin?' (DC, August 2017)

(196)

Input: $\begin{array}{c} L \\ \\ []_{\omega} s k o + [d a k h s]_{\omega} \end{array}$	TBU=V	MAX-T	RIGHTMOST-H%	ALIGN-R	ASSOCIATE-H%
a. $\begin{array}{c} L H\% \\ \neq \\ [[d a k h s]_{\omega} s k o]_{\omega} \end{array}$		*!			
b. $\begin{array}{c} L H\% \\ \\ [[d a k h s]_{\omega} s k o]_{\omega} \end{array}$			*		*
c. $\begin{array}{c} H\% \quad L \\ \quad \\ [[d a k h s]_{\omega} s k o]_{\omega} \end{array}$	*!		*		*
d. $\begin{array}{c} H\% \quad L \\ \quad \\ [[d a k h s]_{\omega} s k o]_{\omega} \end{array}$			*	*!***	

In tableau (196) candidate (a) is not well-formed, because it has a violation of MAX-T. Candidate (c) is eliminated due to association to a consonant, and candidate (d) violates RIGHTMOST-H% and has multiple violations of ALIGN-R. Candidate (b) is optimal because it doesn't associate to a consonant or associate to a TBU with a tone in the input. Candidate (b) also satisfies ALIGN-R by aligning the boundary tone to the right edge of a prosodic word. These tableaux (193), (194), and (196) show that it is preferable to *not* associate a boundary tone, than to associate it to a non-edge position.

The addition of TBU=V and ASSOCIATE-H% can explain why the boundary tone doesn't associate to consonant-final WFVD forms. However, when WFVD results in vowel-final forms, the boundary tone should associate to that vowel, based on the constraints as they stand now.

(197) *go*
ko(?)i

'grease' (JR, DC, August 2017)

(198)

Input:	$[k\text{ɔ}]_{\omega}$	TBU=V	ALIGN-R	ASSOC-H%
⊙	a. $\begin{array}{c} \text{H}\% \\ / \\ [k\text{ɔ}]_{\omega} \end{array}$			
⊖	b. $\begin{array}{c} \text{H}\% \\ [k\text{ɔ}]_{\omega} \end{array}$			*!
	c. $\begin{array}{c} \text{H}\% \\ \backslash \\ [k\text{ɔ}]_{\omega} \end{array}$		*!	

In (198), the input is the WFVD form of *goʔi*; in this input, both the word-final vowel and final laryngeal have been deleted prior to the post-lexical stratum. With this input, the attested form (b) has a fatal violation of ASSOCIATE-H%, while the unattested candidate (a) is optimal.

In §4.4.1, I posit the idea that laryngeals have undergone lenition over time, which surfaces in contemporary Cherokee as deletion. If laryngeals are not deleted due to WFVD, but instead are realized as phonetic features on a preceding vowel (which is now interpreted as deletion in contemporary Cherokee), then the deletion of a laryngeal consonant would not happen in the word stem (with WFVD), but in the final stage of my analysis: the phonetics/phonology interface. If the laryngeal is not deleted until the phonetics/phonology interface, then the laryngeal consonant would still be in the input in the post-lexical stratum. A tableau with this input is shown in (199).

(199)

Input: [k o ʔ] _ω	TBU=V	ALIGN-R	ASSOC-H%
a. $\begin{array}{c} \text{H\%} \\ / \\ [\text{k o ʔ}]_{\omega} \end{array}$	*!		
b. $\begin{array}{c} \text{H\%} \\ \text{☞} [\text{k o ʔ}]_{\omega} \end{array}$			*
c. $\begin{array}{c} \text{H\%} \\ \\ [\text{k o ʔ}]_{\omega} \end{array}$		*!	

Candidate (a) is eliminated because the H% associates to a consonant. Candidate (c) associates the boundary tone to a mora, satisfying TBU=V and ASSOC-H%, but it is not aligned at the right edge, and incurs a fatal violation of ALIGN-R. Candidate (b) is optimal because it satisfies both ALIGN-R by aligning a boundary tone to a prosodic word edge, and TBU=V by not associating to a consonant. Therefore, by including the laryngeal in the post-lexical stratum input, the reason why there is no boundary tone on *go* ‘grease’ is the same reason as to why there is no boundary tone on *goog* ‘summer’, *kóóg* ‘crow’ and *daks=sgo* ‘terrapiin?’.

There is potentially other corroborating evidence for this view of laryngeals. First of all, when WFVD results in a word-final *Ch* sequence, the /h/ appears on the consonant as aspiration. Therefore, if word-final laryngeals are not realized as full consonants following another consonant, they could also not be realized as full consonants following a vowel. Final vowels in Cherokee are also nasalized. It could be the case that the new-final vowel (after WFVD) does not have this nasalization, indicating that a word-final laryngeal is not deleted until after the word-final nasalization process applies. However, a preliminary look at the data is inconclusive, and Uchihara (2013) claims that word-final nasalization can spread to a preceding syllable, if there is an intervening laryngeal.

