Ternary Stress

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Chapter 1: Introduction and Background

1 Introduction

In a large portion of natural languages, stress is rhythmic. Stress falls on alternating syllables, and lapses of any kind are marked. This defines most binary systems. However, a small percentage of languages have a ternary stress pattern, requiring lapses. Ternary stress is characterized by one stressed syllable followed by two unstressed syllables.

Describing these ternary rhythms within standard phonological frameworks has always been a challenge. Binary feet are standard in most analyses of stress, and ternarity has been a puzzle to these theories. Some alternatives have included the introduction of ternary feet or parameters requiring that feet be separated by at least one syllable.

Even in Optimality Theory (Prince and Smolensky 1993, henceforth OT), there has been much dispute over how to adequately explain the phenomenon of ternary stress. In this paper, I will provide an analysis of ternary stress in OT using only binary feet; this theory is referred to as Lapse Length Differentiation Theory, and will be explained in section 3 of this chapter. Five languages are known to be ternary -- Tripura Bangla, Cayuvava, Estonian, Chugach Yupik, and Winnebago -- and I will show that this analysis not only works for all five of these languages, but is, in fact, absolutely required for a successful analysis of Tripura Bangla. Tripura Bangla is discussed in chapter 2, while analyses for the other four are provided in chapters 3 and 4.

The unifying factor of these five languages is that they all have an iterative pattern of ternary stress; that is, throughout the word, stress is consistently on every third syllable. Rather than having a single lapse in each word, the words of these languages have lapses between every two stressed syllables. For the purposes of this paper, these regular lapses are the characterizing factor of ternary stress.

Certain languages which are often referred to as having a ternary stress system are not included here, either for lack of sufficient data or because the ternary pattern is non-iterative. (For more details, see Appendix A.)

2 Background

Other attempts have been made in the past to explain the phenomenon of ternary stress. The most notable of these attempts are the concepts of ternary feet and weak local parsing. Ternary feet were first championed by Levin (1985, 1988) for use in Cayuvava. Levin's initial concept for the ternary foot was a dactyl, although she later abandoned this in favor of the amphibrach. Halle and Vergnaud (1987) continue with Levin's concept of the amphibrach, and argue for it with additional theoretical implications.

Dresher and Lahiri (1991) continue with the concept of the ternary foot, although they evolve it from a flat foot into an internally-layered foot. These binary-branching feet consist of a binary head -- which is essentially a binary foot -- and an optional non-head, which together comprise the binary-branching foot. Although Dresher and Lahiri argue for this foot type with evidence from Old English, they also use it to explain data from Cayuvava. Rice (1992) continues with the concept of the binary-branching foot, applying it to Chugach Yupik as well as Cayuvava. In Kager (1997), the concept of the binary-branching foot is translated into OT.

The other primary theory of ternary stress is weak local parsing, which was first posited in Hayes (1995). Weak local parsing states that there must be at least one unstressed syllable between any two feet -- although not between a foot and a word edge. Weak local parsing is the marked setting for the parameter, with its unmarked setting as strong local parsing. Strong local parsing accounts for binary stress systems, and requires that no unstressed syllables intervene between feet. Kager (1994) applies the concept of weak local parsing into OT terms, positing a constraint *FTFT which captures the same generalizations as weak local parsing.

3 Lapse Length Differentiation Theory

An OT analysis of ternary stress utilizing strictly binary feet and lapse constraints has been proposed in Elenbaas and Kager (1999, henceforth E&K). E&K describe a general binary analysis for all ternary stress systems; in their system, foot alignment constraints act as constraints against feet, with lapse constraints forcing any additional feet.

In an analysis of binary alternating systems, Kager (2001) suggests splitting the *LAPSE constraint into a family of lapse constraints which more accurately predict attested typology and also gaps in typology. Instead of penalizing all lapses equally, Kager's family of lapse constraints license lapses word-finally and at the main stress of the word. These constraints are defined as follows:

(1) Kager’s Lapse Constraints [1]

a) *LAPSE

assign one violation mark for every sequence of two consecutive unstressed syllables

b) LAPSE-AT-PEAK

assign one violation mark for every sequence of two consecutive unstressed syllables that is not adjacent to the word peak

c) LAPSE-AT-END

assign one violation mark for every sequence of two consecutive unstressed syllables that is not word-final

In addition to these positionally-licensed lapse constraints, *EXTENDED-LAPSE (also called *LONG-LAPSE) is a more specific type of lapse constraint. *EXTENDED-LAPSE (Nespor and Vogel 1989, Elenbaas and Kager 1999, Kager 2001) prohibits sequences of *three* consecutive unstressed syllables; that is, two overlapping lapses are more marked than two separate lapses. This constraint is ideal for use in dealing with ternary systems, because it will allow the observed single lapses but force additional feet when the lapse would become too large.

[1] Kager (2001) also proposes *INITIAL-LAPSE as part of the family of lapse constraints. *INITIAL-LAPSE assigns one violation mark for every sequence of two consecutive unstressed syllables that is word-initial. However, this constraint is unneeded; see chapter 5 for more details.

I propose a synthesis of these two classes of lapse constraints – positionally licensed lapses and extended lapses. Specifically, I argue that a family of positionally licensed extended-lapse constraints exist. In addition to *EXTENDED-LAPSE, there are constraints licensing longer lapses adjacent to main stress or word-finally. Specifically, these constraints will be defined as follows:

(2) Extended-Lapse Constraints

a) *EXTENDED-LAPSE
   assign one violation mark for every unstressed syllable that is both preceded and followed by another unstressed syllable

b) EXTENDED-LAPSE-AT-PEAK
   assign one violation mark for every unstressed syllable that is both preceded by an unstressed syllable and followed by another unstressed syllable, neither of which are adjacent to the word peak

c) EXTENDED-LAPSE-AT-END
   assign one violation mark for every unstressed syllable that is both preceded by an unstressed syllable and followed by a non-word-final unstressed syllable

Evidence for this claim will come from the Tripura dialect of Bangla, henceforth referred to as Tripura Bangla or TB. Crucially, there must be an EXTENDED-LAPSE-AT-END constraint for the successful analysis of TB. TB prohibits extended-lapses generally, but allows them word-finally. Unlike EXTENDED-LAPSE-AT-END, *EXTENDED-LAPSE would fail to properly describe this pattern.

The constraints currently in use are not sufficient for TB, as will be shown in chapter 2. In this paper, I extend E&K's general approach of using foot alignment and lapse constraints to analyze ternary stress systems. However, E&K do not provide the right lapse constraints for an analysis of TB. Chapter 2 provides a binary analysis of the ternary stress system found in TB, incorporating the new type of lapse constraint mentioned in (2).

In chapters 3 and 4, additional evidence will be provided in support of this theory of using positionally licensed extended lapses to explain ternary stress. In fact, I argue that all ternary stress is due to the following ranking schema: Extended Lapse Constraint >> Foot Economy Constraint >> Lapse Constraint.

In this schema, Extended Lapse Constraint refers to any of the constraints defined in (2), while Lapse Constraint refers to any member of the family of constraints defined in (1). Foot Economy Constraints are alignment constraints, which have the effect of banning feet whenever possible. Specifically, in this ranking schema, languages will have the bare minimum number of feet required to avoid extended lapses.

This theory of explaining ternary stress differentiates it from binary stress by looking at the *lengths* of permissible lapses. Binary stress occurs when Foot Economy Constraints are dominated by Lapse Constraints, because short lapses are banned; ternary stress occurs when Foot Economy Constraints are dominated by *Extended* Lapse Constraints, because short lapses are allowed while long lapses are banned. Due to this theory's defining characteristic of discriminating between lengths of lapses, I will refer to this ranking schema as Lapse Length Differentiation Theory (LLDT).

Another way in which LLDT differs from the theory posited by E&K is that there are no gradient constraints. In LLDT, we will be using the generalized alignment constraints proposed in McCarthy and Prince (1993b); however, they will be formulated as categorical constraints, following McCarthy (2003). Foot Economy Constraints can be any of the constraints defined in (3b) or (3c).

(3) Alignment constraint definitions (McCarthy and Prince 1993b, McCarthy 2003)

a) ALIGN-R/L (HD, WD)
assign one violation mark for every foot containing main stress that is not aligned with the right/left edge of the word

b) ALIGN-BY-FT (FT, WD, R/L)
assign one violation mark for every foot that is separated from the right/left edge of the word by at least one foot

c) ALIGN-BY-σ (FT, WD, R/L)
assign one violation mark for every foot that is separated from the right/left edge of the word by at least one syllable

The constraints defined in (1), (2), and (3) are the backbone of LLDT; no additional foot types or constraints are needed to get the generalizations of ternary stress. To capture language-specific variations and generalizations, other constraints must of course be used. In this paper, I assume basic foot theory. The other constraints that will be used in this paper are defined in (4).

(4) General constraints

a) IAMB (Prince and Smolensky 1993, McCarthy and Prince 1993a)
assign one violation mark for every foot that is not right-headed

b) TROCHEE (Prince and Smolensky 1993, McCarthy and Prince 1993a)
assign one violation mark for every foot that is not left-headed

c) WEIGHT-TO-STRESS PRINCIPLE (Prince 1990, henceforth WSP)
assign one violation mark for every heavy syllable that is unstressed

d) *CLASH (Prince 1983)
assign one violation mark for every pair of consecutive stressed syllables

e) FTBIN (Prince 1980, McCarthy and Prince 1986, 1993a, 1993b)
assign one violation mark for every foot that is not binary on a moraic or syllabic level

f) NONFINALITY(FT) (Prince and Smolensky 1993)
assign one violation mark for every foot that is word-final

g) NONINITIALITY(FT) (Kennedy 1994, Kenstowicz 1994, Hayes 1995, Alderete 1995)
assign one violation mark for every foot that is word-initial

h) PARSE-2 (Kager 1994)
assign one violation mark for every sequence of two unparsed moras

The constraint Parse-2 deserves special mention here. This constraint penalizes sequences of unparsed syllables, which may seem at first to be similar to *Extended-Lapse. However, Parse-2 and *Extended-Lapse do not assign violations in the same places, just as Parse-Syll and *Lapse can be teased apart in the right circumstances. For more on Parse-2, please refer to chapters 3 and 4.

While LLDT will account for the general ternary rhythm found in all five of the languages described in this paper, these constraints will capture the language-specific variations; for instance, whether the language has iambs or trochees and whether the language is quantitity-sensitive or not.

4 Outline

In the following chapters, LLDT will be more thoroughly explained and argued for, with evidence from the five languages with ternary stress. Chapter 2 makes the case for LLDT through evidence from Tripura Bangla, while chapters 3 and 4 give additional support for the theory with data from the other four languages with ternary stress. In chapter 3, we will look at the trochaic languages with ternary stress -- Cayuvava and Estonian; in chapter 4, we will turn to the iambic languages -- Chugach Yupik and Winnebago. Finally, chapter 5 will provide some conclusions and observations about LLDT.

Chapter 2: Positionally Licensed Extended Lapses in Tripura Bangla

1 Analysis of Tripura Bangla[2] [words with only light syllables]

In Tripura Bangla, stress is assigned in a ternary pattern. In words with only light syllables, main stress is on the first syllable; secondary stress is placed on every third syllable afterwards, except where it would create a word-final stress.

Because it is quantity sensitive, the stress pattern in TB can be seen most clearly in words with only light syllables.

(1) TB words with only light syllables (Das 2001)

	3n syllables	
a)	**á**.to.ri	'intestine'
b)	**ó**.nu.kɔ.**rò**.ni.yɔ	'imitable'
	3n+1 syllables	
c)	**á**.ra.sa.li	'trouble making'
d)	ɔ́.no.nu.**dà**.βo.ni.yɔ	'unintelligible'
	3n+2 syllables	
e)	**bá**.ri	'home'
f)	ɔ́.nɔ.mo.**nì**.yɔ	'rigid'
g)	ɔ́.no.nu.kɔ̀.ro.ni.yɔ̀.ta	'inimitability'

In words with only light syllables, Tripura Bangla places main stress on the first syllable. Secondary stress is placed on the third syllable after a stressed syllable exhaustively through the end of the word, except where the stress would be word-final.

The basic stress pattern emerges from the interaction of the constraints defined in chapter 1, repeated here as (2).

(2) Constraint definitions (McCarthy and Prince 1993b, McCarthy 2003)

a) ALIGN-R/L (HD, WD)
assign one violation mark for every foot containing main stress that is not aligned with the right/left edge of the word

b) ALIGN-BY-FT (FT, WD, R/L)
assign one violation mark for every foot that is separated from the right/left edge of the word by at least one foot

c) ALIGN-BY-σ (FT, WD, R/L)
assign one violation mark for every foot that is separated from the right/left edge of the word by at least one syllable

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[2] Bangla is a language used by about 211,000,000 first- and second-language speakers in Bangladesh, India, Nepal, Saudi Arabia, and Malawi, among other countries. The Tripura Bangla dialect is spoken in Tripura, a region of India. TB is described in Das (2001), which is the source of all data and descriptive generalizations found here.

Word-initial stress in TB indicates the use of trochaic feet. Due to trochaic feet in TB, stress cannot be word-final in a word containing only light syllables.

(3) TROCHEE >> IAMB

/LL/	TROCHEE	IAMB
→ ('LL)		*
(L'L)	*!	

Main stress is placed on the first syllable of words due to the high ranking of ALIGN-L (HD, WD) with respect to ALIGN-R (HD, WD).

(4) ALIGN-L (HD, WD) >> ALIGN-R (HD, WD)

/LLLLL/	ALIGN-L (HD, WD)	ALIGN-R (HD, WD)
→ ('LL)L(,LL)		*
(,LL)L('LL)	*!	

