Metrical Grids and Active Edges

by

Daniel Asherov

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Author . . . .

Department of Linguistics and Philosophy
September 2023

Certified by . . . .

Donca Steriade
Professor of Linguistics
Thesis Supervisor

Certified by . . . .

Adam Albright
Professor of Linguistics
Thesis Supervisor

Accepted by . . . .

Daniel Fox
Anshen-Chomsky Professor of Language & Thought
Department Head

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Abstract

Theories of word stress assignment differ in the kind of representations they adopt. One family of theories asserts that stress is assigned by grouping stress-bearing elements into small units below the level of the word (typically, metrical feet), such that one element in each unit is marked as stronger, hence stressed (e.g., Liberman and Prince 1977; Hayes 1980). Another family of theories, often referred to as grid-only, models stress assignment without appealing to feet or similar bracketed representations above the syllable (Prince 1983; Selkirk 1984; Gordon 2002).
While the grid-only approach generates the attested languages with relatively simple representations, it also generates a host of patterns which are very different from those attested in human languages (Hayes 1995; Kager 2012; also see Stanton 2016).

This thesis aims to solve a set of overgeneration problems that arise in the grid-only approach. The solution involves three components. The first is a novel class of constraints that are sensitive to word edges but unspecified to the edge they apply to (left or right). The value of this edge, considered the "active" edge, is determined by the ranking between two competing constraints (cf. Richards 2016). The second component involves a specific characterization of alignment constraints and the crucial exclusion of computationally weaker or stronger alternatives. The third component is a set of principled fixed rankings between two classes of constraints. In particular, I propose that constraints sensitive to the active edge systematically outrank constraints that regulate rhythmic alternations (cf. van der Hulst 1997; 2012). The result is a grid-only theory of stress assignment that has a significantly tighter fit to the typology compared to previous theories.

Thesis supervisor: Donca Steriade
Title: Professor of Linguistics

Thesis supervisor: Adam Albright
Title: Professor of Linguistic

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TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION

In the past several decades, linguists have identified small sets of parameters that capture the ways in which the world's stress patterns vary vastly from one another, yet also bear nontrivial similarities. The restrictions that these patterns obey have been characterized as properties of rules and the representations they operate on in work by Liberman and Prince (1977), Hayes (1980; 1995), Prince (1983), Hammond (1984), Halle and Vergnaud (1987), Blevins (1990), and others. Later work has characterized these restrictions as properties of interacting constraints, including Prince and Smolensky (1993/2004), McCarthy and Prince (1993), Crowhurst and Hewitt (1995), Walker (1996), Alber (1997; 2005), Kager (1999; 2012), Kenstowicz (1997), Elenbaas and Kager (1999), Gordon (2002), de Lacy (2002), Buckley (2009), Rasin (2018), among many others.

Since Liberman and Prince (1977) introduced their metrical theory of stress, two grammatical components have played a central role in the literature on stress representation and assignment. The first is a hierarchical constituent structure, which groups two constituents at a time into larger constituents, such that one of the daughter constituents is marked as stronger than the other. The permissible configurations of this hierarchical structure and the categorization of different types of constituents has varied across theories over the years (e.g., Hayes 1980; 1995; Selkirk 1980; Kager 1995; Hyde 2002; and many others; also see Halle and Idsardi 1995 for another type of constituency).

The second component is the metrical grid, in which individual stressable units correspond to columns, which in turn consist of one or more grid marks. The relative height of the columns is interpreted as the relative prominence among the stressable units. A classic representation of a metrical grid of a prosodic word is given in FIGURE 1, with syllables as the basic stressable units. Each syllable projects one grid mark to level 0 of the grid. Some of the level 0 grid marks further project a level 1 grid mark. Syllables with a level 1 grid mark are more prominent than those without a level 1 grid mark and are labeled as *stressed*. Finally, one of the level 1 grid marks projects a level 2 grid mark, making the corresponding syllable more prominent than all the others, i.e., the one carrying the *primary stress*. Stressed syllables that do not carry the primary stress are typically labeled as carrying a *secondary stress*. This dissertation uses the common notation for primary and secondary stresses, with acute accent representing the former (σ́) and a grave accent representing the latter (σ̀).[1] When the distinction is irrelevant, all stressed syllables will be marked with an acute accent.

FIGURE 1: the metrical grid

x						2
x		x		x		1
x	x	x	x	x	x	0
σ́	σ	σ̀	σ	σ̀	σ	

Departing from Liberman and Prince's original proposal, Prince (1983) and Selkirk (1984) argued that the metrical grid is sufficient for stress computation across languages, and that grouping syllables (or other stressable units) into constituents is unnecessary. This approach, which I will call *grid-only* or *grid-based*, has also been pursued in constraint-based frameworks by Walker (1996), Gordon (2002), and Heinz, Kobele, and Riggle (2005).[2] The present dissertation aims to contribute to these efforts.

Current grid-only theories of stress generate most stress patterns attested in human languages. However, they also generate a wide range of patterns which are very different from those observed in human languages. Theories that fail to generate an attested pattern are said to have an *undergeneration* problem. Theories that generate patterns which are substantially different from those attested are said to have an *overgeneration* problem. Classes of patterns which are generated by a theory but are different from those attested are referred to as *pathological* patterns.

This dissertation develops a constraint-based grid-only theory of stress which addresses a set of overgeneration problems that the approach currently faces. The theory is couched in the Optimality Theory framework (henceforth: OT, Prince and Smolensky 1993/2004) as its predecessors in Walker (1996), Gordon (2002), and Heinz, Kobele, and Riggle (2005). OT adopts the premise that there exists a universal set of violable constraints, CON, and that the differences among languages lie in the ranking among those constraints. Another component of grammar, GEN, generates the

[1] These marks correspond to ˈσ and ˌσ in the International Phonetic Alphabet, respectively.
[2] For another approach to stress assignment that rejects feet and other types of constituent grouping see Scheer and Szigetvári (2005), Faust and Ulfsbjorninn (2018), and Faust (2023).

space of phonological forms considered by the grammar. The term *factorial typology* refers to the set of languages generated by all possible rankings of the constraints in CON (Prince and Smolensky 2004, 33). These rankings may include all permutations of the constraints, or a proper subset of those permutations characterized by universal fixed rankings among certain constraints. The predicted typology of linguistic patterns is taken to be the factorial typology generated by the set of constraints and partial universal rankings in CON given the space of phonological forms generated by GEN. It is the task of the linguist to find the right theory of CON and GEN which generates all attested patterns and avoids overgeneration of pathological patterns.

Alongside the factorial typology, other factors may also play a role in shaping the observed typology. A strong candidate for such a factor is the procedure by which humans learn their target language (Boersma 2003). This possibility has been explored in numerous studies over the years, including work by Alderete (2008), Bane and Riggle (2008), Heinz (2009), Staubs (2014), Stanton (2016), Subramaniam and Albright (2019), O'Hara (2021), Pater and Prickett (2022), and Lee et al. (2023), among others. The division of labour between the space of possible grammars and the restrictions on the procedure by which grammars are learned is an active research program; a study by Stanton (2016) examining this topic in the context of a specific typological gap will be discussed in §2.7.

The empirical generalizations in this dissertation are drawn mostly from the data available in StressTyp2 (Goedemans, Heinz, and van der Hulst 2015), a cross-linguistic survey of stress systems which includes 754 languages or language varieties across the majority of known language families, as well as Gordon's (2002) survey of 262 quantity-insensitive patterns, and Kager's (2012) survey of 293 stress window systems, some of which are not included in StressTyp2.

The theory constructed here has three key properties that provide a tighter fit between the grammatical theory of stress and the observed typology compared to its predecessors. The first property is that most edge-sensitive constraints refer to a single edge, which is independently determined by other constraints. The second is that alignment constraints are nonlocal, but sensitive only to the stressed syllable closest to the edge. Finally, the third property is that (most) edge-sensitive constraints universally dominate constraints on rhythmic alternation.

The dissertation is structured around each of these three properties. In Chapter 2, I argue for a set of edge-neutral constraints, which are sensitive to one edge of the prosodic word. In Chapter 3, I discuss the computational properties of three types of stress alignment constraints and show that only one of them avoids overgeneration. In Chapter 4, I turn to constraints on rhythmic alternation and their relation to edge-sensitive constraints. Finally, Chapter 5 provides a calculation of the factorial typology of the theory as a whole and compares it to other constraint-based grid-only theories of stress.

Chapter 2: One active edge

2.1. Introduction

In most constraint-based theories of stress, edge-bound stress assignment is modeled as a competition between constraints that attract stresses (or feet) to the right edge and those that attract them to the left edge (McCarthy and Prince 1993). In single-stress languages, whichever among these constraints is ranked highest determines the edge with respect to which the stress is assigned.

Alignment constraints sensitive to word edges penalize the distance between edges and stressed syllables. The specific alignment constraints in (1) penalize every syllable that separates some specific edge from its nearest stress. There are multiple conceivable ways to implement alignment constraints, which will be discussed extensively in Chapter 3.