However, despite lacking clear independent motivation, keeping a laryngeal until the phonetics/phonology interface can account for both the overall process of WFVD and boundary tone placement after WFVD, so it is the best analysis at this time.

7.5 Stage 3: Clean up

The final stage in my analysis of Cherokee phonology is the ‘clean up’ stage. This stage represents the phonetics/phonology interface. This is the point at which toneless TBUs gain a L tonal target (see §3.2). All lexical and post-lexical processes have happened before this point, and all that’s left is to give phonetic features to phonological features. At this stage, I also expect that word-medial /h/s in clusters to combine with their neighboring segments (producing surface aspiration and voiceless resonants), and that deletion of word-final laryngeals after WFVD occurs (see §7.4.2.3).

7.6 What are the Advantages of a Stratal OT Analysis?

Stratal OT has several advantages over both the standard implementation of OT, Parallel OT, as well as other stratified frameworks, such as LPM, Cophonology and Morpheme-Specific Phonology. Parallel OT evaluates all candidates at once, and selects an optimal candidate which violates the fewest and lowest ranked constraints. Under this approach, several aspects of Cherokee phonology would be difficult to explain. First of all, Parallel OT would have a hard time accounting for distribution of word-medial and word-final codas. Words in WFVD form show a much wider range of codas than what is legal word-medially. In order to capture what looks like two systems of syllabification in Parallel OT, constraints would have to be constructed which evaluate word-medial syllables separately from word-final syllables. In Stratal OT, no such distinction is necessary: if syllable wellformedness constraints are evaluated before WFVD produces illicit word-final consonants, those wellformedness constraints do not have to specify what part of the word is under evaluation.

Secondly, Parallel OT also has a harder time accounting for clitic phonology. For certain phonological phenomena, the clitic appears to be part of the word (boundary tone), but for others (WFVD, Laryngeal Metathesis, H tone spread), the clitic is not part of the word. To capture the exclusion of the clitic for these processes, it would be necessary to specify in the constraints that the clitic is not part of the domain of WFVD, etc. This kind of analysis in Parallel OT is bulky, and not really in the spirit of the universality of constraints. However, built into the Stratal OT framework (as well as other serial frameworks) is the notion that domains of different sizes are evaluated in different strata, and in those different strata, constraint rankings differ. Clitics don't participate in Laryngeal Metathesis, because when they attach in the post-lexical stratum, after Laryngeal Metathesis has occurred in the stem stratum. Therefore, even if the addition of a clitic creates a triggering environment (CVhR), Laryngeal Metathesis does not cross the boundary between a host word and the clitic.

Therefore, Parallel OT cannot account for the patterns seen in Cherokee. I now turn to other serial theories—LPM, Cophonology and Morpheme-Specific Phonology—to show that Stratal OT is the best theory for Cherokee. A serial analysis like LPM does not have the shortcomings that Parallel OT does. LPM assumes that rules apply to domains of different sizes, so it is not difficult to explain why clitics participate in some processes, but not others. If the clitic is attached after a level where the process has applied, the clitic won't undergo that process. However, since LPM is a rule-based framework, it would have a hard time accounting for the boundary tone distribution. If the rule which aligns a boundary tone to the right edge of the word applies (and an autosegmental representation of tone is assumed), there is no reason that a boundary tone shouldn't appear on words in WFVD form. Additionally, SPE-style rules cannot account for the boundary tone appearing on a non-final prosodic word edge if the final prosodic word edge is unavailable. By using a serial OT framework, the boundary tone distribution can be explained by several competing

demands on wellformedness. The boundary tone in Cherokee appears word-finally, unless there is already a tone on the word-final segment; in that case, the boundary tone moves to another boundary, thus satisfying the demand in the grammar that the boundary tone appear on an edge. When the boundary tone doesn't appear, it is due to the interaction of a constraint which require the boundary tone be aligned to an edge-final segment, and a constraint that requires a boundary tone be associated to a mora. The boundary tone distribution therefore shows that surface form which satisfies the phonological demands of the grammar isn't always a form with a boundary tone.