Words up to four syllables in length have only a single left-aligned foot. A second foot in TB requires that the word have at least five syllables; a third foot requires at least eight syllables. This is due to the interaction of a left-alignment constraint with the lapse constraints. Under its original gradient definition or the categorical formation in (2), ALIGN-BY-σ (FT, WD, L) acts as a constraint against having noninitial feet. ALIGN-BY-σ (FT, WD, L) prefers to underparse the word rather than incur additional violation marks for each additional foot.

Because every non-initial foot is a violation of ALIGN-BY-σ (FT, WD, L), it acts as a constraint against feet. The economy of feet due to ALIGN-BY-σ (FT, WD, L) creates lapses; therefore, ALIGN-BY-σ (FT, WD, L) must rank above all of the basic lapse constraints, as shown in (5). This ranking ensures that words will be underparsed at the expense of creating more lapses. In the tableau below and in all other tableaux with lapse constraints, the relevant lapses have been underlined.

(5) ALIGN-BY-σ (FT, WD, L) >> *LAPSE, LAPSE-AT-END, LAPSE-AT-PEAK

/LLLL/	ALIGN-BY-σ (FT, WD, L)	*LAPSE	LAPSE-AT-END	LAPSE-AT-PEAK
→ ('LL)LL		**	*	*
('LL)(,LL)	*!			

In five-syllable words, a second foot is added. In words with up to four syllables, a single foot can be used without creating any extended lapses that are not word final. However, due to unviolated ALIGN-L (HD, WD) there is no way of parsing a five-syllable word with a single foot and still avoid extended lapses. The extended lapses which are relevant to the tableau, in this case the non-final extended lapses, have been bolded. This typographical convention will be followed for the remainder of this paper.

(6) Potential parses of a five-syllable word using a single foot

/LLLLL/	EXTENDED-LAPSE-AT-END	ALIGN-L (HD, WD)
('L**L)LL**L	*!	
L('LL)LL		*!
LL('LL)L		*!
LLL('LL)	*!	*!

In order to have more than one foot per word, ALIGN-BY-σ (FT, WD, L) must be dominated by some constraint compelling additional feet. EXTENDED-LAPSE-AT-END can be used here to prevent long sequences of unstressed syllables after the main stress.

(7) EXTENDED-LAPSE-AT-END

assign one violation mark for every sequence of three consecutive unstressed syllables that is not word-final

(8) EXTENDED-LAPSE-AT-END >> ALIGN-BY-σ (FT, WD, L)

/LLLLL/	EXTENDED-LAPSE-AT-END	ALIGN-BY-σ (FT, WD, L)
→ ('LL)L(,LL)		*
('L**L)LL**L	*!	

Another logical possibility in the place of EXTENDED-LAPSE-AT-END is EXTENDED-LAPSE-AT-PEAK. However, it becomes clear in seven-syllable words that the extended lapses are permissible only word-finally, and not adjacent to the main stress. That is, the extended lapse in ɔ.*no.nu.da.βo.ni.y*ɔ will be ɔ́.*no.nu.dà.**βo.ni.y***ɔ, not ɔ́.***no.nu.da***.*βò.ni.y*ɔ. This means that EXTENDED-LAPSE-AT-END must outrank EXTENDED-LAPSE-AT-PEAK.

(9) EXTENDED-LAPSE-AT-END >> EXTENDED-LAPSE-AT-PEAK

/LLLLLLL/	EXTENDED-LAPSE-AT-END	EXTENDED-LAPSE-AT-PEAK
→ ('LL)L(,L**L)LL**		*
('L**L)LL**(,LL)L	*!	

EXTENDED-LAPSE-AT-PEAK must also be outranked by ALIGN-BY-σ (FT, WD, L) to avoid additional feet being added to satisfy the lapse constraint.

(10) ALIGN-BY-σ (FT, WD, L) >> EXTENDED-LAPSE-AT-PEAK

/LLLLLLL/	ALIGN-BY-σ (FT, WD, L)	EXTENDED-LAPSE-AT-PEAK
→ ('LL)L(,L**L)LL**	*	*
('LL)L(,LL)(,LL)	**!	

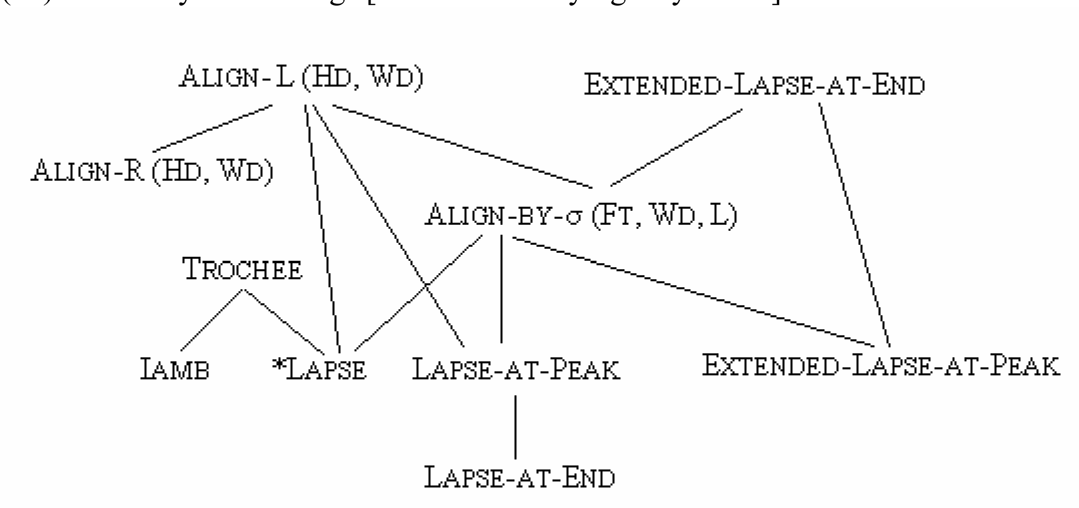
Additionally, TB prefers to have its lapses be next to the main stress of the word, rather than word-finally.

(11) LAPSE-AT-PEAK >> LAPSE-AT-END

/LLLLL/	LAPSE-AT-PEAK	LAPSE-AT-END
→ ('LL)L(,LL)		*
('LL)(,LL)L	*!	

For all words with only light syllables, the following rankings have been established:

(12) Summary of Rankings [words with only light syllables]



As shown in the summary tableau in (13), these rankings are crucial for an effective analysis of TB. The constraints IAMB and ALIGN-R(HD, WD) have been left out of the tableau to conserve space; however, they are low ranked constraints which do not affect the outcomes shown below. All other ranking arguments that have been established are shown in the following tableau.

(13) Summary Tableau [words with only light syllables]

	TROCHEE	ALIGN-L(HD, WD)	EXTENDED-LAPSE-AT-END	ALIGN-BY-σ (FT, WD, L)	EXTENDED-LAPSE-AT-PEAK	*LAPSE	LAPSE-AT-PEAK	LAPSE-AT-END
3n syllables								
(13a) *LLL*								
→ ('LL)L						*		
L('LL)		*!		*				
(L'L)L	*!							
(13b) *LLLLLL*								
→ ('LL)L(,LL)L				*		**	*	*
('LL)(,LL)(,LL)				**!				
('L**L)LL**(,LL)			*!	*		**	*	**
('LL)(,L**L)LL**				*	*!	**	**	*
L('LL)(,LL)L		*!		**		*	*	
3n+1 syllables								
(13c) *LLLL*								
→ ('LL)LL						**	*	*
L('LL)L		*!		*		*		
('LL)(,LL)				*!				
(13d) *LLLLLLL*								
→ ('LL)L(,L**L)LL**				*	*	***	**	**
('LL)L(,LL)(,LL)				**!		*		*
('LL)(,LL)(,LL)L				**!		*	*	
('LL)(,LL)L(,LL)				**!		*	*	*
('L**L)LLLLL**			*!**		***	*****	****	****
('L**L)LLL**(,LL)			*!*	*	*	***	**	***
('L**L)LL**(,LL)L			*!	*		***	**	**
('LL)(,L**L)LLL**			*!	*	**	***	***	**
3n+2 syllables								
(13e) *LLLLL*								
→ ('LL)L(,LL)				*		*		*
(,LL)L('LL)		*!		*		*		*
('LL)(,LL)L				*		*	*!	
('L**L)LLL**			*!		*	***	**	**

(13f) *LLLLLLLL*	TROCHEE	ALIGN-L(HD, WD)	EXTENDED-LAPSE-AT-END	ALIGN-BY-σ (FT, WD, L)	EXTENDED-LAPSE-AT-PEAK	*LAPSE	LAPSE-AT-PEAK	LAPSE-AT-END
→ ('LL)L(,LL)L(,LL)				**		**	*	**
('LL)(,LL)(,LL)(,LL)				***!				
('LL)(,LL)L(,LL)L				**		**	**!	*
('LL)(,LL)(,L**L)LL**				**	*	**	**	*
('L**L)LL**(,LL)(,LL)			*!	**		**	*	**
('LL)(,L**L)LL**(,LL)			*!	**	*	**	**	**

Without the use of EXTENDED-LAPSE-AT-END, there is no analysis that will work for all word lengths in TB. The tableau in (13) shows EXTENDED-LAPSE-AT-END making crucial decisions in TB. An explanation of why all other solutions fail at this problem will be addressed in the following section.

2 Justification for Extended-Lapse-at-End

As mentioned in chapter 1, Kager (2001) proposed an enrichment of the standard *LAPSE constraint by providing additional lapse constraints which, together, had the effect of licensing lapses in certain places and prohibiting them elsewhere. These constraints are listed in (14).

(14) Kager's Lapse Constraints

a) *LAPSE

assign one violation mark for every sequence of two consecutive unstressed syllables

d) LAPSE-AT-PEAK

assign one violation mark for every sequence of two consecutive unstressed syllables that is not adjacent to the word peak

e) LAPSE-AT-END

assign one violation mark for every sequence of two consecutive unstressed syllables that is not word-final

Similarly, I have proposed that the *EXTENDED-LAPSE constraint can be enriched for licensing extended lapses in some contexts and prohibiting them in others. This can be done by mirroring the family of basic lapse constraints, creating equivalent constraints with extended-lapses.

These extended-lapse constraints serve to license longer lapses word-finally and adjacent to the word peak. This family of extended lapse constraints is as follows:

(15) Extended-Lapse Constraints

a) *EXTENDED-LAPSE
   assign one violation mark for every sequence of three consecutive unstressed syllables

b) EXTENDED-LAPSE-AT-PEAK
   assign one violation mark for every sequence of three consecutive unstressed syllables that is not adjacent to the word peak

c) EXTENDED-LAPSE-AT-END
   assign one violation mark for every sequence of three consecutive unstressed syllables that is not word-final

The constraints defined in (15b)-(15c) are in a stringency relationship with (15a). Because (15a) is more stringent than (15b)-(15c), languages will prefer to avoid extended-lapses in general. However, if a longer lapse must occur, it is preferred – though not guaranteed – to be either word-final or next to the main stress. This is helpful in Tripura Bangla; extended lapses are prohibited generally, but allowed in a word-final position. If EXTENDED-LAPSE-AT-END is used in the analysis of TB, there are no problems.

The need for the ranking Extended-Lapse-at-End >> ALIGN-BY-σ (FT, WD, L) >> LAPSE-AT-PEAK is motivated in the previous section. If EXTENDED-LAPSE-AT-END did not exist, there could not be a solution for TB that would explain the patterns in words with 3n+1 syllables, such as ('**L**L)LL or ('**L**L)L(,**L**L)LL. *EXTENDED-LAPSE is not sufficient in the place of EXTENDED-LAPSE-AT-END. The current rankings – substituting *EXTENDED-LAPSE for EXTENDED-LAPSE-AT-END – predict that *('**L**L)(,**L**L) and *('**L**L)L(,**L**L)(,**L**L) should be the winners for the four- and seven-syllable candidates.

(16) *EXTENDED-LAPSE for 3n+1 Syllables

/LLLLLLL/	*EXTENDED-LAPSE	ALIGN-BY-σ (FT, WD, L)	LAPSE-AT-PEAK
☺ ('LL)L(,L**L)LL**	*!	*	**
💣 ('LL)L(,LL)(,LL)		**	
('L**L)LLLLL**	*!***		****

As shown in (16), *EXTENDED-LAPSE predicts the wrong winner for words with 3n+1 syllables. EXTENDED-LAPSE-AT-END is doing important work in TB, and the analysis cannot succeed without it. The effects of EXTENDED-LAPSE-AT-END interacting with the relevant constraints in TB are shown in (17).

(17) EXTENDED-LAPSE-AT-END >> ALIGN-BY-σ (FT, WD, L) >> LAPSE-AT-PEAK, *LAPSE >> LAPSE-AT-END

/LLLLLLL/	EXTENDED-LAPSE-AT-END	ALIGN-BY-σ (FT, WD, L)	LAPSE-AT-PEAK	*LAPSE	LAPSE-AT-END
→ ('LL)L(,LL)LL		*	**	***	**
('LL)L(,LL)(,LL)		**!		*	*
('L**L)LLLL**L	*!**		****	*****	****

As shown in (17), EXTENDED-LAPSE-AT-END is crucial for a successful analysis of TB. In fact, the desired winning candidate is harmonically bounded if EXTENDED-LAPSE-AT-END is not in CON. A portion of the summary tableau in (13d) will be reproduced here as (18), replacing EXTENDED-LAPSE-AT-END with *EXTENDED-LAPSE. The number of violations is indicated with an Arabic numeral for ease of comparison.