(1) Edge-specific alignment constraints

ALIGN/R	Assign one * for each syllable separating the right edge from the nearest stressed syllable
ALIGN/L	Assign one * for each syllable separating the left edge from the nearest stressed syllable

Edge-sensitive anti-lapse constraints (henceforth “ESAL”; Alderete 1999; Gordon 2002) penalize sequences of unstressed syllables near an edge. These constraints are useful for modeling bounded languages in which stress is restricted to a disyllabic or trisyllabic window at some edge. The grid-only constraint set in Gordon includes four ESAL constaints, given in (2), which differ in the length of the prohibited lapse and the specific edge they refer to.[3]

[3] Throughout this dissertation I will deviate from constrains’ definition in cited work whenever the original definition does not explicitly state how violations are counted.

(2) Edge-sensitive anti-lapse constraints which refer to a specific edge (based on Gordon 2002)

*LAPSE/R	Assign one * for a sequence of two unstressed syllables at the right edge
*LAPSE/L	Assign one * for a sequence of two unstressed syllables at the left edge
*EXTLAPSE/R	Assign one * for a sequence of three unstressed syllables at the right edge
*EXTLAPSE/L	Assign one * for a sequence of three unstressed syllables at the left edge

In this chapter, I argue for an alternative view of grid-based stress assignment, according to which grammars only have one set of edge-sensitive constraints. The argument comes from an overgeneration problem, identified by Kager (2012), which arises due to the competition among ESAL constraints. I will show that the problem is not inherent to ESAL constraints, but rather to their formulation as referring to prespecified edges (right or left). I will propose that most edge-sensitive constraints, including ESAL constraints, refer to a single variable edge, the *active edge*, whose position is independently determined by the grammar. I will then discuss two constraints that deviate from this generalization and which reflect asymmetrical properties of the two edges.

The structure of the chapter is as follows. In §2.2, I discuss the overgeneration problem that arises from edge-prespecified ESAL constraints following Kager (2012). The subsequent sections will be dedicated to the description of the alternative approach. In §2.3, I define a basic set of constraints which are sensitive to the active edge, as well as constraints that determine which edge is active. §2.4 is dedicated to a necessary restriction on the possible rankings among these constraints. I then propose in §2.5 two edge-specific constraints, which capture the limited phenomena in which both edges play a role in stress assignment. The next section, §2.6, discusses primary stress assignment. Finally, in §2.7 I consider a learnability-based explanation for the overgeneration problem and discuss some problems it encounters.

2.2. The midpoint problem

The term MIDPOINT PATHOLOGY, defined in (3), refers to patterns in which an object is drawn towards a middle position in a form (Eisner 1997; Hyde 2008; 2015). Here, I will use it to refer specifically to cases in which stress is drawn to the middle of the word in words of certain lengths in deviation from some regular edge-sensitive pattern (Kager 2012; Stanton 2016).[4] Consider the two stress systems in (4). In pattern (4a), stress is fixed at the right edge of the word in the usual case, but is penultimate in four-syllable words, and antepenultimate in five-syllable words. This is a midpoint system because stress is drawn towards the middle of the word specifically in words of four or five syllables, but is final otherwise. Pattern (4b) is sensitive to some stress-attracting property ("designated property" in Kager 2012, enforced by the constraint DPS for "Designated Property to Stress"), such as long vowels or underlying accents, and the curly brackets mark the edges of the stressable window. In this pattern, the usual stressable window includes the last three syllables of the word (two in disyllabic words), but it contracts to include only the penult and the antepenult in four-syllable words, and only the antepenult in five-syllable words. Pattern (4b), like (4a), is a midpoint system because stress is drawn to the middle of the word in words of certain lengths, deviating from the otherwise regular trisyllabic window at the right edge.

(3) MIDPOINT PATHOLOGY: a family of patterns in which stress is drawn towards the middle of the word in words of certain lengths in a way that deviates from some regular edge-sensitive pattern

[4] This definition is narrower than that in Eisner and Hyde and is designed to capture the pathologies generated by some of the grid-only theories of stress considered here. It is also broader than Stanton's definition, who uses the term to describe systems in which "the stressable window contracts to a single word-internal syllable in some words, but not others." I adopt the definition in (3) to include languages in which the stressable window always includes only one syllable because of a high-ranked alignment constraint (e.g., pattern 4a).

(4) Two midpoint patterns

a. Fixed stress *EXTLAPSE/R >> *EXTLAPSE/L >> ALIGN/R >> …		b. Stress window *EXTLAPSE/R >> *EXTLAPSE/L >> DPS >> …	
σ **σ́**	ultima	{**σ σ**}	disyllabic window
σ σ **σ́**	ultima	{**σ σ σ**}	trisyllabic window
σ σ **σ́** σ	**penult**	σ {**σ σ**} σ	**disyllabic** window
σ σ **σ́** σ σ	**antepenult**	σ σ {**σ**} σ σ	**monosyllabic** window
σ σ σ σ σ **σ́**	ultima	σ σ σ {**σ σ σ**}	trisyllabic window

Kager showed that midpoint systems such as those in (4) are generated by grid-only theories which rely on ESAL constraints to restrict the distance of stress from the edges of the word. Midpoint systems arise when two (or more) ESAL constraints referring to opposite edges are ranked high. This is because in words of certain lengths, the only way to satisfy them simultaneously is to place the stress near the middle of the word. The two patterns in (4) are generated by grammars in which *EXTLAPSE/R is ranked above *EXTLAPSE/L, and both are ranked above the other stress constraints.

To see this, consider the grammar in (5), which generates pattern (4a). In words with three syllables (5-i), any stressed position would satisfy both *EXTLAPSE/R and *EXTLAPSE/L, so stress is placed on the ultima (candidate a) to satisfy ALIGN/R, which in turn dominates ALIGN/L. In words with four syllables (5-ii), stress cannot fall on the ultima (candidate a), because this would violate *EXTLAPSE/L. Among the remaining candidates, penultimate stress (candidate b) is the one that satisfies both *EXTLAPSE/L and *EXTLAPSE/R with the lowest number of violations of ALIGN/R. In words with five syllables (5-iii), there is only one stressed position which satisfies both *EXTLAPSE/R and *EXTLAPSE/L, namely the antepenultimate syllable (candidate c). In words with six syllables (5-iv) or more there is no stressed position which would satisfy *EXTLAPSE/R and *EXTLAPSE/L simultaneously. Since the former is ranked above the latter, stress falls on the final syllable (candidate a), which is the one that satisfies *EXTLAPSE/R with the lowest number of violations of ALIGN/R. The window-based pattern (4b) is generated by a similar grammar, except that ALIGN/R is dominated by a DPS constraint.

(5) Grammar generating pattern (4a)

			*EXTLAPSE/R	*EXTLAPSE/L	ALIGN/R	ALIGN/L
i. σσσ						
☞	a.	σσ**σ́**				**
	b.	σ**σ́**σ			*!	*
	c.	**σ́**σσ			*!*	
ii. σσσσ						
	a.	σσσ**σ́**		*!		***
☞	b.	σσ**σ́**σ			*	**
	c.	σ**σ́**σσ			**!	*
	d.	**σ́**σσσ	*!		***	
iii. σσσσσ						
	a.	σσσσ**σ́**		*!		****
	b.	σσσ**σ́**σ		*!	*	***
☞	c.	σσ**σ́**σσ			**	**
	d.	σ**σ́**σσσ	*!		***	*
	e.	**σ́**σσσσ	*!		****	
iv. σσσσσσ						
☞	a.	σσσσσ**σ́**		*		*****
	b.	σσσσ**σ́**σ		*	*!	****
	c.	σσσ**σ́**σσ		*	*!*	***
	d.	σσ**σ́**σσσ	*!		***	**
	e.	σ**σ́**σσσσ	*!		****	*
	f.	**σ́**σσσσσ	*!		*****	

The property of ESAL constraints which gives rise to midpoint patterns is that the domains which require stress at opposite word edges overlap in words of certain lengths. For example, in words with five syllables, the trisyllabic domain of *EXTLAPSE/R at the end of the word overlaps with the trisyllabic domain of *EXTLAPSE/L at the beginning of the word. The overlap includes exactly one syllable, the one in the antepenultimate (and postpeninitial) position.

In most foot-based theories, domains cannot overlap because each syllable is parsed into maximally one foot (but see Hyde 2012). Bounded stress systems are modeled as those in which feet are either attracted to the right edge (if ALIGNR(FT,ω) >> ALIGNL(FT,ω)) or to the left edge (if the opposite ranking holds). Unlike in the case of ESAL constraints, the tension between ALIGNR(FT,ω) and ALIGNL(FT,ω) cannot be eliminated by shifting the position of the stressed syllable (or the foot) away from one of the word edges. Assuming feet are maximally binary, words longer than two syllables which have a single foot would be incapable of satisfying ALIGNL(FT,ω) and ALIGNR(FT,ω) simultaneously. This is illustrated in (6) for words with four syllables.