Constraint-based serial frameworks like Cophonology and Morpheme-Specific Phonology rely on the notion that morphemes sometimes behave in ways that cannot be explained with only phonology: “one morpheme undergoes or triggers a process while another morpheme fails to undergo or trigger that process, even though the two are in all relevant respects indistinguishable” (Pater 2010). In these frameworks, morphemes are lexically marked for certain constraints or constraint rankings, therefore blocking or triggering exceptional phonological changes. While these frameworks could treat clitics as lexically marked for certain constraints, I think that Stratal OT better captures the patterns seen in Cherokee. Instead of lexically marking clitics for phonological constraints, clitics are evaluated by the same constraints as nonclitic words in Stratal OT, which fits with the idea that clitics are words, not bound morphemes. Stratal OT also targets phonological domains instead of morphemes; therefore, the boundary tone alignment targets phonological words that are and are not internally complex because the boundary tone is aligned in the final stratum. If the boundary tone appears on both stem-final and clitic-final vowels, it is harder to argue that the clitic introduces its own grammar. Additionally, the domain where WFVD occurs is separated from the boundary tone alignment not by a grammar associated with a morph, but by the strata inherent to the framework.

Therefore, Stratal OT is best-equipped to account for the patterns of right edge phenomena in Cherokee. By separating the phonology into levels, cases of bleeding and domain-specific phonology can be explained. Additionally, by using a serial OT framework, the optimality of words without boundary tones or non-final boundary tones is easily explained.

In the following section, I walk through how the analysis works for the three types of boundary tone alignment: alignment to a word-final edge, alignment to a non-final edge, and absence of a boundary tone.

7.6.1 Boundary Tones Placement

In this section, I show how Stratal OT can correctly generate forms with and without a boundary tone. I also show that this framework can generate both word-final and non-final boundary tones. To show this, I use the forms $CV(V)C=C\check{V}$ (word-final boundary tone), $CV(V)C\check{V}=C\acute{V}$ (non-final boundary tone), and $CV(V)C=C\acute{V}$ (no boundary tone).

7.6.1.1 Stratal OT and Final Boundary Tones

Final boundary tones appear on the following forms: $CV(V)C\check{V}$, $CV(V)CV=C\check{V}$, and $CV(V)C=C\check{V}$. To demonstrate how Stratal OT handles word-final boundary tones, I will use an example like $CV(V)C=C\check{V}$, the first word in the following example (200).

- (200) ***úúnehltánééjü*** *juhnoogúsdíʔi*
 úú-nehlt-ahn-éé(ʔi)=ju
 3B-try-PFT-NXP=CQ

‘Did he try to sing?’ (DC, June 2017)

The first word in (200) is a host word in WFVD form with the question clitic =*ju* attached; the boundary tone appears on the clitic vowel. In Stratal OT, at the stem and word strata, the host word and clitic are evaluated separately. In the following tableau (201), the host word is evaluated for syllable and tone wellformedness.

(201)

Stem Stratum:

Input: $\begin{array}{cccc} \text{H} & \text{L} & \text{H} & \text{H} \\ & & & \\ \text{uu} & \text{-neh} & \text{l t} & \text{-ahn-ee?i} \end{array}$	SSP	*hC	IDENT-IO[s.g.]	MAX-T	DOM BIN
a. $\begin{array}{cccc} \text{H} & \text{L} & \text{H} & \text{H} \\ \nearrow & & & \nearrow \\ \text{uu} & \text{.ne} & \text{.}^{\text{h}}\text{l t a} & \text{.hnee. ?i} \end{array}$	*!	*	*		*
b. $\begin{array}{cccc} \text{H} & \text{L} & \text{H} & \text{H} \\ \nearrow & & & \nearrow \\ \text{uu} & \text{.neh} & \text{.l t a} & \text{.hnee. ?i} \end{array}$	*!	*	*		*
c. $\begin{array}{cccc} \text{H} & \text{L} & \text{H} & \text{H} \\ \nearrow & & & \nearrow \\ \text{uu} & \text{.ne}^{\text{h}}\text{l} & \text{.t a} & \text{.hnee. ?i} \end{array}$		*!	*		*
d. $\begin{array}{cccc} \text{H} & \text{L} & \text{H} & \text{H} \\ \nearrow & & & \nearrow \\ \text{uu} & \text{.ne}^{\text{h}}\text{l} & \text{.t}^{\text{h}}\text{a} & \text{.nee. ?i} \end{array}$			**		*
e. $\begin{array}{cccc} \text{H} & \text{L} & \text{H} & \text{H} \\ \nearrow & & & \nearrow \\ \text{uu} & \text{.ne}^{\text{h}}\text{l} & \text{.t}^{\text{h}}\text{a} & \text{.nee. ?i} \end{array}$			**	*!	
f. $\begin{array}{cccc} \text{H} & \text{L} & \text{H} & \text{H} \\ & & & \\ \text{uu} & \text{.ne}^{\text{h}}\text{l} & \text{.t}^{\text{h}}\text{a} & \text{.nee. ?i} \end{array}$			**		**!*