(18) Possible Candidates for 7-Syllable Words

	/LLLLLLL/	*EXTENDED-LAPSE	ALIGN-BY-σ (FT, WD, L)	*LAPSE	LAPSE-AT-PEAK	LAPSE-AT-END
A	☺ ('LL)L(,L**L)LL**	1	1	3	2	2
B	💣 ('LL)L(,LL)(,LL)	0	2	1	0	1
C	('LL)(,LL)(,LL)L	0	2	1	1	0
D	('LL)(,LL)L(,LL)	0	2	1	1	1
E	('L**L)LLLLL**	4	0	5	4	4
F	('L**L)LLL**(,LL)	2	1	3	2	3
G	('L**L)LL**(,LL)L	1	1	3	2	2
H	('LL)(,L**L)LLL**	2	1	3	3	2

The desired output is A; however, as in (16), the candidate *('LL)L(,LL)(,LL) wins. In fact, A can never win under any permutation of these rankings. There is no single harmonic bound on A, but it is collectively harmonically bounded by the set {C, E}. A bounding set is defined in Samek-Lodovici and Prince (1999) as follows:

(19) Definition of a Bounding Set (Samek-Lodovici and Prince 1999)

A set B⊆K is a bounding set B(z) for z∈K relative to a constraint set Σ, iff B has these properties:

Strictness
Every member of B is better than z on at least one constraint in Σ.

Reciprocity
If *z* is better than some member of B on a certain constraint C∈Σ, then some other member of B beats *z* on the constraint C.

Less formally, all of the candidates contained in a bounding set must outperform the bounded candidate on at least one constraint. Additionally, if the bounded candidate does better on a given constraint than some member of the bounding set, another candidate in the bounding set must do better than the bounded candidate.

In this case, candidates C and E create a bounding set on candidate A. The intended winner and the members of the bounding set are shown in (20), with the constraints unranked.

(20) Winner is Harmonically Bounded

	/LLLLLLL/	*EXTENDED-LAPSE	ALIGN-BY-σ (FT, WD, L)	*LAPSE	LAPSE-AT-PEAK	LAPSE-AT-END
A	☺ ('LL)L(,L**L)LL**	1	1	3	2	2
C	('LL)(,LL)(,LL)L	0	2	1	1	0
E	('L**L)LLLLL**	4	0	5	4	4

Candidate C does better than A on all of the constraints except ALIGN-BY-σ (FT, WD, L). ALIGN-BY-σ (FT, WD, L) is violated once by A, while E perfectly satisfies the constraint. Regardless of ranking, A can never be the winning candidate with this set of constraints.

However, EXTENDED-LAPSE-AT-END breaks the reciprocity. The tableau in (20) is repeated as (21), with the addition of EXTENDED-LAPSE-AT-END.

(21) Winner is Not Harmonically Bounded

	/LLLLLLL/	*EXTENDED-LAPSE	ALIGN-BY-σ (FT, WD, L)	*LAPSE	LAPSE-AT-PEAK	LAPSE-AT-END	EXTENDED-LAPSE-AT-END
A	☺ ('LL)L(,L**L)LL**	1	1	3	2	2	0
C	('LL)(,LL)(,LL)L	0	2	1	1	0	0
E	('L**L)LLLLL**	4	0	5	4	4	3

Both the intended winner and C perfectly satisfy EXTENDED-LAPSE-AT-END, while E violates it. If EXTENDED-LAPSE-AT-END is undominated, E will be eliminated as a possible candidate. With E no longer a contender, highly ranked ALIGN-BY-σ (FT, WD, L) will select A as the winner.

Without EXTENDED-LAPSE-AT-END, there is no way to deal with 3n+1 syllable words in TB. If *EXTENDED-LAPSE is used instead of EXTENDED-LAPSE-AT-END to force more than one foot, there must be something else outranking it which breaks the reciprocity and chooses the forms ('LL)LL and ('LL)L(,LL)LL over *('LL)(,LL) and *('LL)L(,LL)(,LL), respectively. A possible solution for this problem might be the addition of a constraint against having a foot word-finally.

(22) NONFINALITY(FT)

assign one violation mark for every foot that is word-final

This particular constraint would fix the problem in words with 3n+1 syllables, as seen below.

(23) NONFINALITY(FT) >> *EXTENDED-LAPSE

/LLLLLLL/	NONFINALITY(FT)	*EXTENDED-LAPSE
→ ('LL)L(,L**L)LL**		*
('LL)L(,LL)(,LL)	*!	

However, TB has word-final feet in all words with 3n+2 syllables, such as ('**L**L)L('**L**L) or ('**L**L)L('**L**L)L('**L**L). This ranking will produce correct forms for words with 3n+1 syllables, but incorrect forms for words with 3n+2 syllables.

(24) Problems with 3n+2 Syllables

/LLLLLLLL/	NONFINALITY(FT)	*EXTENDED-LAPSE	ALIGN-BY-σ (FT, WD, L)
☺ ('LL)L(,LL)L(,LL)	*!		
('LL)L(,L**L)LLL**		*!*	*
💣 ('LL)(,LL)L(,LL)L			**

If NONFINALITY(FT) is at work in TB, it must be outranked by another constraint which allows word-final feet in words with 3n+2 syllables. Constraints which can help in these cases, such as LAPSE-AT-PEAK, must be ranked below *EXTENDED-LAPSE to produce the rhythm observed elsewhere in TB; that is, no consistent ranking can be reached with NONFINALITY(FT) that will account for all observed patterns in TB. Therefore, the combined forces of *EXTENDED-LAPSE and NONFINALITY(FT) are unable to replace EXTENDED-LAPSE-AT-END.

The answer, therefore, cannot be the addition of another constraint outranking *EXTENDED-LAPSE. Instead, we must use a different constraint in its place; the constraint must still prohibit long lapses, yet allow them where they occur in TB. EXTENDED-LAPSE-AT-END is the only constraint which can satisfy both of these needs and predict all of the attested winners in TB.

3 Tripura Bangla with Heavy Syllables

As mentioned in the introduction, Tripura Bangla is a quantity sensitive language. In TB, heavy syllables will be stressed even where it would disrupt other features of the stress pattern. Even though word-initial stress is always observed in words with only light syllables, heavy syllables can disrupt this pattern. If the second syllable of a word is heavy, it will receive main stress. However, if the third syllable is heavy – and preceded by two light syllables – then it will receive secondary stress. A foot will be constructed on the initial two syllables, and stress will still be word-initial. However, the heavy syllable is still disrupting the underparsing effects of ALIGN-BY-σ (FT, WD, L) by causing two adjacent feet to be constructed.

Additionally, heavy syllables can force the violation of TB's ban on word-final stress. If a heavy syllable is word final, it receives stress unless it is preceded by another heavy syllable or if it would receive main stress [('LH) instead of *L('H)]. Heavy syllables always remain unstressed in TB when they follow another heavy syllable or would cause main stress to be word-final.

Some examples of words with heavy syllables in Tripura Bangla are provided here. For more, please see the appendix.

(25) Selected data from Tripura Bangla with heavy syllables

a)	**aít**.na	d)	**nóŋ**.ra.mi	g)	na.**ríŋ**.gi.ni
b)	**ká**.rɔn	e)	**bíg**.ga.**ɸɔ̀n**	h)	**ʃón**.bi.**bìʃ**.ʈɔ
c)	**tól**.ɸar	f)	ʃɔ́**m**.pot.ti	i)	**kúʈ**.na.gi.ri

Quantity sensitive languages show the effects of having the Weight-to-Stress Principle (WSP) highly ranked.

(26) WSP (Prince 1990)
assign one violation mark for every unstressed heavy syllable

In this instance, WSP must rank above the head alignment constraint [ALIGN-L (HD, WD)] and the constraint which avoids additional feet [ALIGN-BY-σ (FT, WD, L)]. Feet in TB are analyzed as moraic trochees.

(27) WSP >> ALIGN-L (HD, WD)

/LHσ/	WSP	ALIGN-L (HD, WD)
→ L('H)σ		*
('LH)σ	*!	

(28) WSP >> ALIGN-BY-σ (FT, WD, L)

/LLH/	WSP	ALIGN-BY-σ (FT, WD, L)
→ ('LL)(,H)		*
('LL)H	*!	

As mentioned above, there are certain instances where TB will not stress a heavy syllable. Heavy syllables are left unstressed if doing so would place main stress word-finally. This is due to the constraint NONFINALITY(HD), as seen in (30).

(29) NONFINALITY(HD)
assign one violation mark for each main stress syllable that is word-final

(30) NONFINALITY(HD) >> WSP

/LH/	NONFINALITY(HD)	WSP
→ ('LH)		*
L('H)	*!	

Also, two adjacent syllables cannot be stressed, even if they are both heavy.

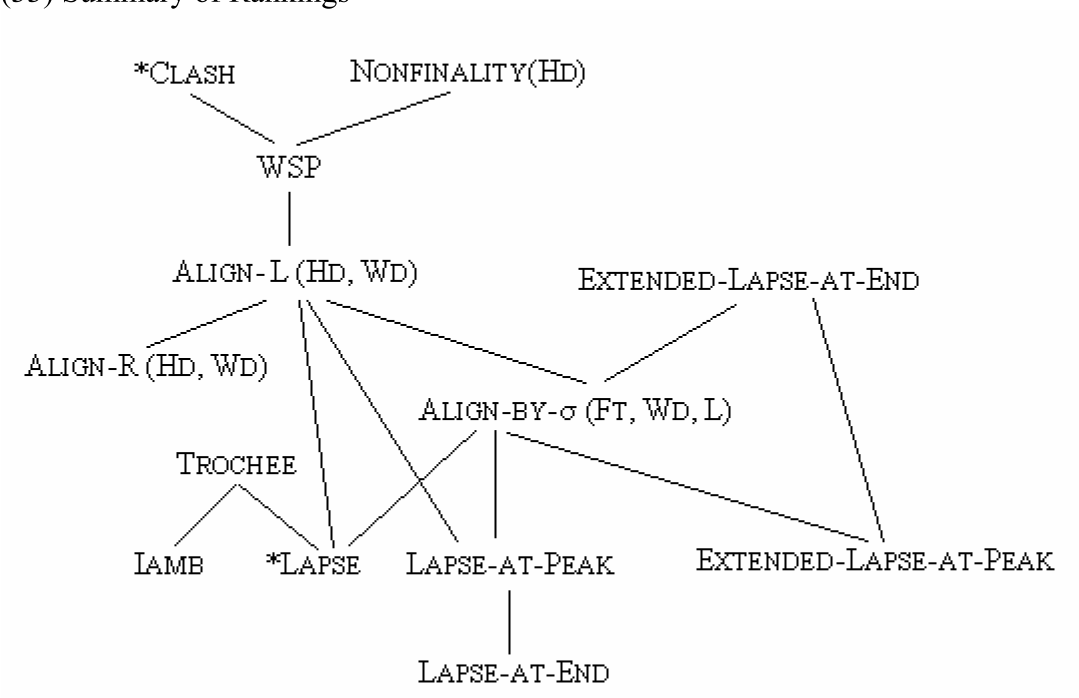
(31) *CLASH
assign one violation mark for every sequence of two consecutive stressed syllables

(32) *CLASH >> WSP

/HHL/	*CLASH	WSP
→ ('H)HL		*
('H)(,H)L	*!	

This combination of candidates and rankings fully accounts for the stress pattern of words with heavy syllables in TB. *CLASH and WSP frequently play a role in the interaction of heavy syllables with stress, as will be seen in chapters 3 and 4. With the addition of these constraints necessary to deal with heavy syllables, the rankings for TB look like this:

(33) Summary of Rankings



4 Conclusions and Questions

The following conclusions result from the analysis of Tripura Bangla presented here. It is possible to analyze the ternary pattern of TB through the use of a binary system. The ternary rhythm is created by the underparsing effects of a categorical ALIGN-BY-σ (FT, WD, L). The lapse constraints of Kager (2001) can be used to provide a complete analysis of TB, with the addition of the EXTENDED-LAPSE-AT-END constraint. EXTENDED-LAPSE-AT-END is a crucial part of the analysis of TB, and any description without it will fail. This chapter has shown the definite need for EXTENDED-LAPSE-AT-END, and for the ranking schema defined in LLDT.

The addition of this constraint to the grammar brings up new questions. If there is a constraint *Extended-Lapse-at-End*, should *Extended-Lapse be split to fully parallel the divided *LAPSE constraint? If so, what would be the possible uses of *Extended-Lapse-at-Peak*?

Because these constraints are both less stringent than *EXTENDED-LAPSE, languages would still avoid lapses of three or more consecutive unstressed syllables whenever possible. However, these constraints would predict a language where extended lapses are permitted adjacent to the main stress, but prohibited elsewhere.

This prediction does not seem like a problem for LLDT, though I do not know any examples of such a language. A language with ternary alternation which assigns a main stress at one edge of the word, then builds feet from the other end of the word would create an extended lapse next to the word peak, as in (34). In this trochaic language, main stress is in the rightmost foot of the word, while a secondary stress must be placed word-initially (where it will not create a degenerate foot). Extended lapses are permitted adjacent to the word peak, while shorter lapses are permitted elsewhere.

(34) Extended-Lapse-at-Peak Language

a) ('σσ)
b) σ('σσ)
c) (,σσ)('σσ)
d) (,σσ)σ('σσ)
e) (,σ**σ)σσ**('σσ)
f) (,σσ)(,σσ)σ('σσ)
g) (,σσ)σ(,σσ)σ('σσ)
h) (,σσ)σ(,σ**σ)σσ**('σσ)

To get a more concrete sense of how the constraints would interact to produce such a language, we will examine eight- and nine-syllable words. (35) shows LLDT working to produce this bidirectional ternary stress language, using the general ranking Extended-Lapse-at-Peak >> Align-by-σ (Ft, Wd, L), Align-by-σ (Hd, Wd, R) >> *Lapse. *Extended-Lapse is also included in this tableau to show that there is a distinction between the two extended lapse constraints.