(6) A foot in the center of the word does not solve the tension between two alignment constraints

4σ	ALIGNR(FT,ω)	ALIGNL(FT,ω)
a. σσ[σσ**]**		**
b. σ[σσ]**σ**	*	*
c. [σσ]σσ	**	

The foot-based constraint set does not generate the pattern in (4a) because there is no consistent ranking compatible with all words in the pattern. This is shown in (7) (the midpoint candidates from pattern (4a) are marked with 'MP'). The foot-based grammar that assigns stress to the ultima in words of three and six syllables (7-i,iv) is one that places an iamb at the right edge of the word; the necessary rankings for generating this configuration are IAMB>>TROCHEE and ALIGNR(FT,ω)>>NONFIN(FT). Penultimate stress in words with four syllables, however, is incompatible with this ranking combination (7-ii). Stress on the penult can be derived either with a right-aligned trochee, which requires the ranking TROCHEE>>IAMB, or alternatively with an iamb separated from the end of the word by an unparsed syllable, which requires the ranking NONFIN(FT)>> ALIGNR(FT,ω). Furthermore, antepenultimate stress in words with five syllables (7-iii) requires a trochaic foot that precedes an unparsed final syllable; this configuration requires two rankings which are incompatible with a final-stress grammar, namely TROCHEE>>IAMB and NONFIN(FT)>> ALIGNR(FT,ω).

(7) Midpoint pattern (4a) gives rise to a ranking paradox in a foot-based approach

			IAMB	TROCHEE	ALIGNR (FT,ω)	NONFIN(FT)	ALIGNL (FT,ω)
i. σσσ							
☞	a.	σ[σ**σ́]**		*		*	*
	b.	σ[**σ́**σ]	*!			*	*
	c.	[σ**σ́]**σ		*	*!		
ii. σσσσ							
☞	a.	σσ[σ**σ́]**		*		*	**
MP	b.	σσ[**σ́**σ]	*!			*	**
MP	c.	σ[σ**σ́]**σ		*	*!		*
	d.	σ[**σ́**σ]σ	*!		*		*
iii. σσσσσ							
☞	a.	σσσ[σ**σ́]**		*		*	***
	b.	σσσ[**σ́**σ]	*!			*	***
	c.	σσ[σ**σ́]**σ		*	*!		**
MP	d.	σσ[**σ́**σ]σ	*!		*		**
iv. σσσσσσ							
☞	a.	σσσσ[σ**σ́]**		*		*	****
	b.	σσσσ[**σ́**σ]	*!			*	****
	c.	σσσ[σ**σ́]**σ		*	*!		***
	d.	σσ[**σ́**σ]σσ	*!		**		**

Recall that the reason that ESAL constraints give rise to midpoint patterns is that they impose overlapping requirements at opposite edges. In words of a certain lengths, the stressed positions that satisfy the stress requirements at both edges are limited to a domain in the middle of the word. This overgeneration problem does not arise if the stress-demanding constraints are precluded from being active simultaneously at both edges.

Parametric theories of stress (Prince 1983; Halle and Vergnaud 1987; Halle and Idsardi 1995; Hayes 1995) have this property.[5] In Prince's (1983) grid-only theory of stress, a directionality parameter ("D") determines the edge from which grid construction begins, while a separate altitude parameter ("A") determines whether the first element at this edge starts with a peak or a trough.[6]

[5] This is also true for non-parametric rule-based theories of stress (Chomsky and Halle 1968); I focus on parametric theories because they take the choice of the edge with respect to which the stress is assigned to be independent from other aspects of stress placement, similarly to the constraints considered here.
[6] Yet another parameter, E (for "edge"), determines the edge with respect to which primary stress and extrametricality are determined.

In what follows, I propose a grid-based constraint set that adopts the premise that all ESAL constraints (and most edge-sensitive stress constraints in general) “see” the same word edge in a given candidate.

2.3. The active edge hypothesis

Each of the ESAL constraints in (2) refers to a prespecified edge, either the beginning of the word or its end. *LAPSE/R and *LAPSE/L prohibit a two-syllable lapse at the right and left edge, respectively. *EXTLAPSE/R and *EXTLAPSE/L prohibit lapses spanning over three syllables at their respective edges.

If the set of constraints in CON is universal, all four constraints should in principle be able to affect stress placement in a single language. In the previous section, we saw that this property of ESAL constraints makes undesirable predictions for the typology of stress. Specifically, some of the grammars in which two ESAL constraints are satisfied at opposite edges generate midpoint patterns, which are typologically unattested.

While the grid-only approach to stress relies on ESAL constraints, it is not necessary that they be prespecified to a specific edge, left or right, in CON. In what follows, I propose that ESAL constraints are instead defined with respect to a variable, which I will refer to as the *active edge* (cf. Richards 2016 on active edges in the syntax-phonology interface). Violations of ESAL constraints are calculated relative to whichever edge is active in the candidate under evaluation, the right edge or the left edge.

The active edge is independently determined by the relative ranking between two constraints, EDGE[R] AND EDGE[L], defined in (8).

(8) Constraint dictating which edge is active

EDGE[R]	Assign one * if the right edge is inactive
EDGE[L]	Assign one * if the left edge is inactive

The exclusion of candidates in which both edges are active can be achieved in several ways. One possibility is to postulate a restriction on GEN that limits the number of active edges in a candidate to exactly one. Another possibility is to define each of the two EDGE[R/L] constraints as demanding the exclusion of an active edge at the opposite edge. Since the outcome seems to be equivalent, I will assume the former. This restriction is stated in (9).

(9) RESTRICTION ON GEN: Candidates have exactly one active edge

The active edge will be marked with a superscript 'A'. The selection of the active edge is illustrated in (10).

(10) Evaluation of candidates with active edges

	σσσσσ	EDGE[R]	EDGE[L]
a.	$σσσσσ]^A$		*
b.	$^A[σσσσσ$	*	

The ranking between EDGE[R] and EDGE[L] approximates Prince's (1983) directionality parameter. I will return to this point in the following subsection.

I adopt the null hypothesis that all edge-sensitive constraints on stress assignment refer to the active edge. I will revisit this hypothesis in §4, where two specific constraints will be defined with respect to the beginning of the word or its end.

The first set of constraints sensitive to the active edge is given in (11). These constraints are sufficient to capture languages in which stress is consistently assigned to one of the first or last three syllables. ALIGN/E attracts the stress to the active edge. It is not violated if the syllable at the active edge is stressed, violated once if the nearest stress is one syllable away, and so forth. NONPERIPH/E and EXTNONPERIPH/E are stress-repelling constraints. They are violated if the syllable closest to the active edge (NONPERIPH/E) or if either of the two syllables closest to the active edge (EXTNONPERIPH/E) is stressed.

(11) Some constraints that are sensitive to the active edge

ALIGN/E — Assign one * for each syllable separating the active edge from the nearest stressed syllable

NONPERIPH/E — Assign one * for a stressed syllable at the active edge

EXTNONPERIPH/E — Assign one * for a sequence of two syllables at the active edge if either of them is stressed

Tableaux (12), (13), and (14) illustrate grammars that produce final stress, penultimate stress, and antepenultimate stress, respectively. In all three grammars, the stress is positioned near the right edge of the word due to the ranking EDGE[R]>>EDGE[L] and the effect of ALIGN/E. The choice among the three right-most syllables is determined by the relative ranking between ALIGN/E and each of NONPERIPH/E and EXTNONPERIPH/E. When ALIGN/E dominates both NONPERIPH/E and EXTNONPERIPH/E, stress falls on the ultima (12). When ALIGN/E dominates EXTNONPERIPH/E, but not NONPERIPH/E, the result is penultimate stress (13). Finally, when EXTNONPERIPH/E dominates ALIGN/E, stress falls on the antepenult (14).

(12) Grammar generating final stress in the active-edge approach

	σσσσσ	EDGE[R]	EDGE[L]	ALIGN/E	NONPER/E	EXTNON PER/E
☞ a.	σσσσ**σ́**]A		*		*	*
b.	σσσ**σ́**σ]A		*	*!		*
c.	σσ**σ́**σσ]A		*	*!*		
d.	A[σσ**σ́**σσ	*!		**		
e.	A[σ**σ́**σσσ	*!		*		*
f.	A[**σ́**σσσσ	*!			*	*

(13) Grammar generating penultimate stress in the active-edge approach

	σσσσσ	EDGE[R]	EDGE[L]	NON PER/E	ALIGN/E	EXTNON PER/E
a.	σσσσ**σ́**]A		*	*!		*
☞ b.	σσσ**σ́**σ]A		*		*	*
c.	σσ**σ́**σσ]A		*		**!	
d.	A[σσ**σ́**σσ	*!			**	
e.	A[σ**σ́**σσσ	*!			*	*
f.	A[**σ́**σσσσ	*!		*		*

(14) Grammar generating antepenultimate stress in the active-edge approach

	σσσσσ	EDGE[R]	EDGE[L]	NON PER/E	EXTNON PER/E	ALIGN/E
	a. σσσσ**σ́**]A		*	*!	*	
	b. σσσ**σ́**σ]A		*		*!	*
☞	c. σσ**σ́**σσ]A		*			**
	d. A[σσ**σ́**σσ	*!				**
	e. A[σ**σ́**σσσ	*!			*	*
	f. A[**σ́**σσσσ	*!		*	*	

So far, I have shown that the constraints in (11) are sufficient to capture fixed stress near word edges. However, they do not generate window systems, in which stress may fall on any of two or three syllables at a specific edge, but not anywhere else. In Gordon's system, the constraints responsible for such patterns are the edge-specific ESAL constraints in (2). As discussed in the previous section, these constraints give rise to the midpoint problem.