In (201), the candidates are differentiated by either the syllabification of the *lhtah* word-medial sequence (candidates a-d), or spreading of H tones (candidates d-f). Candidate (d) is optimal because it avoids *hC sequences by realizing /h/ as a feature on /l/, due to proximity, and /t/, due to Laryngeal Metathesis: /tahn/ → [t^h a.n]. In candidate (d), only the first and final H tone spreads; if the middle H tone spread, it would violate Max-T (as seen in candidate e). Therefore, this tableau shows that these constraints produce the attested segment order, syllabification, and pattern of spreading. As the output of the stem stratum, candidate (d) becomes the input of the word stratum (202), where it is evaluated by highly ranked mapping and WFVD constraints.

(202)

Word Stratum:

Input:	MATCH(WORD, ω)	*V] ω	MAX-V-IO
$\begin{array}{cc} \text{H} & \text{L} \\ \nearrow & \\ \text{uu} & \cdot \text{ne}^{\text{h}} \end{array} \text{ l} \cdot \begin{array}{cc} \text{H} & \text{H} \\ & \nearrow \\ \text{t}^{\text{h}} & \text{a} \cdot \text{nee} \end{array} \cdot \text{? i}$			
$\text{a. } \begin{array}{cc} \text{H} & \text{L} \\ \nearrow & \\ [\text{uu} & \cdot \text{ne}^{\text{h}} \end{array} \text{ l} \cdot \begin{array}{cc} \text{H} & \text{H} \\ & \nearrow \\ \text{t}^{\text{h}} & \text{a} \cdot \text{nee} \end{array} \cdot \text{? i}]_{\omega}$		*!	
$\text{b. } \begin{array}{cc} \text{H} & \text{L} \\ \nearrow & \\ [\text{uu} & \cdot \text{ne}^{\text{h}} \end{array} \text{ l} \cdot \begin{array}{cc} \text{H} & \text{H} \\ & \nearrow \\ \text{t}^{\text{h}} & \text{a} \cdot \text{nee} \end{array} \cdot \text{?}]_{\omega}$			*
$\text{c. } \begin{array}{cc} \text{H} & \text{L} \\ \nearrow & \\ \text{uu} & \cdot \text{ne}^{\text{h}} \end{array} \text{ l} \cdot \begin{array}{cc} \text{H} & \text{H} \\ & \nearrow \\ \text{t}^{\text{h}} & \text{a} \cdot \text{nee} \end{array} \cdot \text{? i}$	*!		

The tableau in (202) shows the optional constraint ranking that produces WFVD: *V] ω >> MAX-V-IO. Candidates (a) and (b) are both possible because they map to a prosodic word (unlike candidate c), but candidate (b) wins when the WFVD markedness constraint outranks the faithfulness constraint in this optional ranking.

To generate the form *úúnehltánéjù* in (200), the question clitic =*ju* must also be evaluated by the constraint rankings at the stem and word strata. Since =*ju* is only one syllable and has no tone, the input of the stem stratum is / [[] ω ju] ω / and the output of the stem stratum (and therefore input of the word stratum) is [[] ω ju] ω (203).

(203)

Word Stratum:

Input:	SUBCAT	MATCH(WORD, ω)	*V] ω	MAX-V-IO
a. [ju] ω	*!		*	
b. [j] ω	*!			*
c. [[] ω ju] ω		*		

In the word stratum, the clitic cannot map to a prosodic word because doing so would violate SUBCAT (candidates a and b). Candidate (c) violates MATCH(WORD, ω), but not SUBCAT. The output of the word stratum for both the host word and the clitic becomes

the input for the post-lexical stratum. In the tableau below (204), the input is $[[]_{\omega} ju]_{\omega} + [úú.nelh.thá.néé.ʔ]_{\omega}$.

(204)

Post-lexical Stratum:

Input: $[[]_{\omega} ju]_{\omega} + [úú.nelh.thá.néé.ʔ]_{\omega}$	SUBCAT	MATCH(WORD, ω)	TBU=V	RIGHTMOST-H%	*ASSOC
a. $[[[\begin{array}{ccccc} & H & L & & H & H & & H\% \\ & \swarrow & & & & \swarrow & & / \\ & & & & & & & \end{array}]_{\omega} . ne^h l . t^h a . nee . ʔ]_{\omega} [ju]_{\omega}]_{\omega}$					*
b. $[[[\begin{array}{ccccc} & H & L & & H & H & & H\% \\ & \swarrow & & & & \swarrow & & / \\ & & & & & & & \end{array}]_{\omega} . ne^h l . t^h a . nee . ʔ]_{\omega} [ju]_{\omega}]_{\omega}$				*!	
c. $[[[\begin{array}{ccccc} & H & L & & H & H & & H\% \\ & \swarrow & & & & \swarrow & & / \\ & & & & & & & \end{array}]_{\omega} . ne^h l . t^h a . nee . ʔ]_{\omega} [ju]_{\omega}]_{\omega}$			*!	*	*
d. $[[\begin{array}{ccccc} & H & L & & H & H & & H\% \\ & \swarrow & & & & \swarrow & & / \\ & & & & & & & \end{array}]_{\omega} . ne^h l . t^h a . nee . ʔ]_{\omega} [ju]_{\omega}]_{\omega}$	*!		*		*
e. $[[\begin{array}{ccccc} & H\% & & & H & L & & H & H \\ & & & & \swarrow & & & & \swarrow \\ & & & & & & & & \end{array}]_{\omega} . ne^h l . t^h a . nee . ʔ]_{\omega} [ju]_{\omega}]_{\omega}$	*!			*	*
f. $[[\begin{array}{ccccc} & H & L & & H & H & & H\% \\ & \swarrow & & & & \swarrow & & / \\ & & & & & & & \end{array}]_{\omega} . ne^h l . t^h a . nee . ʔ]_{\omega} [ju]_{\omega}]_{\omega}$		*!	*		*

Candidate (a) is optimal because 1) the subcategorization frame of the clitic is satisfied by moving to the right of the host word and forming a prosodic word with the host word, and 2) the boundary tone aligns to the edge of the rightmost prosodic word domain, on the vowel of the clitic =*ju*. The output of the post-lexical stratum goes to the phonetics/phonology interface, where the host word-final glottal stop is deleted, or becomes part of the preceding vowel (§7.5). Therefore, the entire derivation can be summarized as follows:

(205)

Stem Stratum	Input: / [[] _ω ju] _ω / Output: [[] _ω ju] _ω	Input: / uú-nehlt-áhn-eéʔi / Output: úú.ne ^{h1} .t ^h á.néé.ʔi
Word Stratum	Input: [[] _ω ju] _ω Output: [[] _ω ju] _ω	Input: úú.ne ^{h1} .t ^h á.néé.ʔi Output: [úú.ne ^{h1} .t ^h á.néé.ʔ] _ω
Post-lexical Stratum	Input: [[] _ω ju] _ω + [úú.ne ^{h1} .t ^h á.néé.ʔ] _ω Output: [[úú.ne ^{h1} .t ^h á.néé.ʔ] _ω jü] _ω	
Phonetics/Phonology Interface	Input: [[úú.ne ^{h1} .t ^h á.néé.ʔ] _ω jü] _ω Output: úú.ne ^{h1} t ^h ánééjü (written orthographically as <i>úúnehltánééjü</i>)	

In the stem stratum, syllabification, tone spreading and Laryngeal metathesis occur, and in the word stratum, prosodic word mapping and WFVD occur. At the post-lexical stratum, forms can “see” neighboring forms in the syntax, and so the enclitic =*ju* combines with the first prosodic word to its right in the syntactic structure. It is also in the post-lexical stratum that a boundary tone is aligned to the rightmost prosodic word boundary. The output of the post-lexical stratum goes to the phonetics/phonology interface, where stray laryngeals either combine with preceding segments (to form aspirated obstruents or voiceless resonants).

In the next section, I show that these constraints will still also generate non-final boundary tones.

7.6.1.2 Stratal OT and Non-Final Boundary Tones

The form CV(V)C^{̈́}=C[́] has a non-final boundary tone. Some clitic with tone (either H or L) attaches to a host word in citation form, and the boundary tone appears on the final vowel of the host word, instead of on the clitic. The example in (206) shows this pattern:

- (206) *jajihnoó* naʔv èèdóóʔv
 ca-ci=hnóó naʔv èètóóha
 2B-mother near here

‘Is your mother near?’ (DC, June 2017)

As with the example in the previous section, the host word and the clitic are evaluated separately in the stem and word strata. In the stem stratum, the word is syllabified, but the word *jaji* is underlyingly toneless, so no tone spreading occurs. Therefore, the output of the stem stratum is *ca.ci*. In the word stratum, the output of the stem stratum is mapped to a prosodic word. For this example (207), the WFVD are ranked $\text{MAX-V-IO} \gg *V]_{\omega}$.

(207)

Word Stratum:

Input:	ca.ci	MATCH(WORD, ω)	MAX-V-IO	$*V]_{\omega}$
☞ a.	[ca.ci] $_{\omega}$			*
b.	[ca.c] $_{\omega}$		*!	
c.	ca.ci	*!		

By having the optional ranking $\text{MAX-V-IO} \gg *V]_{\omega}$, the final vowel is not deleted in this stratum; the output of the word stratum includes the final vowel.