(35) Eight-syllable words in the Extended-Lapse-at-Peak Language

/σσσσσσσσ/	Extended-Lapse-at-Peak	Align-by-σ (Hd, Wd, R)	Align-by-σ (Ft, Wd, L)	*Lapse	*Extended-Lapse
→ (,σσ)σ(,σσ)σ('σσ)			**	**	
(,σσ)(,σ**σ)σσ**('σσ)			**	**	*!
σσ(,σ**σ)σσ**('σσ)			**	**!*	*
(,σσ)(,σσ)σ('σσ)σ		*!	**	**	
(,σσ)(,σσ)(,σσ)('σσ)			***!		
σ(,σ**σ)σσσ**('σσ)	*!		**	***	**
(,σσ)σσσσ('σσ)	*!		*	****	***
σσσσσσ('σσ)	*!**		*	*****	****

In (36), on the other hand, we will look at nine-syllable words. It is clear in this tableau that extended lapses at the word peak are acceptable, while extended lapses in general are prohibited.

(36) Nine-syllable words in the EXTENDED-LAPSE-AT-PEAK Language

/σσσσσσσσσ/	EXTENDED-LAPSE-AT-PEAK	ALIGN-BY-σ (HD, WD, R)	ALIGN-BY-σ (FT, WD, L)	*LAPSE	*EXTENDED-LAPSE
→ (,σσ)σ(,σ**σ)σσ**('σσ)			**	***	*
(,σσ)(,σ**σ)σσσ**('σσ)	*!		**	***	**
σσσ(,σ**σ)σσ**('σσ)	*!		**	****	**
(,σσ)σ(,σσ)σ('σσ)σ		*!	**	***	
(,σσ)(,σσ)(,σσ)σ('σσ)			***!	*	
σ(,σ**σ)σσσ**('σσ)	*!		**	***	**
(,σ**σ)σσσσσ**('σσ)	*!**		*	*****	****
σσσσσσσ('σσ)	*!***		*	******	*****

Although unattested, this seems like a possible human language due to the presence of such bidirectionality in languages with binary alternation. However, it is nearly identical to the observed stress pattern in Sentani (Elenbaas 1999). The crucial difference between Sentani and the language described in (34) is that Sentani is essentially an iambic language, though the rightmost foot in each word switches to a trochee to avoid word-final main stress.

Unfortunately, in Sentani there are no reported words longer than seven syllables, so it is impossible to tell whether or not it actually has a pattern of ternary stress or merely a binary pattern of bidirectionality coupled with an avoidance of stress clashes. Without longer words, this distinction cannot be made.

Both languages with bidrectional stress and languages with ternary stress are cross-linguistically rare. Due to the fact that neither pattern is common, it is reasonable to think that it would be even rarer for these patterns to co-occur. Therefore, simply because a bidirectional ternary stress language has not yet been discovered does not mean that it is an unnatural language type.

Additionally, EXTENDED-LAPSE-AT-END causes no typological problems. This constraint predicts languages where stress must fall within a limited window of the right word edge. In fact, these types of languages are attested. Because EXTENDED-LAPSE-AT-END can account for these types of languages, its usage extends beyond ternary stress alone.

The uses of EXTENDED-LAPSE-AT-END in languages with a stress window will be more fully examined in chapter 5.

Chapter 3: Case Studies in Trochaic Languages

1 Cayuvava[3]

Of all known examples of ternary stress, Cayuvava (Key 1967) is the most clear instance because it is quantity insensitive. The stress pattern is not affected by the Weight-to-Stress Principle (Prince 1990), and therefore the ternarity can be clearly seen without interference from other factors.

In words longer than two syllables, Cayuvava assigns main stress on the third syllable from the end, and secondary stress on every third syllable before the main stress. In two-syllable words, stress is initial.

(1) Cayuvava data

a)	**dá**.pa	'canoe'
b)	**tó**.mo.ho	'small water container'
c)	**à**.ri.hi.**hí**.be.e	'I have already put the top on'
d)	a.**rí**.po.ro	'he already turned around'
e)	ma.**rà**.ha.ha.**é**.i.ki	'their blankets'
f)	a.ri.**pí**.ri.to	'already planted'
g)	i.ki.**tà**.pa.re.**ré**.pe.ha	'the water is clean'

The minimal word in Cayuvava is two syllables: a single binary foot. Words in Cayuvava are parsed into binary feet, skipping every third syllable. This creates two-syllable lapses. Feet are never word-final, except in the case of two-syllable words; in two-syllable words, there is a single foot which fully parses the entire word. Because stress is initial in certain words (including words longer than two-syllables), feet must be trochaic. The words in (1) are parsed into trochaic feet in (2).

(2) Cayuvava data, with feet

a)	(**dá**.pa)	'canoe'
b)	(**tó**.mo).ho	'small water container'
c)	(**à**.ri).hi.(**hí**.be).e	'I have already put the top on'
d)	a.(**rí**.po).ro	'he already turned around'
e)	ma.(**rà**.ha).ha.(**é**.i).ki	'their blankets'
f)	a.ri.(**pí**.ri).to	'already planted'
g)	i.ki.(**tà**.pa).re.(**ré**.pe).ha	'the water is clean'

[3] Cayuvava is an exinct language once spoken in Bolivia. Cayuvava is described in Key (1967), which is the source of all data and descriptive generalizations found here.

I will begin by getting the basics out of the way. As mentioned above, feet must be trochaic in Cayuvava due to initial stress in two-syllable words. This is due to the ranking of TROCHEE over IAMB. The observed form in Cayuvava has initial stress; the winner in (3) produces initial stress by having a trochaic foot. The loser in (3) has an iambic foot, producing final stress.

(3) TROCHEE >> IAMB

/LL/	TROCHEE	IAMB
→ ('LL)		*
(L'L)	*!	

Additionally, feet must be binary in Cayuvava because the minimal word is two-syllables. This means that FTBIN must be undominated. If feet were less than binary, the minimal word would be a single syllable; if feet were more than binary, the minimal word would be three syllables.

NONFINALITY(FT) visibly affects the stress pattern of Cayuvava. In Cayuvava, feet are prohibited from being in word-final position. The loser in (4) is eliminated because it has a foot in word-final position, even though it fully satisfies ALIGN-BY-σ(FT, WD, R). The observed form violates the right-alignment constraint, but wins because it does not have a word-final foot.

(4) NONFINALITY(FT) >> ALIGN-BY-σ(FT, WD, R)

/LLL/	NONFINALITY(FT)	ALIGN-BY-σ(FT, WD, R)
('LL)L		*
L('LL)	*!	

Additionally, main stress always falls on the rightmost foot in a word; this is because ALIGN-BY-FT (HD, WD, R) is undominated in Cayuvava. The only difference between the two forms in (5) is the placement of main stress. The losing candidate fails because it has main stress in the leftmost foot. In the winner, main stress is right-aligned.

(5) ALIGN-BY-FT (HD, WD, R) >> ALIGN-BY-FT (HD, WD, L)

/LLLLLL/	ALIGN-BY-FT (HD, WD, R)	ALIGN-BY-FT (HD, WD, L)
→ (,LL)L('LL)L		*
('LL)L(,LL)L	*!	

Now we come to the role of extended lapse constraints in Cayuvava. Although lapses are generally allowed in Cayuvava, none of these lapses are ever three syllables in length or longer. That is to say, lapses are permitted but *extended* lapses are prohibited. This means that the constraint *EXTENDED-LAPSE is undominated in Cayuvava.

ALIGN-BY-FT (FT, WD, R) is also highly-ranked in Cayuvava, and in effect it serves as a constraint against having more than one foot. As a result, feet are kept to a minimum in Cayuvava; additional feet are only added to prevent a violation of undominated *EXTENDED-LAPSE. In fact, all of the alignment constraints act as foot economy constraints in ternary stress languages, requiring that there be as few feet as possible while still avoiding extended lapses. This is reflected in the ranking schema which produces all iterative ternary stress languages: Extended Lapse Constraint >> Foot Economy Constraint >> Lapse Constraint.

In words less than six syllables, these two constraints do not come into conflict in Cayuvava. *EXTENDED-LAPSE can be satisfied with a single foot, which means that ALIGN-BY-FT (FT, WD, R) is also unviolated; that is, in a five-syllable word like *aripirito*, it is possible to have a single foot and no extended lapses, as in a.ri.(pí.ri).to. However, in words of six syllables or longer, a choice must be made between extended lapses and additional feet, putting these two constraints in conflict. In these cases, it becomes clear that ALIGN-BY-FT (FT, WD, R) is outranked by *EXTENDED-LAPSE. However, since (non-extended) lapses are allowed, the foot economy constraint ALIGN-BY-FT (FT, WD, R) must outrank all constraints against shorter lapses.

As shown in (6), the loser has fewer violations of the lapse constraints, and even satisfies LAPSE-AT-PEAK perfectly. However, the losing candidate also incurs an extra violation of the foot economy constraint, which eliminates its chances. The winning candidate, on the other hand, performs better on the foot economy constraint even though it does worse on all three lapse constraints.

(6) ALIGN-BY-FT (FT, WD, R) >> *LAPSE, LAPSE-AT-PEAK, LAPSE-AT-END

/LLLLLLLL/	ALIGN-BY-FT (FT, WD, R)	*LAPSE	LAPSE-AT-PEAK	LAPSE-AT-END
→ LL(,LL)L('LL)L	*	***	*	**
(,LL)(,LL)L('LL)L	**!	**		*

Extended lapses, on the other hand, are never allowed in Cayuvava. At six syllables and longer, it is impossible to avoid extended lapses, yet still retain a single foot. In words of this type, two feet are required to prevent any extended lapses; this is evidence for ranking *EXTENDED-LAPSE over ALIGN-BY-FT(FT, WD, R). The winner in (7) violates the foot economy constraint by having more than one foot, but manages to avoid having any extended lapses. The loser, meanwhile, perfectly satisfies the alignment constraint but is eliminated because it produces an extended lapse.

(7) *EXTENDED-LAPSE >> ALIGN-BY-FT (FT, WD, R)

/LLLLLL/	*EXTENDED-LAPSE	ALIGN-BY-FT (FT, WD, R)
→ (,LL)L('LL)L		*
LL('L**L)LL**	*!	

ALIGN-BY-σ (FT, WD, L) is not a highly ranked constraint. It is outranked by *EXTENDED-LAPSE, and therefore frequently violated in Cayuvava (see (2d-g) for examples). In (8), the winner violates ALIGN-BY-σ (FT, WD, L), but avoids extended lapses through the placement of its single foot. The loser, on the other hand, perfectly satisfies the left-alignment constraint, yet creates an extended lapse. Extended lapses are prohibited in Cayuvava, so this eliminates the loser.

(8) *EXTENDED-LAPSE >> ALIGN-BY-σ (FT, WD, L)

/LLLL/	*EXTENDED-LAPSE	ALIGN-BY-σ (FT, WD, L)
→ L('LL)L		*
('**L)LL**	*!	

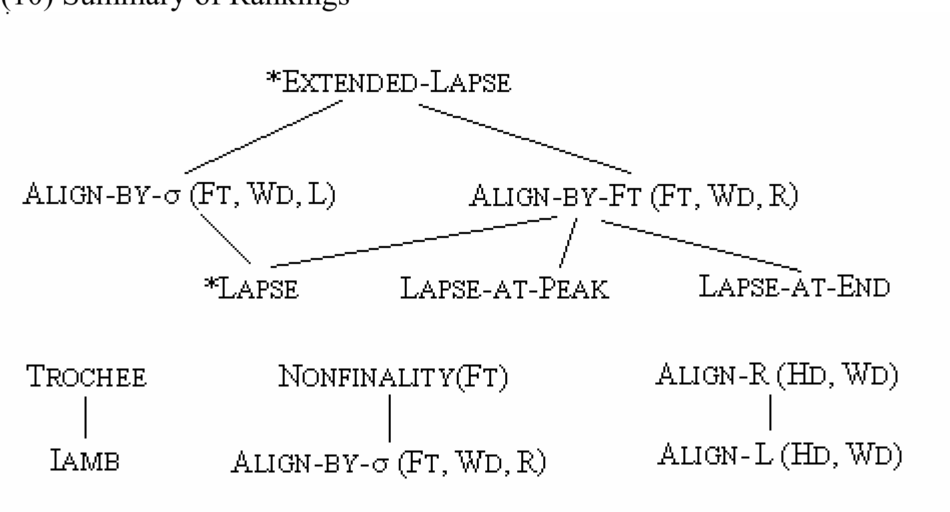
However, the effects of ALIGN-BY-σ (FT, WD, L) can still be seen in certain situations, despite the fact that it is generally violated in Cayuvava, as in (9). The winning candidate in (9) performs better on the left-alignment constraint than the loser, which creates the crucial distinction and produces the correct observed form.

(9) ALIGN-BY-σ (FT, WD, L) >> *LAPSE

/LLLLLL/	ALIGN-BY-σ (FT, WD, L)	*LAPSE
→ (,LL)L('LL)L	*	**
L(,LL)('LL)L	**!	*

A combined summary of rankings for Cayuvava can be seen in (10).

(10) Summary of Rankings



This set of rankings can fully account for the ternary stress pattern in Cayuvava. As with all ternary stress languages, undominated *EXTENDED-LAPSE is crucial for the successful description of this language. The ranking schema Extended Lapse Constraint >> Foot Economy Constraint >> Lapse Constraint will be shown further in the following sections.

2 Estonian[4]

Estonian (Hint 1973) has two different realms of stress: words with overlength syllables and words without overlength syllables. A pattern of ternary stress can be observed in the words without overlength syllables; I will provide an analysis of non-overlength stress in this section. Non-overlength stress in Estonian can be described as a variable binary/ternary pattern. The ternary pattern in Estonian provides additional support for my claim that ternarity can be produced by the ranking of Extended-Lapse Constraint >> Foot Economy Constraint >> Lapse Constraint. In fact, this ranking schema is especially clear in Estonian due to its alternating binary/ternary pattern. The alternation is caused by Foot Economy and Lapse constraints being unranked with respect to each other. When Foot Economy outranks Lapse, the ternary pattern is produced; when Lapse outranks Foot Economy, the binary pattern is produced.