The active edge system advocated here includes two ESAL constraints, defined in (15). Both constraints refer to the active edge, and they differ only in the length of the prohibited lapse; *LAPSE/E prohibits a sequence of two unstressed syllables at the active edge, while *EXTLAPSE/E prohibits a sequence of three.

(15) Edge-sensitive anti-lapse constraints sensitive to the active edge

*LAPSE/E	Assign one * for a sequence of two unstressed syllables at the active edge
*EXTLAPSE/E	Assign one * for a sequence of three unstressed syllables at the active edge

Grammars in which one (or both) of the ESAL constraints is ranked above a DPS constraint (e.g., constraint attracting stress to long vowels or underlying accents) generate window systems. The opposite ranking generates unbounded stress systems, where stress is not limited to a domain at one of the edges. In window systems, the default position of stress is determined by the relative ranking of the active edge constraints in (11).

Tableau (17) illustrates the grammar of a window system, in which stress falls on the right-most heavy syllable within the last three syllables, but if all three are light, it falls on the ultima, even if there is a heavy syllable preceding the antepenult. The DPS constraint responsible for attracting stress to heavy syllables is WSP (for WEIGHT-TO-STRESS, Prince 1990), defined in (16). In (17-i), the antepenultimate syllable is heavy and all other syllables are light. The candidate with stress on the antepenult (candidate c) is the winner because it violates neither *EXTLAPSE/E nor WSP, while the other candidates violate one or both of them. In (17-ii), the only heavy syllable lies outside of the final trisyllabic window; since *EXTLAPSE/E dominates WSP, the candidate with stress on the heavy syllable (candidate d) is eliminated. None of the last three syllables is heavy, and therefore stress falls on the candidate with the lowest number of violations of ALIGN/E, which is the candidate with final stress (candidate a).

(16) WSP   Assign one * for each heavy syllable which is unstressed

(17) Grammar generating Quantity-sensitive stress limited to the last three syllables

	*EXTLAPSE/E	WSP	ALIGN/E
i. σσσ̄σσ			
a. σσσ̄σ**σ́**]^{A}		*!	
b. σσσ̄**σ́**σ]^{A}		*!	*
☞ c. σσ**σ̄́**σσ]^{A}			**
d. σ**σ́**σ̄σσ]^{A}	*!	*	***
e. **σ́**σσ̄σσ]^{A}	*!	*	****
ii. σσ̄σσσ			
☞ a. σσ̄σσ**σ́**]^{A}		*	
b. σσ̄σ**σ́**σ]^{A}		*	*!
c. σσ̄**σ́**σσ]^{A}		*	*!*
d. σ**σ̄́**σσσ]^{A}	*!		***
e. **σ́**σ̄σσσ]^{A}	*!	*	****

In the next section, I show that EDGE[L] and EDGE[R] must occupy an upper stratum in the ranking hierarchy, above the other constraints on stress assignment.

2.4. Interaction between EDGE[R/L] and other constraints

In the system outlined above, edge-sensitive constraints are evaluated relative to an active edge, whose position is in turn determined by the ranking between two other constraints, EDGE[L] and EDGE[R]. Since these constraints are violable, an active-edge theory that allows them to be dominated by other constraints generates a set of pathological patterns which I will refer to as CONDITIONAL EDGE SELECTION patterns, defined in (18).[7] Conditional edge selection occurs when the higher-ranked ACTIVE EDGE constraint must be violated in order to satisfy a constraint that dominates it.

(18) CONDITIONAL EDGE SELECTION PATHOLOGY: a family of patterns in which the edge with respect to which stress is assigned depends on the properties of certain syllables

The three patterns in (19) are examples of conditional edge selection and are generated by grammars in which both EDGE[R] and EDGE[L] are dominated by a constraint against stressed syllables containing some stress-repelling properties ("REP" for "Repel"), such as a nucleus containing a schwa (see §3.2 for a detailed discussion), denoted as σ̆. In pattern (19a), stress falls by default on the ultima, but when the ultima has a stress-repelling property, it falls on the initial. The grammar that generates this pattern, shown in (20), is one in which REP and ALIGN/E dominate EDGE[R], which in turn dominates EDGE[L]. In pattern (19b), stress shifts to the opposite edge only if both the penult and the ultima have a stress-repelling property. This happens when the constraints that dominate EDGE[R] are REP and *LAPSE/E.[8]

[7] Such patterns also arise from constraints that are both edge-specific and local. I will return to this issue in Chapter 3.
[8] In the patterns in (19), stress shifts away from certain syllables due to a stress-repelling property. The problem extends also to patterns in which stress shifts towards syllables at the opposite edge of the word due to stress-attracting properties, such as syllable weight.

(19) Conditional edge selection patterns

a. Peripheral at the right edge → Peripheral at the left edge

i. σ σ σ σ **σ́** ultima
ii. **σ́** σ σ σ σ̆ initial

b. Disyllabic window at the right edge → disyllabic window at the left edge

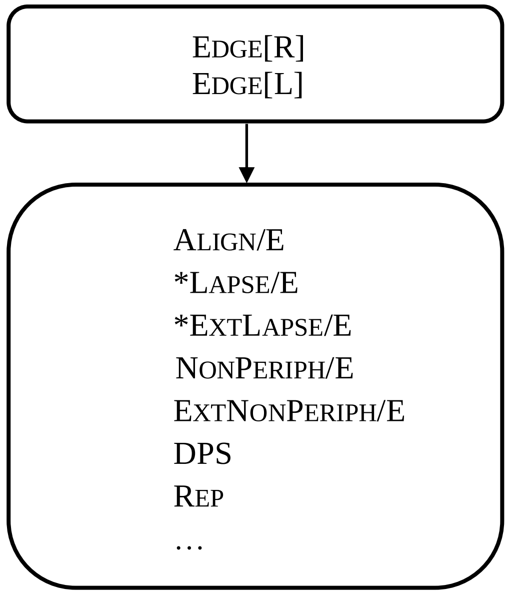
i. σ σ σ σ **σ́** ultima
ii. σ σ σ **σ́** σ̆ penult
iii. **σ́** σ σ σ̆ σ̆ initial
iv. σ̆ **σ́** σ σ̆ σ̆ peninitial

(20) Grammar generating the conditional edge selection pattern in (19a)

			Rep	Align/E	Edge[R]	Edge[L]
i.		σσσσσ				
☞	a.	σσσσ**σ́**]^{A}				*
	b.	σσσ**σ́**σ]^{A}		*!		*
	c.	^{A}[**σ́**σσσσ			*!	
	d.	^{A}[σ**σ́**σσσ		*!	*	
ii.		σσσσσ̆				
	a.	σσσσ**σ̆́**]^{A}	*!			*
	b.	σσσ**σ́**σ̆]^{A}		*!		*
☞	c.	^{A}[**σ́**σσσσ̆			*	
	d.	^{A}[σ**σ́**σσσ̆		*!	*	

Since patterns like those in (19) arise only when both Edge[R] and Edge[L] are dominated by another constraint, a minimal modification to the active-edge theory suffices to exclude them: Edge[R] and Edge[L] occupy a superior stratum in the ranking hierarchy, such that they are universally ranked above the other constraints on stress. A summary of the proposed constraint set and universal rankings so far is given in Figure 2 (using DPS for stress-attracting constraints and Rep for stress-repelling constraints). We will revise this characterization of Con in the following chapters.

FIGURE 2: illustration of the proposed fixed rankings in CON (version 1, to be revised)



The universal ranking in FIGURE 2 bears resemblance to a proposal by Kager (2004) that deals with stress pathologies concerning primary stress. Kager proposes that the constraints that determine the placement of primary stress with respect to the edges of the word occupy a stratum that universally supersedes constraints prohibiting lapses or clashes in particular environments. I will return to this proposal in Chapter 4. In other domains of phonology, universal rankings have been used to capture typological implicational relations among segments and features (Prince and Smolensky 2004, 152; Kager 1999, 44; among others).

In §2.3, I alluded to the fact that the ranking between EDGE[R] and EDGE[L] approximates the setting of the directionality parameter in Prince's (1983) grid-only theory of stress. The universal ranking in (19) makes their effect equivalent. Unlike true parametric theories, however, the present framework retains the advantages of Optimality Theory (see Prince and Smolensky 2004; Kager 1999) without including a separate parameter module.[9]

[9] Similar ideas are raised in Gordon (2002, 510 fn. 25) and Buckley (2009, 408) in the context of primary stress assignment. They both entertain the possibility (for different reasons) that CON only has one alignment constraint sensitive to the primary stress, and that the edge to which it refers is determined by an external parameter.