In the stem stratum, the high tone on the connector clitic =*hnóó* spreads to the preceding mora. In the word stratum, the clitic is not mapped to a prosodic word, and does not undergo WFVD:

(208) a.

Stem Stratum:

Input: $\begin{array}{c} \text{H} \\ \\ [[]_{\omega} \text{hnoo}]_{\omega} \end{array}$	OCP	MAX-T	DOM BIN	*ASSOC
a. $\begin{array}{c} \text{H} \\ \\ [[]_{\omega} \text{hnoo}]_{\omega} \end{array}$			*!	
b. $\begin{array}{c} \text{H} \\ \vdots \\ \\ [[]_{\omega} \text{hnoo}]_{\omega} \end{array}$				*
c. $\begin{array}{c} \text{HH} \\ \\ [[]_{\omega} \text{hnoo}]_{\omega} \end{array}$	*!		*	
d. $\begin{array}{c} \text{HH} \\ \neq \\ [[]_{\omega} \text{hnoo}]_{\omega} \end{array}$		*!		*

b.

Word Stratum:

Input: $\begin{array}{c} \text{H} \\ \nearrow \\ [[]_{\omega} \text{hnoo}]_{\omega} \end{array}$	SUBCAT	MATCH(WORD, ω)	MAX-V-IO	*V] $_{\omega}$
a. $\begin{array}{c} \text{H} \\ \nearrow \\ [[]_{\omega} \text{hnoo}]_{\omega} \end{array}$		*		
b. $\begin{array}{c} \text{H} \\ \nearrow \\ [\text{hnoo}]_{\omega} \end{array}$	*!			*
c. $[\text{hn}]_{\omega}$	*!		*	

In the post-lexical stem, the input includes both the clitic and the syntactic material to its right: $[[]_{\omega} \text{hnóo}]_{\omega} + [\text{ca.ci}]_{\omega}$.

(209)

Post-lexical Stratum:

Input: $\begin{array}{c} \text{H} \\ \nearrow \\ []_{\omega} \text{hnoo}]_{\omega} + [\text{ca} . \text{ci}]_{\omega} \end{array}$	SUBCAT	MATCH(WORD, ω)	MAX-T	RIGHTMOST-H%	ASSOC-H%
a. $\begin{array}{c} \text{HH}\% \\ \nearrow \\ [[\text{ca} . \text{ci}]_{\omega} [\text{hnoo}]_{\omega} \end{array}$			*!		
b. $\begin{array}{c} \text{HH}\% \\ \nearrow \\ [[\text{ca} . \text{ci}]_{\omega} [\text{hnoo}]_{\omega} \end{array}$				*	*!
c. $\begin{array}{c} \text{H}\% \quad \text{H} \\ \quad \nearrow \\ [[\text{ca} . \text{ci}]_{\omega} [\text{hnoo}]_{\omega} \end{array}$				*	
d. $\begin{array}{c} \text{H} \quad \text{H}\% \\ \nearrow \quad \nearrow \\ [\text{hnoo}]_{\omega} [\text{ca} . \text{ci}]_{\omega} \end{array}$	*!				
e. $\begin{array}{c} \text{H} \quad \text{H}\% \\ \nearrow \quad \nearrow \\ []_{\omega} \text{hnoo} [\text{ca} . \text{ci}]_{\omega} \end{array}$			*!		

In (209), candidates (b) and (c) violate RIGHTMOST-H% because the boundary tone is not associated to the rightmost prosodic word edge. However, (b) is eliminated because it also violates ASSOC-H%. This shows that it is preferable to associate a boundary tone to a non-final edge, than to not associate a boundary tone at all.

This example of a non-final boundary tone can be summarized as follows:

(210)

Stem Stratum	Input: / [[] _ω hnoó] _ω / Output: [[] _ω hnóó] _ω	Input: / ca-ci / Output: ca.ci
Word Stratum	Input: [[] _ω hnóó] _ω Output: [[] _ω hnóó] _ω	Input: ca.ci Output: [ca.ci] _ω
Post-lexical Stratum	Input: [[] _ω hnóó] _ω + [ca.ci] _ω Output: [[ca.cị] _ω hnóó] _ω	
Phonetics/Phonology Interface	Input: [[ca.cị] _ω hnóó] _ω Output: cacìhnóó (written orthographically as <i>jaǰìhnóó</i>)	

In the post-lexical stratum, the boundary tone associates to the final vowel of the host word instead of to the clitic vowel. The tone surfaces on the non-final prosodic word edge because 1) tone faithfulness from input to output is higher ranked than boundary tone alignment, and 2) the boundary tone can associate to a non-final TBU provided the TBU is still on a prosodic word edge.