Main stress always occurs on the first syllable of a word, and the final consonant of a word is always extrametrical. Secondary stress, according to the binary pattern, falls on every other syllable after the main stress, regardless of weight. In odd-numbered words, the final syllable is left unparsed if it is light; if it is heavy, it forms a foot and receives stress.

The binary pattern for secondary stress places stress on every second syllable following the main stress, as in ***pí****.mes.****tà****.va.le*; the ternary pattern places secondary stress on every third syllable following the main stress, as in ***pí****.mes.ta.****và****.le*. Although the ternary pattern is suppressed in certain contexts, the ternary and binary rhythms are otherwise in free variation. For example, /pi.mes.ta.va.le/ could be parsed as either ***pí****.mes.****tà****.va.le* [the binary pattern] or ***pí****.mes.ta.****và****.le* [the ternary pattern].

There are two contexts where the ternary pattern is blocked in Estonian. The first circumstance is where it causes a heavy syllable to be unparsed – which violates the constraint Parse-2 – such as **(****pí****.mes).*tat.*(****tù****.te)*. Heavy syllables can be unstressed, as in *(****hí****.li).(****sè****.mat).(****tè****.le)*, as long as they are in a foot. It is only when a heavy syllable is unparsed that it creates the violation of Parse-2 and therefore these types of candidates are blocked.

The second environment is where a degenerate foot would be created, violating FtBin – such as **(****ré****.te).li.(****lè****)*. Degenerate feet are always prohibited in Estonian.

(1) Estonian data

		binary rhythm	ternary rhythm
two syllables:	σσ	(**pá**.lat<t>)	same as binary
three syllables:	σσL	*(**pí**.mes).(**tà**<v>) [because of FtBin]	(**pí**.mes).ta<v>
	σσH	(**ká**.va).(**làt**<t>)	*(**ká**.va).lat<t> [because of Parse-2]

[4] Estonian is spoken by about 1,000,000 people, with approximately 950,000 of them located in Estonia. Other speakers of Estonia can be found in Finland, as well as several other countries. Hint (1973) and Hayes (1995) are the sources of all data and descriptive generalizations for Estonian in this paper.

		binary rhythm	**ternary rhythm**
four syllables:	σσLL	(**ré**.te).(**lì**.le)	*(**ré**.te).li.(**lè**) [because of FTBIN]
	σσLH	(**té**.ra).(**và**.mal<t>)	(**té**.ra).va.(**màl**<t>)
	σσHH	(**pá**.ri).(**màt**.tel<t>)	*(**pá**.ri).mat.(**tèl**<t>) [because of PARSE-2]
five syllables:	σσLLL	(**pí**.mes).(**tà**.va).le	(**pí**.mes).ta.(**và**.le)
	σσLHL	(**pí**.mes).(**tà**.vas).se	(**pí**.mes).ta.(**vàs**.se)
	σσHLL	(**pí**.mes).(**tàt**.tu).te	*(**pí**.mes).tat.(**tù**.te) [because of PARSE-2]
	σσLLH	(**ú**.lis).(**tà**.va).(**mài**<t>)	(**ú**.lis).ta.(**và**.mai<t>)
	σσLHH	(**əp**.pet).(**tà**.jat).(**tèk**<s>)	(**əp**.pet).ta.(**jàt**.tek<s>)
six syllables:	σσLLLL	(**ó**.sa).(**và**.ma).(**lè**.ki)	(**ó**.sa).va.(**mà**.le).ki
	σσLHLL	(**hí**.li).(**sè**.mat).(**tè**.le)	(**hí**.li).se.(**màt**.te).le
	σσHHLL	(**vá**.ra).(**sèi**.mat).(**tè**.le)	*(**vá**.ra).sei.(**màt**.te).le [because of PARSE-2]
	σσHLLL	(**əp**.pet).(**tùs**.te).(**lè**.ki)	*(**əp**.pet).tus.(**tè**.le).ki [because of PARSE-2]

First, we will look at some preliminary generalizations. Main stress is always initial in Estonian. This means that Estonian is a trochaic language, and that main stress is left-aligned. As shown in (2), Estonian will have trochees even at the expense of having an unstressed heavy syllable. That is to say, the loser in (2) stresses the heavy syllable but is produced as an iamb; the winner emerges as a trochee, although the heavy syllable is unstressed.

(2) TROCHEE >> WSP

/LH/	TROCHEE	WSP
→ ('LH)		*
(L'H)	*!	

Additionally, left-alignment is undominated in Estonian. This can be observed in (3), where the WSP is again violated – this time in favor of the main stress of the word falling on the initial syllable. The winner has an unstressed heavy syllable, but the main stress of the word is still left-aligned; however, the loser fails to have main stress left-aligned, even though the heavy syllable is stressed.

(3) ALIGN-BY-σ (HD, WD, L) >> WSP

/LHL/	ALIGN-BY-σ (HD, WD, L)	WSP
→ ('LH)L		*
L('HL)	*!	

Because main stress is always left-aligned, it must also be the case that Align-by-σ (Hd, Wd, L) outranks right-alignment constraints, such as Align-by-σ (Ft, Wd, R). This is shown in (4), where the winner has main stress left-aligned at the expense of failing to align a foot with the right edge of the word. The loser has a foot aligned with the right-edge of the word, but fails to have the main stress left-aligned; therefore, Align-by-σ (Hd, Wd, L) dominates Align-by-σ (Ft, Wd, R).

(4) Align-by-σ (Hd, Wd, L) >> Align-by-σ (Ft, Wd, R)

/LHL/	Align-by-σ (Hd, Wd, L)	Align-by-σ (Ft, Wd, R)
→ ('LH)L		*
L('HL)	*!	

With the preliminaries out of the way, we will begin by examining Estonian words with only light syllables after the initial two syllables. In Estonian, the weight of the first two syllables does not matter; as shown above, Align-by-σ (Hd, Wd, L) is undominated, so main stress will always be initial – regardless of whether the first and second syllables are light or heavy. There is no variation in Estonian for words of up to four syllables in length, as shown in (5). The explanation for this is simply that, because degenerate feet are prohibited, the binary and ternary rhythm predict identical stress patterns in words of up to four syllables. That is, words with two syllables are always *('**σ**σ)*, such as *(**pá**.lat*<*t*>), because the binary and ternary rhythms both produce this same parsing; words with three syllables always emerge as *('**σ**σ)L*, such as *(**pí**.mes).ta*<*v*>, because degenerate feet are not permitted; and words with four syllables are always parsed as *('**σ**σ)(,LL)*, such as *(**ré**.te).(**lì**.le)*, also because of the prohibition on degenerate feet.

However, words with more than four syllables allow for variation between the two rhythms. Five-syllable words can be produced as either *('**σ**σ)(,**L**L)L* [binary rhythm] or *('**σ**σ)L('**L**L)* [ternary rhythm], and six-syllable words can either be parsed as *('**σ**σ)(,**L**L)(,**L**L)* or *('**σ**σ)L(,**L**L)L*.

(5) Estonian data with only light syllables

		binary rhythm	**ternary rhythm**
two syllables:	σσ	(**pá**.lat<t>)	same as binary
three syllables:	σσL	*(**pí**.mes).(**tà**<v>)	(**pí**.mes).ta<v>
four syllables:	σσLL	(**ré**.te).(**lì**.le)	*(**ré**.te).li.(**lè**)
five syllables:	σσLLL	(**pí**.mes).(**tà**.va).le	(**pí**.mes).ta.(**và**.le)
six syllables:	σσLLLL	(**ó**.sa).(**và**.ma).(**lè**.ki)	(**ó**.sa).va.(**mà**.le).ki

Because certain candidates are blocked due to the creation of degenerate feet, FtBin – the constraint which requires that feet are binary – must outrank constraints that would favor parsing the final syllable into a degenerate foot, in this case *Lapse. As shown in (6), the observed form allows a lapse but no degenerate foot is created. The loser avoids lapses, yet it is eliminated because a degenerate foot is formed.

(6) FTBIN >> *LAPSE

/σσL/	FTBIN	*LAPSE
→ ('σσ)L		*
('σσ)(,L)	*!	

According to LLDT, ternarity is caused by the ranking schema Extended-Lapse Constraint >> Foot Economy Constraint (Alignment Constraint) >> Lapse Constraint. Binary stress, on the other hand, occurs when all Alignment constraints are dominated by at least one member of the Lapse family.

In Estonian, it must be the case that an Extended Lapse constraint is undominated. This is shown in (7), where the losing candidate violates *EXTENDED-LAPSE even though it has fewer feet, thus better satisfying the foot economy constraint. The winner in (7) avoids an extended lapse through the addition of a foot, thus proving the ranking shown below.

(7) *EXTENDED-LAPSE >> ALIGN-BY-FT (FT, WD, R)

/σσLL/	*EXTENDED-LAPSE	ALIGN-BY-FT (FT, WD, R)
→ ('σσ)(,LL)		*
('σ**σ)LL**	*!	

To have an alternation between binary and ternary stress, the foot economy and lapse constraints are unranked with respect to each other. When constraints are unranked with respect to each other, a ranking must be chosen each time the grammar gets to this stratum of unranked constraints. Because a different ranking will be chosen each time, this unranking stratum of constraints will produce alternations within a given speaker of the language. (Antilla and Cho 1998 and references cited therein)

In this particular case, the alternations are caused by having the foot economy constraint and the lapse constraint unranked with respect to each other. When foot economy dominates lapse, a ternary pattern will be optimal; when lapse dominates foot economy, a binary pattern will be optimal.

The following tableau shows the relevant lapse constraint and alignment constraints – both of the right-alignment constraints – unranked with respect to each other, causing variation. For example, *(**pí**.mes).(**tà**.va).le* – or *('**σ**σ)(,**LL**)L* – emerges when LAPSE-AT-END outranks ALIGN-BY-σ (FT, WD, R) but – with the reverse ranking – *(**pí**.mes).ta.(**và**.le)* or *('**σ**σ)L(,**LL**)* is produced. Both right-alignment constraints are necessary here, unranked with respect to LAPSE-AT-END. ALIGN-BY-σ (FT, WD, R) chooses the ternary candidate in a case like *('**σ**σ)L(,**HL**)* [*(**pí**.mes).ta.(**vàs**.se)*], while ALIGN-BY-FT (FT, WD, R) selects *('**σ**σ)L(,**LL**)L*, or *(**ó**.sa).va.(**mà**.le).ki*. In both of these cases, the other right-alignment constraint cannot assist in choosing a candidate, because it creates a tie between the two viable candidates. Both of these constraints are encompassed by the gradient constraint ALIGN-R (FT, WD); however, categorical alignment constraints are used in this paper due to the typological issues raised by gradient constraints. (See McCarthy 2003)

(8) Unranked constraints producing variation

		ALIGN-BY-FT (FT, WD, R)	ALIGN-BY-σ (FT, WD, R)	LAPSE-AT-END
a)	→ ('σσ)(,LL)L	*	**!	
	→('σσ)L(,LL)	*	*	*!
b)	→ ('σσ)(,LH) L	*	**!	
	→ ('σσ)L(,HL)	*	*	*!
c)	→ ('σσ)(,LL)(,H)	**!	**!	
	→ ('σσ)L(,LH)	*	*	*!
d)	→ ('σσ)(,LH)(,H)	**!	**!	
	→ ('σσ)L(,HH)	*	*	*!
e)	→ ('σσ)(,LL)(,LL)	**!	**	
	→ ('σσ)L(,LL)L	*	**	*!
f)	→ ('σσ)(,LL)(,LL)	**!	**	
	→ ('σσ)L(,LL)L	*	**	*!

All three of these constraints must be unranked with respect to each other to get the proper observed alternations. If ALIGN-BY-FT (FT, WD, R) were above the others, the binary candidates in (8c-f) would never surface; similarly, if ALIGN-BY-σ (FT, WD, R) outranked the others, the binary candidates in (8a-8d) would never surface. On the other hand, if LAPSE-AT-END dominated both alignment constraints, the ternary pattern would never surface.

Estonian is a quantity sensitive language, and its regular stress pattern can be disrupted by heavy syllables. Heavy syllables generally get stressed in Estonian due to WSP. However, there will never be two adjacent stresses, even if there are two adjacent heavy syllables, as shown below. The winner in (10) has an unstressed heavy syllable, avoiding a clash; meanwhile, the loser is eliminated because of its clash, even though all heavy syllables are stressed.

(10) *CLASH >> WSP

/σσHH/	*CLASH	WSP
→ ('σσ)(,HH)		*
('σσ)(,H)(,H)	*!	

Additionally, FtBin is still preventing degenerate feet – even when the stress pattern has been interrupted with heavy syllables. In (11), the observed form has a non-final lapse while the loser has no lapses at all. However, the winner does better on FtBin because there are no degenerate feet; this shows the ranking provided below.

(11) FtBin >> Lapse-at-End

/σσLH/	FtBin	Lapse-at-End
→ ('σσ)L(,H)		*
('σσ)(,L)(,H)	*!	

WSP also must be unranked in the same stratum as the constraints listed above; that is, WSP is unranked with respect to Align-by-Ft (Ft, Wd, R), Align-by-σ (Ft, Wd, R), and Lapse-at-End. This causes the variation seen in words of the pattern *σσLH*, e.g. ***(té**.ra).(**và**.mal<t>)* vs. ***(té**.ra).va.(**màl**<t>)*, as shown below in (12). Both candidates are potential winners; they tie on the right-alignment constraints, but are each favored by a different constraint which is also unranked in the stratum. Specifically, WSP selects ***(té**.ra).va.(**màl**<t>)* because the heavy syllable is stressed even though there is a non-final lapse; on the other hand, Lapse-at-End chooses ***(té**.ra).(**và**.mal<t>)* because there are no lapses although it fails to stress the heavy syllable.