The next section will focus on patterns in which both word edges play some role in stress assignment. While such patterns ostensibly require that there be more then active edge, I will show that these effects arise due to asymmetrical properties of the two edges.

2.5. Stress effects at the inactive edge

In §2.3 above I adopted the null hypothesis that all stress constraints which refer to word edges are sensitive solely to the active edge. In this section, I discuss two types of stress effects that seem to require that the grammar simultaneously refer to both word edges. In §2.5.1 I consider patterns in which unstressability effects occur at the edge opposite to the active edge. I then discuss languages in which there is a fixed stress at both edges in §2.5.2. We will see that both cases relate to typological asymmetries between the two edges, specifically that the end of the word tends to repel stress, while the beginning of the word tends to attract stress. This will inform an expansion of the constraint set, previously adopted in a foot-based theory by Hyde (2002), which retains the benefits of the active-edge approach while also capturing simultaneous stress effects at both edges and their typology.

2.5.1. Non-finality

Languages that prohibit stress on a peripheral syllable are common. In some languages, stress is assigned by default to the next-to-peripheral syllable: in Chamorro (Austronesian; Chung 1983) and Mohawk (Iroquoian; Bonvillain 1973) the default stress falls on the penult, while in Lakota (Siouan; Boas and Deloria 1933; 1941) and Koryak (Chukotko-Kamchatkan; Zhukova 1972) it falls on the peninitial. In other languages, stress skips the next-to-peripheral syllable, too: in Macedonian (Indo-European; Lunt 1952) and Wappo (Yuki–Wappo; Radin 1929) the default stress falls on the antepenult, whereas in Azkoitia Basque (dialect of an isolate; Hualde 1998) and Winnebago (Siouan; Susman 1943; Hale and Eagle 1980) it falls on the postpeninitial.

In the active-edge approach outlined above, grammars which assign stress to the next-to-peripheral syllable (i.e., peninitial or penult) are those in which ALIGN/E is dominated by NONPERIPH/E but not EXTNONPERIPH/E; and grammars that skip two peripheral syllables (i.e., stress the postpeninitial or antepenult) are those in which ALIGN/E is dominated by EXTNONPERIPH/E (see tableaux (13) and (14) in §2.3, respectively). This way to derive non-peripherality effects predicts that all such effects conform to the generalization in (21).

(21) **Predicted non-peripherality effects (to be revised)**: unstressability of peripheral syllables may only occur at the edge with respect to which the stress is assigned.

The prediction in (21) is inconsistent with the typology of unstressability effects. Consider the default accent pattern in Azkoitia Basque (Hualde 1998) in (22). The generalization is as follows: accent falls on the postpeninitial, unless it is the final syllable, in which case it falls on the peninitial. Notice that the generalization makes reference to both word edges: stress is normally assigned by counting from the left edge, but an unstressability effect applies to the peripheral syllable at the right edge.

(22) Azkoitia Basque default accentuation in singular nouns (Hualde 1998, 106, see also Kager 2012, 1467)

a.	ó.na	'the good one-ABS'
b.	gi.zó.na	'the man-ABS'
c.	txa.pé.la	'the beret-ABS'
d.	it.tu.rí.xe	'the fountain-ABS'
e.	a.lar.gú.ne	'the widow-ABS'
f.	e.ma.kú.mi.e	'the woman-ABS'
g.	i.el.tsé.ru.e	'the bricklayer-ABS'
h.	te.le.bí.si.xu.e	'the television-ABS'

The non-finality effect in the disyllabic and trisyllabic forms in (22a-c) is also observed within the nominal paradigm of individual nouns. Compare the paradigm of the disyllabic base *gizon* 'man' in (23) with that of the trisyllabic base *alargun* 'widow' in (24). In the paradigm of *gizon*, stress falls on the postpeninitial syllable in all forms except the absolutive, which is trisyllabic, and therefore the postpeninitial syllable is also the final. Nouns with longer bases, like *alargun*, have stress on the postpeninitial syllable throughout the entire paradigm, because the postpeninitial never coincides with the final position.

(23) Singular nouns with trisyllabic stem in Azkoitia Basque (Hualde 1998, 106)

	/gizon/	'man'
a.	gi.zó.na	'the man-ABS'
b	gi.zo.ná.i	'the man -DAT'
c.	gi.zo.ná.na	'the man -GEN+ABS'
d	gi.zo.ná.kin	'the man -COM'
e.	gi.zo.nán.tza.ko	'the man -BEN'

(24) Singular noun with quadrisyllabic stem in Azkoitia Basque (Hualde 1998, 106)

	/alargun/	'widow'
a	a.lar.gú.ne	'the widow-ABS'
b	a.lar.gú.ne.i	'the widow-DAT'
c	a.lar.gú.ne.na	'the widow-GEN+ABS'
d	a.lar.gú.ne.kin	'the widow-COM'
e	a.lar.gú.nen.tza.ko	'the widow-BEN'

Non-finality effects are also common in languages with alternating secondary stresses. Contra the prediction stated in (21), non-finality effects on alternating secondary stresses are widely attested in languages in which the alternation starts near the left edge. Consider the data in (25) from Badimaya (Pama-Nyungan; Dunn 1988). The generalization is as follows: stress falls on the initial syllable and on every other non-final syllable to its right.

(25) Badimaya (Pama-Nyungan; Dunn 1988, 34)

a.	wá.na.ra	'long, thin'
b.	wín.d^{y}in.d^{y}i	'grasshopper'
c.	ŋán.gaŋ.gù.wa	'to choke on something'
d.	wá.nal.dyì.li.ŋa	'scorpion'

The set of constraints considered in the previous sections cannot generate languages like Azkoitia Basque and Badimaya, where stress assignment is sensitive to the left edge but also is repelled by peripheral syllable at the right edge. The reason is that fixing the stress with respect to the left edge requires that it be the active edge. For example, to derive initial stress Badimaya, the constraint

ALIGN/E must refer to the left edge.[10] Similarly, in Azkoitia Basque, postpeninitial stress requires that EXTNONPERIPH/E and either ALIGN/E or *EXTLAPSE/E refer to the left edge. Non-finality effects, on the other hand, require that NONPERIPH/E refer to the right edge. If there is only one active edge, these two settings are inconsistent with one another.

The correct solution must also capture the fact that the opposite pattern, in which stress is assigned with respect to the right edge and the initial syllable repels stress, seems to be unattested (Gordon 2002, 525; Kager 2012, 1468). A hypothetical example for such a pattern is given in (26), which is the mirror image of Badimaya. Stress is assigned to the final syllable (i.e., with respect to the right edge) and on every other syllable to its left, with the exception of the initial.

(26) Unattested mirror-Badimaya

a. σσσ́
b. σσ̀σσ́
c. σσσ̀σσ́

The dissociation between non-peripherality effect at the active edge, which is attested at both edges, and non-peripherality effect at the opposite edge, which is attested only at the right edge, is achieved in a system in which the constraints responsible for the two effects are distinct. The proposed modification of CON, then, is the addition of the edge-specific constraint NONFINALITY (in 27), which prohibits stress on the final syllable. This results in two sources for stress-repelling effects at the end of the word, namely either a high-ranked NONFINALITY (with any active edge) or a high-ranked NONPERIPH/E (if the active edge is on the right). A stress-repelling effect at the beginning of the word can only be triggered by NONPERIPH/E, and only if the active edge is the left edge. Crucially, a constraint like NONINITIALITY is not included in the constraint set (Gordon 2002, 525; Kager 2012, 1487).[11]

[10] In the final proposal advocated here, there will be other ways to derive the Badimaya pattern (but not Azkoitia Basque). The important point is that the opposite pattern (in 26) is unattested.

[11] Although there is ample previous work on stress which made use of a constraint like NONINITIALITY, all these cases can be derived with NONPERIPH/E. This is because in all of these cases there is no evidence for an active edge at the end of the word. I refer the reader to the studies cited in Walker (1996, 6 ft. 5), Buckley (2009, 401 ft.16), and Kager (2012, 1468); also see van de Vijver's (1998) proposal for an *EDGEMOST constraint, which is violated if either of the peripheral syllables is stressed.

(27) NONFINALITY Assign one * for a stressed syllable at the right edge

NONINITIALITY Assign one * for a stressed syllable at the left edge (excluded from CON)

The addition of NONFINALITY to CON changes the predicted typology of unstressability effects from the one stated in (21) to that in (28).

(28) **Predicted non-peripherality effects (revised)**: unstressability of peripheral syllables may only occur at the edge with respect to which the stress is assigned or word-finally.