7.6.1.3 Stratal OT and No Boundary Tones

Of the six minimally distinct forms, two do not have a boundary tone: CV(V)C and CV(V)C=Ć. The form CV(V)C has its final vowel deleted by WFVD, and the form CV(V)C=Ć has its host word in WFVD form and a clitic with tone attaches. The example in (211) shows the CV(V)C=Ć pattern:

- (211) *nààhiyúúhnóó* *uujeelvhnóó*
 nààhiyúú(ǰi)=hnóó uu-ceelv-hn-ǰ(ǰi)
 then=CN 3B-pretend-PFT-EXP
 ‘Then he pretended.’ (DC, June 2017)

In this example (211), the host word *nààhiyúúʔi* appears without its final /ʔi/ syllable, and the connector clitic =*hnóó*, which has an underlying H tone, attaches to the right of the word.

Like in the previous two examples, both the host word and the clitic are evaluated in the stem and word strata: in the stem stratum for syllabification and tone¹⁶ (and other well-formed segment sequences), and in the word stratum for mapping to a prosodic word and WFVD. In this example (211), the final vowel of *nààhiyúúʔi* is deleted in the word stratum. Therefore, the input for the post-lexical stratum is: $[[]_{\omega} \text{hnóó}]_{\omega} + [\text{nààhiyúúʔ}]_{\omega}$.

(212)

Post-lexical Stratum:

Input:		TBU=V	MAX-T	RIGHTMOST-H%	ALIGN-R	ASSOC-H%
$\begin{array}{c} \text{H} \quad \text{LF} \quad \text{SH} \\ \wedge \quad \wedge \quad \wedge \\ [[]_{\omega} \text{hnóó}]_{\omega} + [\text{naahi yuuʔ}]_{\omega} \end{array}$						
$\begin{array}{c} \text{LF} \quad \text{SH} \quad \text{HH\%} \\ \wedge \quad \wedge \quad \cancel{\wedge} \\ \text{a. } [[\text{naahi yuuʔ}]_{\omega} [\text{hnóó}]_{\omega}] \end{array}$			*!			
$\begin{array}{c} \text{LF} \quad \text{SH} \quad \text{H H\%} \\ \wedge \quad \wedge \quad \wedge \\ \text{b. } [[\text{naahi yuuʔ}]_{\omega} [\text{hnóó}]_{\omega}] \end{array}$				*		*
$\begin{array}{c} \text{LF} \quad \text{SH H\%} \quad \text{H} \\ \wedge \quad \wedge / \quad \wedge \\ \text{c. } [[\text{naahi yuuʔ}]_{\omega} [\text{hnóó}]_{\omega}] \end{array}$		*!		*		
$\begin{array}{c} \text{LF} \quad \text{SH H\%} \quad \text{H} \\ \wedge \quad \cancel{\wedge} \quad \wedge \\ \text{d. } [[\text{naahi yuuʔ}]_{\omega} [\text{hnóó}]_{\omega}] \end{array}$			*!	*	*	
$\begin{array}{c} \text{LF H\% SH} \quad \text{H} \\ \wedge \quad \quad \cancel{\wedge} \quad \wedge \\ \text{e. } [[\text{naahi yuuʔ}]_{\omega} [\text{hnóó}]_{\omega}] \end{array}$				*		*!***

Candidates (a) and (d) violate MAX-T by associating the boundary tone to a TBU that already has tone. Candidate (c) violates TBU=V because the boundary tone is associated to the glottal stop. Both candidates (b) and (e) violate RIGHTMOST-H% because the boundary

¹⁶My analysis of tone doesn't account for LF or SH, so I don't provide a tableau that shows how they are associated.

tone isn't associated to the rightmost prosodic word boundary. However, (e) is eliminated because it violates ALIGN-R because the boundary tone is associated to a non-edge TBU.

This example of a form without a boundary tone can be summarized as follows:

(213)

Stem Stratum	Input: / [[] _ω hnoó] _ω / Output: [[] _ω hnóó] _ω	Input: / nàà.hi.yúú.ʔi / Output: nàà.hi.yúú.ʔi
Word Stratum	Input: [[] _ω hnóó] _ω Output: [[] _ω hnóó] _ω	Input: nàà.hi.yúú.ʔi Output: [nàà.hi.yúú.ʔ] _ω
Post-lexical Stratum	Input: [[] _ω hnóó] _ω + [nàà.hi.yúú.ʔ] _ω Output: [[nàà.hi.yúú.ʔ] _ω hnóó] _ω	
Phonetics/Phonology Interface	Input: [[nàà.hi.yúú.ʔ] _ω hnóó] _ω Output: nààhiyúúhnóó	

The boundary tone cannot appear on the clitic vowel because the clitic has an underlying tone. The boundary tone then cannot appear on the host word because the host word ends in a glottal stop. Therefore, the boundary tone doesn't associate to any TBU, rather than associate to a non-edge TBU.