(12) WSP unranked, creating variation

	WSP	Align-by-Ft (Ft, Wd, R)	Align-by-σ (Ft, Wd, R)	Lapse-at-End
→ ('σσ)(,LH)	*	*	*	
→ ('σσ)L(,H)		*	*	*

It is also the case that sometimes the ternary rhythm is blocked. This happens in words with heavy syllables, in cases where the ternary rhythm would leave an unfooted heavy syllable. This is due to the undominated effects of Parse-2, as seen below. While a ternary pattern seems possible in the type of word shown in (13), it is not actually possible due to the fact that a heavy syllable is left unparsed. The winner adds an extra foot not present in the loser, violating the foot economy constraint; however, the binary pattern observed in the winner fully satisfies Parse-2. On the other hand, the loser (representing the ternary pattern) has two consecutive unparsed moras – a single heavy syllable – and violates the higher-ranked Parse-2 constraint.

(13) PARSE-2 >> ALIGN-BY-FT (FT, WD, R)

/σσHHLL/	PARSE-2	ALIGN-BY-FT (FT, WD, R)
→ ('σσ)(,HH)(,LL)		**
('σσ)*H*(,HL)L	*!	*

Adding this undominated constraint to the first stratum results in the following summary tableau. This tableau shows how undominated PARSE-2 blocks ternary rhythm in all of the required places. The losers in (14) are all candidates with ternary alternation; however, they never emerge because they all would cause a heavy syllable to be unparsed, thus violating PARSE-2. For example, six-syllable words can emerge with the ternary rhythm, as in *(**ó**.sa).va.(**mà**.le).ki*; however, as seen below, a six-syllable word like *(**vá**.ra)*.sei.*(**màt**.te).le* would not be permitted because it creates an unparsed heavy syllable.

(14) Summary Tableau of Blocked Ternarity

	PARSE-2	WSP	ALIGN-BY-FT (FT, WD, R)	ALIGN-BY-σ (FT, WD, R)	LAPSE-AT-END
→ ('σσ)(làt<t>)			*	*	
('σσ)lat<t>	*!	*		*	
→ ('σσ)(màt.tel<t>)		*	*	*	
('σσ)mat.(tèl<t>)	*!	*	*	*	*
→ ('σσ)(tàt.tu).te		*	*	**	
('σσ)tat.(tù.te)	*!	**	*	*	*
→ ('σσ)(sèi.mat).(tè.le)		*	**	**	
('σσ)sei.(màt.te).le	*!	*	*	**	*
→ ('σσ)(tùs.te).(lè.ki)		*	**	**	
('σσ)tus.(tè.le).ki	*!	**	*	**	*

The combination of rankings provided in this section account for the binary/ternary variation seen in Estonian; additionally, as seen above, these constraint rankings fully explain the instances where the ternary rhythm is blocked.

Chapter 4: Case Studies in Iambic Languages

1 Chugach Yupik[5]

Chugach Yupik (Leer 1985a, 1985b, 1985c) makes a two-way distinction between light and heavy syllables; CV syllables and non-initial CVC syllables are light, while CVV syllables and initial CVC syllables are heavy. In words with only light syllables, main stress is always on the second syllable. Secondary stress is then assigned on every third syllable in words of the length 3n and 3n+2; in words of the length 3n+1, secondary stress is placed on every third syllable, plus a word-final secondary stress.

(1) Chugach Yupik data with light syllables only

a) a.**tá**.ka
b) pi.**sú**.qu.ta.**qú**.ni

c) a.**kú**.ta.**mək**
d) ma.**ŋáχ**.su.qu.**tá**.qu.**ní**

e) a.**tú**.qu.ni.**kí**

Because stress in Chugach Yupik is regularly on the second syllable of the word and there can be word-final stress, feet must be iambic. As shown in (2), the winner has stress on the second syllable as well as word-finally due to parsing into iambic feet. The losing candidate is parsed into trochees, and no longer has stress in the observed places from Chugach Yupik.

(2) IAMB >> TROCHEE

/LLLL/	IAMB	TROCHEE
→ (L'L)(L,L)		**
('LL)(,LL)	*!*	

As mentioned above, main stress in words with light syllables is always on the second syllable; therefore, a foot must be aligned with the left edge of the word. As shown below, the winner contains a left-aligned foot, placing main stress where it belongs in Chugach Yupik. The loser fails to have the main stress foot aligned with the left edge of the word although it does not violate ALIGN-BY-σ (FT, WD, R).

(3) ALIGN-L (HD, WD) >> ALIGN-BY-σ (FT, WD, R)

/LLL/	ALIGN-L (HD, WD)	ALIGN-BY-σ (FT, WD, R)
→ (L'L)L		*
L(L'L)	*!	

[5] There are five major dialects of Yupik: Central Siberian Yupik, Naukan Yupik, and Sirenik Yupik in Siberia, and Pacific Yupik and Central Yupik in Alaska. Chugach Yupik is a dialect of Pacific Yupik spoken on the Alaskan coast from Cook Inlet to the Prince William Sound. All data and descriptive generalizations are taken from Leer (1985a, 1985b, 1985c) and Hayes (1995).

Ternary stress is caused by the ranking schema used throughout this paper: Extended Lapse Constraint >> Foot Economy Constraint >> Lapse Constraint. The specific constraints pertaining to this ranking in Chugach Yupik are *EXTENDED-LAPSE, right-alignment constraints, and *LAPSE. *EXTENDED-LAPSE outranks the right-alignment foot economy constraints, as shown in (4) and (5). In (4), the winner avoids an extended lapse by shifting the foot away from being aligned with the right edge of the word – violating ALIGN-BY-σ (FT, WD, R). The loser, on the other hand, better satisfies the alignment constraint but does so at the expense of creating an extended lapse.

(4) *EXTENDED-LAPSE >> ALIGN-BY-σ (FT, WD, R)

/LLLLLL/	*EXTENDED-LAPSE	ALIGN-BY-σ (FT, WD, R)
→ (L'L)L(L,L)L		**
(L'L)**LL(L**,L)	*!	*

Similarly, *EXTENDED-LAPSE must also outrank ALIGN-BY-FT (FT, WD, R) – the other right-alignment constraint. The winner in (5) again avoids an extended lapse through the addition of a foot; the loser fully satisfies the alignment constraint yet violates *EXTENDED-LAPSE.

(5) *EXTENDED-LAPSE >> ALIGN-BY-FT (FT, WD, R)

/LLLLL/	*EXTENDED-LAPSE	ALIGN-BY-FT (FT, WD, R)
→ (L'L)L(L,L)		*
(L'L)**LLL**	*!	

In keeping with the ranking schema, the Foot Economy Constraints must dominate all of the Lapse constraints. *LAPSE is used here to represent the family of lapse constraints; (6) and (7) show the right-alignment constraints – which were themselves outranked in (4) and (5) – dominating *LAPSE. In (6), the winner is more right-aligned than the loser, even though it performs worse on lapse. There are no lapses in the loser, but the non-head foot is not right-aligned.

(6) ALIGN-BY-σ (FT, WD, R) >> *LAPSE

/LLLLL/	ALIGN-BY-σ (FT, WD, R)	*LAPSE
→ (L'L)L(L,L)	*	*
(L'L)(L,L)L	*!*	

The winner in (7) also violates *LAPSE, but requires one less foot than the loser. The foot economy constraint is dominant here, which is why the loser is eliminated due to containing an additional foot.

(7) ALIGN-BY-FT (FT, WD, R) >> *LAPSE

/LLLLLL/	ALIGN-BY-FT (FT, WD, R)	*LAPSE
→ (L'L)L(L,L)L	*	*
(L'L)(L,L)(L,L)	*!*	

Additionally, PARSE-2 plays a role in Chugach Yupik. In words of 3n+1 syllables, an extra foot is added at the end of the word. As shown in (6) and (7), lapses are permitted elsewhere in Chugach Yupik – including earlier in a 3n+1 syllable word if it is long enough – so this extra foot must be the work of PARSE-2. Chugach Yupik allows two adjacent light syllables to be unstressed, as long as one of them is in a foot.

As (8) shows, an extra foot is required to satisfy PARSE-2 even though it is at the expense of foot economy. The winner in (8) fully satisfies PARSE-2 by never having two consecutive unfooted moras, which is accomplished through the addition of an additional foot; the loser outperforms the winner on foot economy, but fails to avoid pairs of consecutive unparsed moras.

(8) PARSE-2 >> ALIGN-BY-FT (FT, WD, R)

/LLLL/	PARSE-2	ALIGN-BY-FT (FT, WD, R)
→ (L'L)L(L,L)(L,L)		**
(L'L)L(L,L)*LL*	*!	*

PARSE-2 dominates both foot economy constraints; dominance over ALIGN-BY-FT is shown in (8) and dominance over ALIGN-BY-σ is shown below in (9). In the tableau below, the winner has an additional violation of the right-alignment constraint yet there are no pairs of consecutive moras that are unparsed. The loser has a pair of unparsed light syllables, even though it outperforms the winner on foot economy.

(9) PARSE-2 >> ALIGN-BY-σ (FT, WD, R)

/HLLH/	PARSE-2	ALIGN-BY-σ (FT, WD, R)
→ ('H)(L,L)(,H)		**
('H)*LL*(,H)	*!	*

Heavy syllables also occur in Chugach Yupik. As mentioned above, initial CVC syllables and any CVV syllables are heavy in Chugach Yupik. The data in (10) will be represented with L's and H's for the duration of this section.

(10) Chugach Yupik data with heavy syllables

a) **pín**.ka
b) **án**.ŋa.**qá**
c) **án**.či.qu.**kút**
d) **ná:**.qu.ma.**lú**.ku
e) **át**.ma.ku.**táχ**.tu.**tən**
f) **át**.saχ.su.**qú**.ta.qu.**ní**
g) **tán**.nəʁ.liχ.**sú**.qu.ta.**qú**.ni
h) **kúm**.la.či.**wí**.li.ya.**qú**.ta.qu.**ní**.ki

i) **ná:**.**qá:**
j) **kál**.**má:**.nuq

k) **át**.**tí:**
l) **čás**.**sá:**.i
m) **án**.či.**qúa**
n) **íq**.łu.**kí:**.ŋa
o) u.**xá**.či.**má:n**

p) **át**.max.**čí**.**qúa**
q) mu.**lú**.**kút**
r) u.**lú**.tə.ku.ta.**ʁá:**

Chugach Yupik is also a quantity sensitive language, due to a high ranking of WSP. In Chugach Yupik, heavy syllables must be stressed even at the expense of *CLASH, as shown in (11). The winner in (11) does not contain any unstressed heavy syllables; however, because there are two stressed syllables in a row it creates a clash. The loser has no clashes, but leaves a heavy syllable unstressed.

(11) WSP >> *CLASH

/HH/	WSP	*CLASH
→ ('H)('H)		*
('H)***H***	*!	

It must also be the case that WSP outranks foot economy constraints, because stressing all heavy syllables creates additional feet that would not be required simply for the avoidance of extended lapses, as shown in (12). The winner in (12) fully satisfies WSP, at the expense of adding another foot. In contrast, the loser fully satisfies ALIGN-BY-FT (FT, WD, R) yet fails to stress all heavy syllables.

(12) WSP >> ALIGN-BY-FT (FT, WD, R)

/HH/	WSP	ALIGN-BY-FT (FT, WD, R)
→ ('H)('H)		*
('H)***H***	*!	

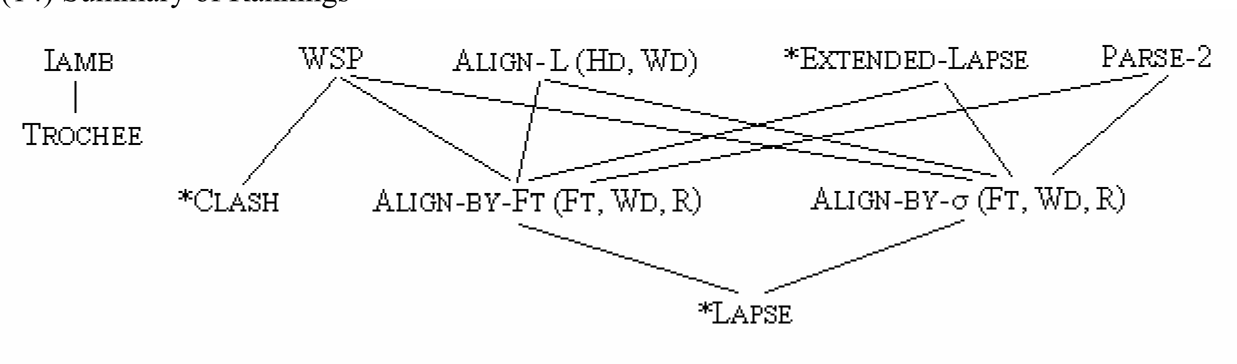
Similarly, in (13), the foot economy constraint ALIGN-BY-σ (FT, WD, R) is dominated by WSP for the same reasons. In this case, the winner still fully satisfies WSP but has two feet which are not right-aligned; the loser has only a single foot which is not right-aligned, but is eliminated for its failure to stress all heavy syllables.

(13) WSP >> ALIGN-BY-σ (FT, WD, R)

	/HHL/	WSP	ALIGN-BY-σ (FT, WD, R)
→	('H)('H)L		**
	('H)***H***L	*!	*

A summary of the rankings is provided in (14).

(14) Summary of Rankings



These ranking arguments combine to accurately explain all aspects of Chugach Yupik stress for words with only light syllables and for those which contain heavy syllables. LLDT is sufficient for the explanation of Chugach Yupik, and accurately accounts for all aspects of its stress system.

2 Winnebago[6]

The data on Winnebago's stress pattern has been disputed by linguists. Miner (1979) claims that Winnebago has a ternary alternation, while Hale and White Eagle (1980) claim that Winnebago has a binary alternation (after the third syllable). Hayes (1995 concludes that Winnebago has *both* binary and ternary alternation, although the reasons for their distribution are unclear. However, the data found in Hale and White Eagle (1980) and Miner (1979) each only capture part of the picture; when the data is combined, a clear ternary pattern emerges which can then be analyzed.