Having included both NONPERIPH/E and NONFINALITY in our theory of stress, the following question arises: is there an edge-specific counterpart to EXTNONPERIPH/E that refers to the right edge, i.e. EXTNONFINALITY, which prohibits stress on the last two syllables (in 29)? Evidence is hard to come by. Consider the hypothetical language in (30), in which stress falls on the initial in words with two or three syllables, and the peninitial in words with four syllables or more. This language is an example of a system with default stress on the peninitial, but both the penult and the ultima repel stress, not just the ultima. Such languages are generated by a theory that incorporated EXTNONFINALITY but seem to be unattested. This could also, in principle, be an accidental gap, because languages with peninitial (and postpeninitial) stress are fairly rare as it is. In the absence of evidence for its effect, I exclude EXTNONFINALITY from the constraint set in subsequent sections.[12]

(29) EXTNONFINALITY Assign one * for a sequence of two σ at the right edge if either of them is stressed (excluded from CON)

[12] I am also unaware of languages in which secondary stresses are subject to an extended non-finality condition that spans over two syllables (cf. one syllable non-finality in Badimaya in (25)). The closest pattern I am aware of occurs in Finnish (Uralic; Karvonen 2005; 2008), where secondary stress is avoided on the last two syllables in words which end with *ia* or *io* (which reportedly are parsed to two different syllables).

(30) Unattested extended non-finality effect in a single stress language

a. σ́σ
b. σ́σσ
c. σσ́σσ
d. σσ́σσσ

Notice that when the left edge is active (EDGE[L]>>EDGE[R]), the effect of NONPERIPH/E is essentially equivalent to NONINITIALITY. This correctly generates languages with (default) peninitial stress, specifically when the left edge is active and NONPERIPH/E is ranked above ALIGN/E (and similarly, postpeninitial stress). However, while the exclusion of NONINITIALITY and inclusion of NONPERIPH/E correctly eliminates non-initiality effects in languages in which stress is fixed at the right edge, there are some other non-initiality effects which the system generates and which seem to be unattested.

The first case is discussed by Kager (2012, 1468). Consider the data from Latin (Indo-European; Kent 1932, 66; Allen 1973, 155) in (31). In Latin, stress falls on the penult if it is heavy, and on the antepenult otherwise; word-final syllables do not attract stress even if they are heavy. This is an example of a language with a trisyllabic window at the right edge in which the final syllable is unstressable. Another language that falls in this category is Central Western Macedonian, where stress falls on the penult by default, on the antepenult in some lexical exceptions, but never on the ultima (Indo-European; Vidoeski 1985; Baerman 1999, reported in Kager 2012, 1467). Kager points out that, unlike at the right edge, there are no languages in which stress is allowed on the peninitial or the postpeninitial, but not the initial. An example for such a hypothetical pattern is given in (32), which mirrors the pattern in Latin: stress falls on the peninitial if it is heavy, and on the postpeninitial otherwise, and the initial does not attract stress even if it is heavy. Such a pattern is predicted to exist in the active-edge approach presented here, specifically when the left edge is active, and both *EXTLAPSE/E and NONPERIPH/E are undominated. It is possible that this is an accidental gap in the typology, considering that trisyllabic windows at the left edge are generally rare (one reported in StressTyp2 and several other cases reported in Kager 2012, 1464). Nevertheless, this is a potential challenge to the active-edge approach.

(31) Non-finality in Latin (Indo-European; Vidoeski 1985; Baerman 1999)

a. kar.pén.tum ‘carriage’
b. a.míː.kuːs ‘friend’
c. sí.mi.le ‘similar’

(32) Unattested mirror-Latin

a. σ̄σ̄́σ̄
b. σ̄σ̄́σ
c. σσσ́

Another pathological case of non-initiality which is not eliminated by the active-edge approach is a language in which stress is unbounded but may never fall on the initial. An example for the opposite pattern, in which stress is unbounded but may never fall on the ultima, is attested in Kashmiri (Indo-European; Kachru 1969; Bhatt 1989), in which stress falls on the left-most heaviest syllable (CVV(C)>CVC>CV), but never on the final, even if it is the heaviest. The relevant data from Kashmiri is given in (33), while the unattested mirror pattern is given in (34). The crucial observation is that in (33b) and (33c), the final syllable is unstressed despite it being the heaviest in the word. The absence of languages like (34) is a potential challenge for the active-edge approach, because it can be generated by a grammar in which the left edge is active and NONPERIPH/E dominates WSP (a similar point applies to other DPS constraints).[13]

(33) Kashmiri (Indo-European; Kachru 1969; Bhatt 1989)

a. pʰí.ki.ri ‘to understand’
b. ʃo.kɨ́r.vaːr ‘Friday’
c. ná.kɨ.voːr ‘nostril’
d. déː.vəː.liː ‘the Hindu festival of lights’

[13] For the same reason, this constraint set generates a pathological pattern in which stress is unbounded, but the initial and the ultima are unstressable (specifically, when the left edge is active, and NONPERIPH/E and NONFINALITY are ranked above a DPS constraint). I will discuss this pattern in Chapter 4 for an independent reason, namely because it also arises when *LAPSE is undominated by the other stress-attracting constraints (see the quasi-midpoint pathology in §4.2).

(34) Unattested mirror-Kasmiri

a. σσσ́
b. σ̄σσ́
c. σσ̄́σ
d. σσσ̄́

The same problem extends to unbounded languages with stress-repelling effects on two syllables at some edge, such as the final and the penult. This happens then the right edge is active, and EXTNONPERIPH/E is ranked high. This recreates the effect of EXTNONFINALITY (29), which, as mentioned above, there is not much evidence for.

In the next section, I show how the active-edge approach derives languages which have two fixed stresses, one at the left edge and one at the right edge (with or without alternating stresses in between).

2.5.2. Bidirectional stress assignment

The constraint set constructed so far is equipped to model languages in which there is a default fixed stress near one of the edges, but it is not equipped to model (most) patterns with two fixed stresses at opposite word edges, which I will refer to as *bidirectional*. This is because the constraint set has the following property: all stress-attracting constraints which are sensitive to the edges (ALIGN/E, *LAPES/E, *EXTLAPSE/E) refer to a single word edge, whichever is the active one. If the right edge is active, there is no stress-attracting constraint that refers to the left edge, and vice-versa.

With the addition of NONFINALITY, there is one class of bidirectional patterns that the system does predict to exist. Specifically, these are languages in which one stress is assigned near the beginning of the word and another stress is assigned to the penult. The reason that the penult can attract stress even if the right edge is inactive is that this is the only way to satisfy both NONFINALITY and *LAPSE simultaneously (cf. van Urk 2013, 28). To see this, consider the alternatives: if both the penult and the ultima are unstressed, then *LAPSE in violated; if the penult is unstressed and the ultima is stressed, then NONFINALITY is violated. Notice that since one of the preconditions for this configuration is that *LAPSE is satisfied, it is predicted to only arise in grammars that avoid lapses in general.

The hypothetical language in (35) is an example for a pattern that fits this stress profile. Stress is assigned to the peninitial and every other syllable following it, up to the penult, which is always stressed. It is generated by the grammar in (36) (I assume EDGE[L]>>EDGE[R] and consider only candidates with an active left edge). The candidate with stress on the initial (candidate a) is eliminated because NONPERIPH/E dominates ALIGN/E. Among the remaining candidates, the one with stress on the ultima (candidate b) is eliminated by to NONFINALITY, and the one in which neither the ultima nor the penult are stressed (candidate c) is eliminated due to *LAPSE. The winning candidate is (d), with stress on the initial and on the penult.

(35) Hypothetical bidirectional pattern generated by NONFINALITY and *LAPSE

a. σσ́σ
b. σσ́σ́σ
c. σσ́σσ́σ
d. σσ́σσ́σ́σ
e. σσ́σσ́σσ́σ

(36) Stress on the penult with an active left edge

	σσσσσσ		NONPERIPH/E	ALIGN/E	NONFIN	*LAPSE	*CLASH
	a.	^{A}[**σ́**σ**σ́**σ**σ́**σ	*!				
	b.	^{A}[σ**σ́**σ**σ́**σ**σ́**		*	*!		
	c.	^{A}[σ**σ́**σ**σ́**σσ		*		*!	
☞	d.	^{A}[σ**σ́**σ**σ́σ́**σ		*			*

The predicted stress pattern in (35) is attested in StressTyp2, specifically in Southern Paiute (Uto-Aztecan; Sapir 1930). In Southern Paiute, stress is assigned to the penult and to every even syllable counting from the left up to the penult. Some examples are given in (37). Other languages with a bidirectional alternating pattern with stress on the penult include Piro (Arawakan; Matteson 1963), Indonesian (Austronesian; Cohn 1989) and Garawa (Garawan; Furby 1974).[14]

[14] In English, long monomorphemic words (typically) bear a primary stress on the penult or antepenult and a secondary stress on the initial (e.g., *Lùxapalíla*, *Wìnnipesáukee*; Liberman and Prince 1977; McCarthy and Prince 1993). This

(37) Southern Paiute penultimate and peninitial stress (Uto-Aztecan; Sapir 1930)[15]

a. ŋ̥u̥.qwín.ti̥ ‘stream’
b. tḁ.ʃíp.pàx.xu̥ ‘when it was evening’
c. qa.nít.ti.rì.ḁ ‘camping places’
d. ma.ró.o̥.qwàj.ʔìq.qw̥ḁ ‘strech it’
e. ti.ná.ḁ.tì.ɣa.à.ʀi̥ ‘hunting-leader’

The limited set of languages that fit the stress profile described above are characterized by the two properties in (38). First, the stress near the right edge falls on the penult. This is because the trigger for the stress at the right edge is the requirement to satisfy *LAPSE and NONFINALITY simultaneously. Second, stress lapses are generally avoided in other positions as well. This is because of the role that *LAPSE plays in fixing the stress on the penult.