7.7 Conclusion

The phonological generalizations presented in previous chapters can be captured by the constraint rankings of each stratum. For example, at the word stratum, the ranking of SUBCAT above MATCH(WORD, ω) captures the fact that clitics are morphological words, and SHOULD map to prosodic units, but some phonological deficiency (formalized with an underlying prosodic subcategorization frame) prevents this mapping. Then, at the post-lexical stratum, the PARSE constraint is now ranked higher than SUBCAT and MATCH(WORD, ω), forcing clitics to be parsed into the prosodic structure, even though it causes the clitic to move from its syntactically generated position.

In this chapter, I have shown that the six minimally distinct patterns of boundary tone placement can be accounted for. The alignment and association of boundary tones is conditioned by WFVD, clitic attachment, and tonal phonology.

APPENDIX A

List of Abbreviations

The following table lists all abbreviations used for glossing in this dissertation.

Table 35: List of Abbreviations

ABBREVIATION	GLOSS	FORM
2/1	2nd person subject/1st person object Pronominal Prefix	<i>-sgi</i>
A	Set A Pronominal Prefix	
ADJ	Adjective Derivational Suffix	<i>-hááʔi</i>
AGT	Agentive Derivational Suffix	<i>-i</i>
AND	Andative Derivational Suffix	<i>-ee/-ee(ʔ)g</i>
AMB	Ambulative Derivational Suffix	varies
AQ	Alternative Question Clitic	<i>=ke</i>
B	Set B Pronominal Prefix	
CIS	Cislocative Pronominal Prefix	<i>di-/da-</i>
CN	Conjunction Clitic	<i>=hnóó</i>
CQ	Conducive Question Clitic	<i>=ju</i>
CS	Concessive Clitic	<i>sginii</i>
CT	Contrastive Clitic	<i>=hv</i>
DST	Distributive Prepronominal Prefix	<i>di-/dee-</i>
DT	Delimiter Clitic	<i>=(s)gwu</i>
DU	Dual	
EQ	Echo Question Clitic	<i>=gi</i>
EX	Exclusive	
EXP	Experienced Past Inflectional Suffix	<i>-vóʔi</i>
FC	Focus Clitic	<i>=dvv</i>
F2	Focus 2 Clitic	<i>=na</i>
FUT	Progressive Future Inflectional Suffix	<i>-éésdi</i>
HAB	Habitual Inflectional Suffix	<i>-ó(ó)ʔi</i>
IMP	Imperative Aspectual Suffix	varies
IMPF	Imperfective Aspectual Suffix	varies
IND	Indicative Inflectional Suffix	<i>-a</i>
IRR	Irrealis Prepronominal Prefix	<i>yi-</i>
ITR	Iterative Prepronominal Prefix	<i>ii-/vv-</i>
NS	Nonsingular (dual or plural)	
NXP	Non-experienced Past Inflectional Suffix	<i>-é(é)ʔi</i>
ORD	Ordinal Derivational Suffix	<i>-iinééʔi</i>
PCP	Participle Derivational Suffix	<i>-da</i>
PFT	Perfective Aspectual Suffix	varies
PL	Plural	
PO	Potential Clitic	<i>=le</i>
PRS	Present Aspectual Suffix	varies

ABBREVIATION	GLOSS	FORM
PRT	Partitive Prepronominal Prefix	<i>ni-</i>
Q	Information Question Clitic	<i>=s(go)</i>
REFL	Reflexive Prefix	<i>ad-/adaa-</i>
REL	Relativizer Prepronominal Prefix	<i>ji-</i>
TQ	Tag Question Clitic	<i>=ka</i>
TRN	Translocative Prepronominal Prefix	<i>wi-</i>

APPENDIX B
Constraints

Below is a list of all constraints used in this dissertation. Triangles next to constraints indicate that the constraint was proposed for this analysis.

CONSTRAINT	PAGE #
ALIGN-R(H%, PRWD)	204
*ASSOCIATE	193
▷ ASSOCIATE-H%	211
*COMPLEX	182
DOM BIN	47
*hC	183
IDENT-IO[s.g.]	185
LINEARCORRESPONDENCE	200
MATCH(WORD, ω)	188
MAX-T	48
MAX-V-IO	189
NOOBSCODA	182
OCP	71
*PREASP	185
RIGHTMOST-H%	205
SSP	182
▷ SUBCAT	196
TBU=V	211
VVC] $_{\sigma}$	180
▷ *V] $_{\omega}$	189
▷ *?C	182

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