In this analysis of Winnebago, I will be using the combined data provided in Hayes (1995), which has data from Hale and White Eagle (1980), Miner (1979, 1981, 1989), Susman (1943), White Eagle (1982), and Halle (1990), along with an additional form from Miner (1979) that is unmentioned in Hayes. In words with only light syllables, either there is agreement on the data or only one source provides words of its length. In words with heavy syllables, however, there is disagreement; this will be looked at later in the chapter. To avoid this confound, we will

[6] Winnebago (also known as Ho-Chunk, Hocak Wazijaci, Hocák, Hocank, or Hochank) is a Native American language spoken by about 230 people in Wisconsin and Nebraska.

begin by looking at words with light syllables only. In Winnebago, long vowels or dipthongs result in a heavy syllable, while codas do not add to syllable weight.

Additionally, the Dorsey's Law data and phenomenon will not be discussed here. The interaction of stress and epenthesis sheds no light on the generalizations of ternary stress, and therefore is excluded from consideration for the purposes of this paper.

In words of at least three syllables, Winnebago consistently places main stress on the third syllable of the word. In words of six syllables or more, secondary stress is placed on every third syllable following the initial stress. In five syllable words, secondary stress is placed word-finally, on the second syllable after the main stress.

Here is the data on words with only light syllables (Hayes 1995, Miner 1979):

(1) Data listed by increasing word size

a) wa.**ĵé**
b) ho.ta.**xí**
c) ha.ra.**čá**.bra
d) ho.ki.**wá**.ro.**ké**
e) ho.ki.**wá**.ro.ro.**ké**
f) hi.i.**zú**.go.ki.**rús**.ge

(2) Data listed by word length categories, with feet

a) *less than 3*
(wa.**ĵé)**
b) *3n*
ho.(ta.**xí**)
ho.(ki.**wá**).ro.(ro.**ké**)
c) *3n+1*
ha.(ra.**čá**).bra
hi.(i.**zú**).go.(ki.**rús**).ge
d) *3n+2*
ho.(ki.**wá**).(ro.**ké**)

Winnebago is an iambic language, as shown by the word-final stress in two-syllable words. The winning candidate in (3) consists of a single iambic foot, while the loser consists of a single trochaic foot.

(3) IAMB >> TROCHEE

/LL/	IAMB	TROCHEE
→ (L'L)		*
('LL)	*!	

To get the general ternary alternation, a form of *EXTENDED-LAPSE must be undominated – as in other languages. As in the cases we've looked at so far, the primary motivation for iterative ternary stress is an extended lapse constraint >> foot economy constraints >> lapse constraints. For Winnebago, *EXTENDED-LAPSE is ranked above both of the right alignment constraints – ALIGN-BY-σ (FT, WD, R) and ALIGN-BY-FT (FT, WD, R).

In (5), the loser perfectly satisfies ALIGN-BY-σ (FT, WD, R) but contains extended lapses. The winner, on the other hand, contains no extended lapses even though it violates the alignment constraint by having more than one foot.

(5) *EXTENDED-LAPSE >> ALIGN-BY-σ (FT, WD, R)

/LLLLL/	*EXTENDED-LAPSE	ALIGN-BY-σ (FT, WD, R)
→ L(L'L)(L'L)		*
LLL(L'L)	*!*	

Similarly, the observed form in (6) has an additional foot but avoids extended lapses. The loser, on the other hand, perfectly satisfies the alignment constraint at the expense of creating extended lapses.

(6) *EXTENDED-LAPSE >> ALIGN-BY-FT (FT, WD, R)

/LLLLL/	*EXTENDED-LAPSE	ALIGN-BY-FT (FT, WD, R)
→ L(L'L)(L'L)		*
LLL(L'L)	*!*	

Because *EXTENDED-LAPSE must outrank all the foot alignment constraints to produce ternary alternation, the ranking of the alignment constraints is also crucial in determining where those feet will lie. In Winnebago, NONINITIALITY(FT) must also outrank the relevant foot alignment constraints to force the main stress onto the third syllable of the word. NONINITIALITY(FT) is a constraint which creates the effect of initial extrametricality (Halle & Vergnaud 1987, Kennedy 1994, Kenstowicz 1994, Alderete 1995, Hayes 1995, Kager 1995).

As can be seen in (7), the winner violates the left alignment constraint but perfectly satisfies NONINITIALITY(FT). On the other hand, the loser violates the noninitiality constraint and performs perfectly on the alignment constraint.

(7) NONINITIALITY(FT) >> ALIGN-BY-σ (FT, WD, L)

/LLLLL/	NONINITIALITY(FT)	ALIGN-BY-σ (FT, WD, L)
→ L(L'L)(L'L)		*
(L'L)(L'L)L	*!	

Additionally, to prevent extra feet from being produced, both ALIGN-BY-σ (FT, WD, R) and ALIGN-BY-FT (FT, WD, R) must outrank the lapse constraints. In (8) and (9) respectively, these constraints are shown outranking *LAPSE. In both tableaux, the winner does better than the loser on the alignment constraint, although it has more lapses. Both losers better satisfy the lapse constraint at the expense of violating the alignment constraint more. In (8), the alignment constraint is violated by shifting a foot leftward in avoidance of a lapse. In (9), the alignment constraint is violated by the addition of another foot.

(8) ALIGN-BY-σ (FT, WD, R) >> *LAPSE

/LLLLLL/	ALIGN-BY-σ (FT, WD, R)	*LAPSE
→ L(L'L)L(L'L)	*	**
L(L'L)(L'L)L	**!	*

In (8), ALIGN-BY-FT (FT, WD, R) could not explain why the observed form is chosen over the loser; there are equal numbers of feet in each candidate, and therefore there cannot be any additional feet intervening between a given foot and the word edge. In (9), on the other hand, ALIGN-BY-σ (FT, WD, R) could not explain why the winner is chosen. Because the rightmost foot in the loser is perfectly aligned with the right edge of the word, it will not receive a violation from ALIGN-BY-σ (FT, WD, R). Instead, both candidates would receive two violation marks for each of their non-right aligned feet.

(9) ALIGN-BY-FT (FT, WD, R) >> *LAPSE

/LLLLLLL/	ALIGN-BY-FT (FT, WD, R)	*LAPSE
→ L(L'L)L(L'L)L	*	**
L(L'L)(L'L)(L'L)	**!	*

Winnebago is a quantity sensitive language. Hayes (1995) breaks the data for words with heavy syllables into two sections – initial heavy syllables and non-initial heavy syllables. I will repeat these categories here, beginning with words which have heavy syllables non-initially.

(10) Words with non-initial heavy syllables

a) ha.(**ĵá:k**)
b) ki.(**rí:**).na

c) hit.(ʔat.**ʔá:k**)
d) hit.(ʔet.**ʔéi**).re
e) hi.(ža.**kí:**).čaš.(gu.**ní**)
f) hi.(ža.**kí:**).čaš.(gu.**nía**).(na.**gá**)

g) ha.(ra.**gí**).(**nái**).(**če**)
h) nik.(šik.**ší**).nik.(ĵa.**né:**).na
i) wa.(γi.**γí**).giš.(gap.**ʔúi**).(že.**ré**)
j) wa.(γi.**γí**).giš.(gap.**ʔúi**).(že.**réa**).(na.**gá**)

With this data, we can add more rankings to our analysis. First of all, WSP is definitely active in Winnebago as heavy syllables are stressed at the expense of shifting the stress pattern. For instance, in (10j), the expected pattern is **L(L'**L**)L(L'**H**)L(H'**L**)L*; however, the actual observed form is *L(L'**L**)L(L'**H**)L('**H**)(L'**L**)*. The reason for this extra foot – and, therefore, extra violation of a foot economy constraint – is that the heavy syllable must be stressed. This is an indication that WSP outranks the foot economy constraints.

As shown in the tableau in (11), the winner incurs an extra violation of ALIGN-BY-FT (FT, WD, R). However, the winner also perfectly satisfies WSP. On the other hand, the loser performs better on the foot economy constraint, yet leaves a heavy syllable unstressed.

(11) WSP>> ALIGN-BY-FT (FT, WD, R)

/LLLLLHLHLL/	WSP	ALIGN-BY-FT (FT, WD, R)
→ L(L'L)L(L'H)L('H)(L'L)		***
L(L'L)L(L'H)L(H'L)L	*!	**

There are also words of Winnebago with initial heavy syllables, as shown in (12).

(12) Words with initial heavy syllables

a) (ho:.**čák**)
b) (ho:.**čág**).ra
c) (ha:.**kí**).(tu.**ĵík**)
d) (wi:.**rá**).guš.(ge.**rá**)[7]

e) (na:.**wá:k**)
f) (bo:.**tá:**).na
g) (yu:.**kí:**).hi.(naŋ.**kí**)

NONINITIALITY(FT) is being violated in all of these cases. This is due to the ranking of PARSE-2 over NONINITIALITY(FT). As seen in (13), placing stress on the third syllable of the word as in the forms with only light syllables would cause a violation of PARSE-2. The winner satisfies PARSE-2 at the expense of violating NONINITIALITY(FT); on the other hand, the loser observes the noninitiality, yet there are two consecutive unparsed moras.

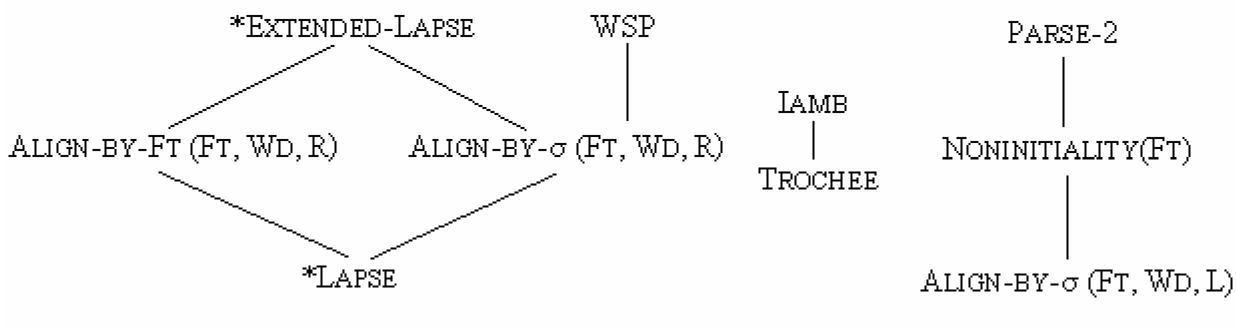
(13) PARSE-2 >> NONINITIALITY(FT)

/HLL/	PARSE-2	NONINITIALITY(FT)
→ (H'L)L		*
H(L'L)	*!	

A summary of all the rankings for Winnebago shown in this section can be seen in (14).

[7] The form in (12d) is disputed; Miner (1979) provides *(wi:.**rá**).guš.(ge.**rá**)*, the form given in (12d), while Hale and White Eagle (1980) provide *(wi:.**rá**).(guš.**gé**).ra*. The difference between *(wi:.**rá**).guš.(ge.**rá**)* and *(wi:.**rá**).(guš.**gé**).ra* is the difference between a binary and ternary alternation. A form like *(wi:.**rá**).(guš.**gé**).ra* is expected if lapse constraints outrank the right alignment constraint ALIGN-BY-σ (FT, WD, R). However, this does not conform to the pattern observed in all other forms in Winnebago. However, in either case, it is clear that NONINITIALITY(FT) is being violated in these cases.

(14) Summary of Rankings



This combination of rankings developed from LLDT adequately explains the stress pattern observed in Winnebago by Hale and White Eagle (1980) and Miner (1979).

Chapter 5: Conclusions

The analyses presented in chapters 2, 3, and 4 have shown that it is possible to account for all types of ternary stress systems using LLDT. In fact, as shown in chapter 2, the family of extended lapse constraints is crucial for the analysis of Tripura Bangla.

This paper has shown that it is possible to analyze ternary stress in OT using only binary feet; additionally, it is possible to analyze these languages without the aid of gradient alignment constraints. One of the crucial elements of LLDT is that it fully explains all systems of ternary stress without introducing constraints or other mechanisms just to account for ternarity; the other element is that it does so using only categorical constraints. As has been shown in the analyses of languages presented here, the only difference between binarity and ternarity is the length of lapses that are permitted or disallowed. LLDT exploits this distinction to explain the differences in these two language types in a natural way.

Additionally, the constraints proposed as part of LLDT are simply a synthesis of existing constraints: the positionally licensed lapse constraints (Lapse-at-End and Lapse-at-Peak) and the familiar *Extended-Lapse. As Lapse-at-End and Lapse-at-Peak are simply extensions of *Lapse, extending the same positional licensing to extended lapse constraints seems natural.

In addition to Lapse-at-End and Lapse-at-Peak, however, Kager (2001) also proposes *Initial-Lapse. This positional markedness constraint contrasts with Lapse-at-End and Lapse-at-Peak because, rather than allowing lapses in certain positions, it bans lapses in specific positions. This is not in the same spirit as the positionally licensed lapses that Kager (2001) proposes in the same lapse family.

It appears that there is no evidence for why a *Initial-Lapse constraint might be desirable. Kager (2001) presents a series of tableaux meant to show that unattested language types are harmonically bounded by the proposed family of lapse constraints. These tableaux are reproduced here as (1a-c).