(38) Predicted properties of languages with fixed stresses at both word edges (not borne out)

a. The fixed stress at the right edge falls on the penult.

b. Stress lapses are avoided.

The range of the attested stress patterns, however, is much wider than that characterized by (38). An example for a language that diverges from (38a) is Tauya (Trans New Guinean; MacDonald 1990), whose stress pattern is illustrated in (39). In Tauya, stress is assigned to the initial and every odd syllable counting from the right. This is a challenge for the active-edge approach because, unlike Southern Paiute, the grammar must refer to both stress edges to generate this pattern.

(39) Tauya initial and final stress (Trans New Guinean; MacDonald 1990)

a. nò.nó ‘child’
b. ʔù.ne.tá ‘mat’
c. mò.mù.ne.pá ‘X sat and X…’
d. jà.po.tì.ja.fó ‘my hand’

pattern holds providing that the first three syllables are light. Some lexical exceptions are attested, e.g., *Monòngahéla* (Chomsky and Halle 1968, 114).

[15] Syllabification is not indicated in the primary source (Sapir 1930), but added here for legibility. Long vowels are ambiguous between mono- and di-syllabic, but this distinction is irrelevant here as long as they are taken to be distinct stress-bearing units.

There are also languages that diverge from (38b). These are the *dual stress* languages, which have exactly two stresses (in words that are long enough), allowing lapses in between. One example is Sibutu Sama (Austronesian; Allison 1979; Kager 1997), in which words longer than three syllables have primary stress on the penult and secondary stress on the initial (in 40). Other examples for dual stress languages include Canadian French (Indo-European; Gendron 1966), Armenian (Indo-European; Vaux 1998), Walmatjari (Pama-Nyungan; Hudson 1978), and Georgian (South Caucasian; Zhgenti 1964; Aronson 1990).

(40) Sibutu Sama penultimate and initial stress (Austronesian; Allison 1979; Kager 1997)

a.	bis.sá.la	'talk'
b.	bìs.sa.lá.han	'persuading'
c.	bìs.sa.la.hán.na	'he is persuading'
d.	bìs.sa.la.han.ká.mi	'we are persuading'

It would be premature to abandon the notion of a single active edge based on such patterns. To see why, consider the typology of bidirectional languages. Among the 262 quantity-insensitive languages surveyed in Gordon (2002), 21 are bidirectional; among those, 14 are dual stress languages and 7 are languages with alternating stresses. The crucial observation is the following: in all of these languages except one, the stress at the left edge falls on the initial (Hyde 2002). The exception to this generalization is Southern Paiute, which has alternating stresses, and is already predicted by the current constraint set (see above). Taking Southern Paiute into account, the empirical generalization is that in (41).[16]

(41) Typological generalization over attested bidirectional languages

a. In dual stress languages, the stress on the left falls on the initial.

b. In bidirectional languages with alternating stresses the stress on the left falls on the initial or the stress on the right falls on the penult (or both).

[16] The generalization in (41) also extends to the languages listed in StressTyp2.

What is common to (41a) and (41b) is that stress on the initial may combine with any fixed stress at the right edge. Previous researchers who analyzed languages like Garawa and English in foot-based frameworks suggested that the constraint responsible for this initial stress is a requirement that the word start with a foot (which happens to be trochaic, McCarthy and Prince 1993, 95). Selkirk (2011) takes this requirement to be an instance of a constraint that refers to the left edge of prosodic constituents in general, STRONGSTART, which demands that the left edge of prosodic constituents (like the prosodic word) align with the left edge of a daughter constituent.[17]

I propose that the reason that initial stress is so ubiquitous in bidirectional languages is that CON includes, alongside ALIGN/E, an alignment constraint which specifically refers to the left edge, ALIGN/L, stated in (42). Crucially, there is no right-edge counterpart to ALIGN/L; when the right edge attracts stress it is because the right edge is active.[18]

(42) ALIGN/L   Assign one * for each syllable separating the left edge from the nearest stressed syllable

The role that ALIGN/L plays in stress assignment is likely not accidental. Initial syllables tend to share certain phonetic properties with stressed syllables. For example, in American English both initial syllables and stressed syllables have increased vowel amplitude and longer seal duration of onsets (Cho and Keating 2009); and in Turkish, both have longer vowel duration (Barnes 2006).[19] In addition, both initial syllables and stressed syllables tend to resist certain types of contrast

[17] In addition, the constraint demands that this daughter constituent be followed by other daughter constituents of at least the same level in the prosodic hierarchy. The exact formulation is as follows (Selkirk 2011, 470):

STRONG START   A prosodic constituent optimally begins with a leftmost daughter constituent which is not lower in the prosodic hierarchy than the constituent that immediately follows.

[18] Similarly to ALIGN/E, ALIGN/L is defined as a nonlocal constraint which assigns violations proportionally to distances between the edge and the nearest stress. I offer an argument against a local alternative in Chapter 3.

[19] Cho & Keating (2009) also show many differences between initial strengthening and stress: increased linguo-palatal contact is associated with the former, but not the latter, while post-consonantal vowel duration is increased in the latter, but not the former (also see Barnes 2006). What is crucial for our purposes is that there is an overlap in the realization of syllables in word-initial position and in stressed positions.

neutralization (Beckman 1998; Smith 2002).[20] The overlap between the realization of the two properties may lead learners to interpret phonetic cues associated with initial syllables as stress.

Bidirectional languages like Tauya (in 39), then, are those in which the right edge is active, and the initial syllable is stressed due to ALIGN/L. This is illustrated in (43). Candidates a-c are preferred over candidates d-f because their active edge is the right edge (EDGE[R] >> EDGE[L]). Candidates (a) and (b) are eliminated because they violate ALIGN/L and ALIGN/E, respectively. The winning candidate is (c), in which both the initial and the ultima are stressed. The difference between bidirectional languages with alternating stresses (Tauya) and dual languages (Sibitu Sama) is that in the latter *LAPSE outranks a stress-minimizing constraint, but not in the former (see ONESTRESS in Chapter 4).

(43) Grammar generating initial and final stress in Tauya

σσσσσσ	EDGE[R]	EDGE[L]	ALIGN/L	ALIGN/E	NONPERIPH/E
a. σ**σ́**σ**σ́**σ**σ́**]^A		*	*!		*
b. **σ́**σ**σ́**σ**σ́**σ]^A		*		*!	
☞ c. **σ́σ́**σ**σ́**σ**σ́**]^A		*			*
d. ^{A}[**σ́**σ**σ́**σ**σ́**σ	*!				
e. ^{A}[σ**σ́**σ**σ́**σ**σ́**	*!		*	*	*
f. ^{A}[**σ́σ́**σ**σ́**σ**σ́**	*!				*

A possibility worth mentioning is that in principle the reported cases of bidirectional stress patterns may be in fact cases in which one of the stresses is a phrasal pitch accent (cf. Gordon 2014, van der Hulst 1997; 2012). If that turns out to be the right characterization of the typology, the addition of ALIGN/L to CON may no longer be justified.

Summing up the discussion of simultaneous stress effects at both word edges, the set of edge-sensitive constraints includes the constraints sensitive to active edges in §2.3 as well as two edge-specific constraints. NONFINALITY is responsible for stress-repelling effects at the right edge when the left edge is active. The examples discussed include the leftwards shift of the primary stress in Azkoitia Basque, the elimination of final secondary stress in Badimaya, and the fixed penultimate

[20] Beckman (1998) and Smith (2002) attributes this property to psycholinguistic processing (Beckman takes this to be a property of root-initial syllables rather than word-initial). See Barnes (2006) for a comparison between the phonological explanation and the psycholinguistic explanation for this effect.

stress in Southern Paiute. ALIGN/L is responsible for bidirectional stress assignment with initial stress, including Sibutua Sama and Tauya. Note that both NONFINALITY and ALIGN/L must be universally ranked below EDGE[R] and EDGE[L], for the reasons described in §2.4 for the other edge-sensitive constraints.

This constraint set derives the default location of stresses in bounded languages, but it does not say anything about the relative prominence among stresses. This will be the focus of the next section.

2.6. Primary stress

It is often assumed that the selection of the edge with respect to which stress is fixed ("directionality") and the edge that attracts primary stress ("end rule") are independently represented in speakers' grammars (Prince 1983). The empirical basis for this assumption is a set of so-called *counting languages*, in which the location of primary stress has been reported to depend on the number of preceding or following syllables (starting to count from some edge or from the right-most/left-most heavy syllable). A well-known example for a counting pattern is found in Creek/Seminole (Muskogean; Haas 1977; Martin and Johnson 2002), exemplified in (44). In the default accent pattern in Creek (i.e., words with no lexically accented morphemes), stresses are assigned from left to right in a binary pattern starting from the second syllable (in words with only light syllables; heavy syllables are always stressed and restart the binary alternation), and the primary stress is assigned to the right-most stressed syllable.[21] Assuming all syllables in the word are light, stress falls on the ultima in even-parity words (44a,c,e) and on the penult in odd-parity words (44b,d,f).