(1) Tableaux from Kager (2001)

a) Lapses at non-word peaks

	Parse-Syl	*Lapse	*Initial-Lapse	Lapse-at-End	Lapse-at-Peak	Align-R
a. (02)(02)(02)(01)**0**	*					*
b. (02)(02)(02)**0**(01)	*	*		*		
5 c. (02)(02)**0**(02)(01)	*	*		*	*	
5 d. (02)**0**(02)(02)(01)	*	*		*	*	
5 e. **0**(02)(02)(02)(01)	*	*	*	*	*	

b) Bidirectionality gaps, head left

	PARSE-SYL	*LAPSE	*INITIAL-LAPSE	LAPSE-AT-END	LAPSE-AT-PEAK	ALIGN-L
a. (10)(20)(20)(20)0	*	*			*	
5 b. (10)(20)(20)0(20)	*	*		*	*	
5 c. (10)(20)0(20)(20)	*	*		*	*	
d. (10)0(20)(20)(20)	*	*		*		
e. 0(10)(20)(20)(20)	*			*		*

c) Bidirectionality gaps, head right

	PARSE-SYL	*LAPSE	*INITIAL-LAPSE	LAPSE-AT-END	LAPSE-AT-PEAK	ALIGN-L
a. (20)(20)(20)(10)0	*	*				
b. (20)(20)(20)0(10)	*	*		*		
5 c. (20)(20)0(20)(10)	*	*		*	*	
5 d. (20)0(20)(20)(10)	*	*		*	*	
e. 0(20)(20)(20)(10)	*			*	*	*

These tableaux show no evidence for *INITIAL-LAPSE; indeed, no evidence is given at any point in the paper for the existence of *INITIAL-LAPSE, and it is not included in the typologies described in Kager (2001).

If *INITIAL-LAPSE is a valid constraint, this predicts that *INITIAL-EXTENDED-LAPSE should also be a constraint. However, factorial typology says that – if *INITIAL-EXTENDED-LAPSE is a constraint – there should be a language where extended lapses are prohibited word-initially, but allowed elsewhere. This could produce strange typological effects. One of these strange languages is shown in (2).

(2) *INITIAL-EXTENDED-LAPSE Language

- a) ('σσ)
- b) σ('σσ)
- c) σσ('σσ)
- d) (,σσ)σ('σσ)
- e) σ(,σσ)σ('σσ)
- f) σσ(,σσ)σ('σσ)
- g) σσ(,σσ)σσ('σσ)
- h) σσ(,σσ)σσσ('σσ)

Once words hit a certain length in this imaginary language, there is persistent postpeninitial stress. This is clearly a strange pattern that we surely don't want our theory to account for. This is due to the effects of an undominated *INITIAL-EXTENDED-LAPSE, as shown below in (3).

(3) Eight-syllable words in the *INITIAL-EXTENDED-LAPSE Language

/σσσσσσσσ/	*INITIAL-EXTENDED-LAPSE	ALIGN-BY-σ (FT, WD, R)	*EXTENDED-LAPSE
→ σσ(,σσ)σσ('σσ)		*	*
(,σσ)(,σσ)(,σσ)('σσ)		**!*	
(,σσ)σ(,σσ)σ('σσ)		**!	
σ(,σσ)σσσ('σσ)		*	**
(,σσ)σσσσ('σσ)		*	**!*
σσσσσσ('σσ)	*!		***
('σσ)σσσσσσ		*	**!***
σσ('σσ)σσσσ		*	**!*

Perhaps it is possible that EXTENDED-LAPSE-AT-END and EXTENDED-LAPSE-AT-PEAK are both constraints, but not *INITIAL-EXTENDED-LAPSE. Because the family of extended-lapse constraints is meant to parallel the family of lapse constraints in Kager (2001), perhaps *INITIAL-LAPSE is also not a constraint. Like its extended lapse counterpart, *INITIAL-LAPSE can also cause typological problems. Cayuvava, a Bolivian language, has the following ternary pattern.

(4) Cayuvava data (Key 1967)

a)	(dá.pa)	'canoe'
b)	(tó.mo).ho	'small water container'
c)	a.(rí.po).ro	'he already turned around'
d)	a.ri.(pí.ri).to	'already planted'
e)	(à.ri).hi.(hí.be).e	'I have already put the top on'
f)	ma.(rà.ha).ha.(é.i).ki	'their blankets'
g)	i.ki.(tà.pa).re.(ré.pe).ha	'the water is clean'

In Cayuvava, *EXTENDED-LAPSE must outrank *INITIAL-LAPSE to allow the correct observed forms to surface; however, factorial typology predicts a case where *INITIAL-LAPSE would outrank *EXTENDED-LAPSE. This imaginary language, Cayuvava', is shown in (5).

(5) Cayuvava'

a)	(dá.pa)
b)	(tó.mo).ho
c)	a.(rí.po).ro
d)	a.(rí.pi).ri.to
e)	(à.ri).hi.(hí.be).e
f)	ma.(rà.ha).ha.(é.i).ki
g)	i.(kì.ta).pa.(ré.re).pe.ha

This does not seem like a reasonable human language. Five- and eight-syllable words must be accounted for separately from the rest of the language; there is not a single descriptive generalization that can apply across all words of Cayuvava'. Because *INITIAL-LAPSE predicts languages like this which seem to be intentionally unattested, yet has no helpful uses, it should not be a part of CON.

On the other hand, EXTENDED-LAPSE-AT-END predicts languages where long lapses are permitted only at the right edges of words. This is a plausible explanation for the attested phenomenon generally referred to as foot extrametricality. Foot extrametricality is when an entire foot is considered to be extrametrical, and stress can fall up to four syllables away from the edge of the word. Some languages, such as Egyptian Radio Arabic, are attributed with optional foot extrametricality; in these languages, stress falls on either of the two word-final feet – the last four syllables of the word. There are several other languages with this four syllable window word-finally, such as Palestinian Arabic, Hindi, and Cupeño. This phenomenon of foot extrametricality can easily be accounted for with EXTENDED-LAPSE-AT-END; in fact, this type of effect is exactly what the constraint predicts.

In conclusion, LLDT fully accounts for all known systems of ternary stress. It achieves this goal without the addition of any overly stipulative constraints, and the typological predictions made by the added constraints are accurate and represent attested languages. Additionally, LLDT can account for ternary rhythm using only categorical alignment constraints. In this paper, it has been shown that, through the use of LLDT, ternary stress systems can be seamlessly accounted for within the framework of OT.

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Appendix A

Discussion of languages that are not ternary.

Certain languages which are often referred to as having a ternary stress system are not included here, for two primary reasons. The first reason is lack of sufficient data. Two languages mentioned in a footnote of Levin (1988) are Kitja, and Mantjiltjara, for which adequate data does not exist; due to this lack of evidence, it is impossible to analyze whether or not these languages actually have a pattern of ternary stress. Another language in this category is Ioway-Oto, for which there is a description of a stress pattern in Whitman (1947) and Gordon (2002) refers to inferred data from this description; however, there isn't enough actual data to make any generalizations or analyses of Ioway-Oto. Another language in this category is Kiribati, also known as Gilbertese. Although it has been discussed in Blevins and Harrison (1999), the generalizations based on this data are hard to be sure of. Phonetic analysis of the stress patterns in Kiribati is required before another theoretical analysis can be attempted, due to the complicated interactions of stress in this language.

The other category of languages which have been characterized in the past as ternary but are not discussed in this paper are those which do not have an iterative ternary stress pattern. Several languages have a three-syllable window for stress, which is similar to the lapses between stresses in ternary stress languages, although it doesn't iterate across the word. For instance, Finnish described in Elenbaas (1999) occasionally has lapses which seem to resemble ternarity. In Finnish, it is possible to have a pattern that resembles ternary stress only in the situation where heavy syllables are disrupting the normal binary pattern. Because the heavy syllables attract the stress, they can alter the pattern in many ways. This especially looks like ternary stress when there are heavy syllables immediately following the light syllable that would usually get stress. Because stress is now falling on the third syllable instead of the second, it appears to be ternary stress. However, in words with only light syllables, stress is on every other syllable in the word -- a classic example of binary stress.

Additionally, there are languages like Auca where a lapse is created through the interaction of suffixes that have been marked for stress non-initially and words that have an odd-number of syllables and therefore do not end with a stressed syllable. Again, this only happens once per word and is not indicative of a ternary rhythm. There are also a number of languages where stress can fall on any of the final three syllables, which can create lapses. However, this window only occurs word-finally; there is no iterative pattern of marking stress on every third syllable. Therefore, these languages are not classified as ternary stress languages for the purposes of this paper.

Appendix B

Tripura Bangla data with heavy syllables, from Das 2001.

8. a. (ˊHL)		b. (ˊLH)	
mál.ʃa	'big metal bowl'	ɸá.til	'earthen pot'
aít.na	'verandah'	ká.rɔn	'reason'
c. (ˊHH)			
ʃɔ́r.kar	'government'		
tól.ɸar	'agitation'		

9. a. (ˊHL)L		b. (ˊHL)(Hˋ)	
ɸák.na.mi	'precocity'	útʃ.tʃa.rɔ̀n	'pronunciation'
nóŋ.ra.mi	'dirtiness'	bíg.ga.ɸɔ̀n	'advertisement'
c. (ˊHH)L		d. (ˊLL)(Hˋ)	
ʃɔ́m.pot.ti	'wealth'	ó.βi.ʃàɸ	'curse'
ʃ ˊn.tuʃ.t̪ɔ	'satisfied'	ɸó.ri.bɛ̀ʃ	'environment'
e. (ˊHH)(Hˋ)		f. L(ˊHL)	
ʃɔ́ŋ.rɔk.kɔ̀n	'reservation'	a.nɔ́n.dɔ	'pleasure'
ʃɔ́ŋ.kit.tɔ̀n	'singing hymns'	ɸo.rík.ka	'examination'
g. L(ˊHH)			
bi.ʃɔ́j.jɔn	'immersion'		
ɔ.hɔ́ŋ.kar	'pride'		

10. a. (ˊLL)(ˋHL)		b. L(ˊHL)(ˋH)	
ɔ́.na.sìʃ.t̪i	'a strange affair'	u.ɸɔ́s.tʰa.ɸɔ̀n	'presentation'
ó.nu.kɔ̀m.pa	'compassion'	o.bíg.ga.ɸɔ̀n	'intimation'
c. L(ˊHL)L		d.(ˊHL)(ˋHL)	
na.ríŋ.gi.ni	'pretentiousness'	ʃón.ni.bìʃ.t̪ɔ	'embedded'
a.bɔ́r.zɔ.na	'garbage'		

e. (´HL)LL		f. (´LL)(`HH)	
kúʈ.na.gi.ri	'mischievousness'	ó.β'i.nɔ̀n.dɔn	'congratulations'
dúr.gɔ.ʈɔ.na	'accident'	ɸó.ri.b `t.tɔn	'change'
g. (´LL)L(`H)		h. (´HH)LL	
ó.β'i.ba.bɔ̀k	'guardian'	báb.zaiʈ.ʈa.mi	'adamancy'
ɔ́.ma.no.ʃik	'inhuman'	ʃɔ́m.por.ki.tɔ	'related'
i. (´HL)L(`H)		j. (´HH)L(`H)	
ʃáŋ.bi.da.nìk	'constitutional'	dúr.bit.ta.yɔ̀n	'criminalization'
11. a. L(´HL)LL		b. (´LL)(`HL)L	
ɔ.ʃáb.da.nɔ.ta	'carelessness'	´.ʃ .mɔ̀t.ti.tɔ	'unconfirmed'
.b ´r.no.ni.yɔ	'indescribable'	ó.nu.bɔ̀t.ti.ta	'obedience'
c. (´HL)L(L̀L)		d. (´LL)L(`HH)	
ɸɔ́dʒ.dʒa.lɔ.sɔ̀.na	'deliberation'	ɔ́.nɔ.bɔ.lɔ̀m.bɔn	'resourcelessness'
		ɔ́.ɸo.ri.bɔ̀t.tɔn	'changelessness'
e. (´LL)L(`HL)		f. (´HL)L(`HL)	
ɔ́.ɸo.ri.hàidʒ.dʒɔ	'inevitable'	ɸɔ́k.kɔ.ɸa.tìt.tɔ	'partisanship'
ɔ́.ɸo.ri.ɸɔ̀k.kɔ	'immature'	ʃɔ́ŋ.kɔ.ʈa.ɸɔ̀n.nɔ	'beleaguered with crisis'
g. L(´HL)L(`H)		h. L(´ HH)L(`H)	
ɔ.ʃɔ́ŋ.zu.zɔ.nèr	'of non-addition'	ɔ.ʃɔ́ŋ.rok.ki.tèr	'of the unreserved'
ɔ.ʃɔ́ŋ.ʃu.dɔ.nèr	'of non-correction'	ɔ.ʃɔ́ŋ.lɔg.nɔ.tàr	'of inconsistency'
i. L(´HH)LL			
ɔ.ʃɔ́ŋ.rok.ki.tɔ	'unreserved'		
ɔ.ʃɔ́ŋ.lɔg.nɔ.ta	'inconsistency'		
12. a. (´LL)(`HL)LL		b. L(´HH)L(`LL)	
ɸá.rɔ.dɔ̀ʃ.ʃi.kɔ.ta	'expertness'	ɔ.ʃɔ́ŋ.rɔk.ko.nì.yɔ	'unreservable'
á.nu.ʃɔ̀ŋ.gi.kɔ.ta	'relatedness'		

c. (ˊLL)L(ˋHL)L | d. L(ˊHL)L(ˋLL)

ɔ́.ɸo.ri.bɔ̀t.ti.tɔ	'unchanged'	ɔ.ʃɔ́ŋ.zu.zo.nì.yɔ	'unattachable'
ɔ́.ɸro.ti.dɔ̀n.di.ta	'uncontestedness'		

(ˊLL)L(ˋHL)LL

13. ɔ́.ɸo.ri.bɔ́̀t.to.ni.yɔ 'unchangeable'

(ˊLL)L(ˋHL)L(ˋLL)

14. ɔ́.ɸo.ri.bɔ́̀t.to.ni.yɔ̀.ta 'unchangeability'