[21] The phonetic correlates of stress on unaccented syllables are understudied. They are not reported in Haas (1977), but the position of the left-most stressed syllable is inferred from high tone spreading patterns (Martin 2011), and alternating rhythm is inferred from the location of the pitch accent (Halle and Vergnaud 1987). In addition, secondary stresses are reported to be audible by some researchers (Martin, p.c.; also see Gordon and Martin 2023).

(44) Creek default accentuation in words with light syllables (Muskogean; Haas 1977; Martin and Johnson 2002)

a.	i.fá	'dog'
b.	hi.cí.ta	'(one) to see one'
c.	a.hì.ci.tá	'(one) to look after'
d.	i.mà.hi.cí.ta	'(one) to look after for (someone)'
e.	i.sì.ma.hì.ci.tá	'(one) to sight at one'
f.	i.tì.wa.nà.yi.pí.ta	'to tie each other'

The reality is more nuanced than that, however. The rarity of such systems is striking: in StressTyp2, only 10 out of the 754 (1.3%) are described as having the primary stress opposite to the edge at which counting starts.[22] Among these languages, three have been reanalyzed as non-counting in previous work: Cairene Arabic is analyzed as morphologically-driven (and also quantity-sensitive) with no reference to the opposite word edge in Becker (2022); Passamaquoddy has fixed stress at both edges (LeSourd 1993); and Dutch primary stress is assigned within a window at the right edge independently from left-to-right counting (Kager 1989). This leaves seven languages, which amount to 0.9% of the languages in StressTyp2.[23,24]

Some previous studies called into question the existence of counting languages altogether. Van der Hulst (1997; 2012) argues for a reanalysis of such cases as lacking the notion of primary stress; instead, the reported prominence peak is suggested to corresponds to a phrasal pitch accent. I refer the reader to van der Hulst (1997, 112–23) for an overview of the counting patterns described in Hayes (1995) and a discussion of some reasons to reconsider their original interpretation.

[22] The languages are Creek (Muskogean; Haas 1977; Martin and Johnson 2002), Cairene Arabic (Semitic; Harrell 1957; McCarthy 1979), Asheninca (Arawakan; Payne 1990), Dutch (Germanic; van der Hulst 1984; Kager 1989), Cayuga (Iroquoian; Chafe 1977), Passamaquoddy (Algonquian; LeSourd 1993), Unami (Algonquian; Goddard 1979), Munsee (Algonquian; Goddard 1979), Wargamay (Pama–Nyungan; Dixon 1981), Nyawaygi (Pama–Nyungan; Dixon 1983).

[23] Among the remaining seven languages, two pairs of closely related languages share the same stress pattern: Unami and Munsee are Delaware languages of the Algonquian family; and Wargamay and Nyawaygi are Dyirbalic languages of the Pama–Nyungan family. This leaves only five distinct stress patterns in which the primary stress is assigned opposite to the edge at which counting begins.

[24] A learnability-based explanation for the scarcity of counting languages is not obvious, as counting patterns can be inferred with relatively short words (cf. Staubs 2014 for a proposal in this vein; also see Stanton 2016 on the effect of word length on learnability). For example, the patterns reported for Wargamay and Nyawaygi can be inferred from words with two to four syllables. In these languages, word stress falls on the left-most even syllable counting from the right, such that in disyllabic and quadrisyllabic words the stress is assigned to the initial syllable (σ́σ, σ́σσσ), while in trisyllabic words it is assigned to the peninitial (σσ́σ). See §2.7 for a discussion of a learnability-based approach to a specific overgeneration problem.

For the lack of conclusive evidence, I adopt the more restrictive view, according to which the primary stress is assigned by default at the edge with respect to which the stress is fixed (in line with the Directionality-Dominance Hypothesis in Hammond 1985a; 1985b), and that reported counting patterns are cases of a phrase-level pitch accent assigned to one of the word-level stresses. This characterization of the typology makes a clear falsifiable prediction: peaks in counting languages, upon further scrutiny, behave as phrasal accents when their prosodic or intonational context is manipulated (see Gordon 2014 for some possible diagnostics). If this prediction is not borne out, the treatment of primary stress assignment in the remainder of this section should be reevaluated.

Returning to the active-edge approach, this means that there is no need for more than one active edge to capture primary stress placement.[25] The constraint responsible for the attraction of the primary stress to the active edge is ALIGNPEAK/E, stated in (45).[26, 27]

(45) ALIGNPEAK/E Assign one * for each stressed syllable separating the active edge from the primary stress

To see that ALIGNPEAK/E is independent from ALIGN/E we would need to find a case in which ALIGNPEAK/E is violated in order to satisfy a higher-ranked constraint, such that the primary stress does not cooccur with the stress closest to the active edge. A relevant pattern is that of Ngiyambaa (Pama–Nyungan; Donaldson 1977), shown in (46). In Ngiyambaa, roots with only short vowels have primary stress on the left-most stressed syllable, which is typically the initial, as in (46a-c). However, if the root contains any long vowels, primary stress is assigned to the left-most syllable with a long vowel. If the primary stress is not on the initial and doesn't clash with the initial, then

[25] This idea that primary stress is always attracted to the same edge as the fixed stress (or at least one of the fixed stresses, see §2.5.2) is incompatible with so-called *default-to-opposite* patterns, in which the primary stress is attracted to a heavy syllable closest to some edge, but in the absence of heavy syllable stress falls near the opposite edge (Hayes 1980; 1995; Prince 1983). The existence of such languages is doubtful; see Gordon (2000) and for reanalysis and discussion, as well as Dobrovolsky (1999).
[26] Gordon (2002, 510, fn.25) and Buckley (2009, 408) also raise the possibility that there is only one version of ALIGNPEAK in CON, and that the edge to which it refers is determined by a parameter. However, they still assume that the edge of the fixed stress and peak alignment are determined independently.
[27] This definition of ALIGNPEAK/E also has consequences for the predicted typology of bidirectional languages. See §5.3 for a discussion.

the initial receives secondary stress, as in (46d,e). As a result, the primary stress coincides with the left-most stress in the usual case, but not if the left-most long vowel is on the postpeninitial or later.

(46) Ngiyambaa unbounded primary stress assignment (Pama–Nyungan; Donaldson 1977)

a.	gí.ra.la	'star'
b.	gí.ra.làŋ-ga	'on star'
c.	gí.ra.lam-bì.di	'big star'
d.	gà.ba.dá:-ga	'on moon'
e.	gà.ba.dá:-bi.di	'big moon'

The constraint responsible for the attraction of stress to long vowels is WSP/PEAK, defined in (47). The ranking that generates the primary stress pattern in Ngiyambaa is one in which the left edge is active, and WSP/PEAK dominates ALIGNPEAK/E. Tableau (48-i) illustrates stress assignment in roots with only short vowels, as in *giralaŋ-ga*. Since WSP/PEAK does not prefer a particular position for primary stress, the candidate with primary stress on the initial (candidate a) wins over its competitor with primary stress on the postpeninitial (candidate b) because only the former satisfies ALIGNPEAK/E. In words beginning with two syllables with short vowels followed by a syllable with a long vowel, as in *gabada:-ga* in tableau (48-ii), WSP/PEAK eliminates the candidate with primary stress on the initial (candidate a), and instead assigns the peak to the postpeninitial (candidate b). The winning candidate is one in which the peak is not assigned to the left-most stressed syllable, thus violating ALIGNPEAK/E.

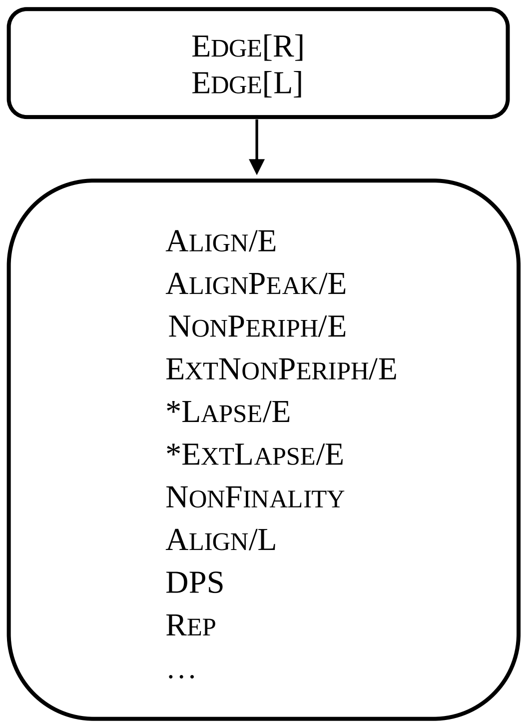
(47) WSP/PEAK Assign one * for each heavy syllable not bearing the stress peak

(48) Illustration of the interaction between ALIGNPEAK/E and a higher-ranked constraint

			WSP/PEAK	ALIGNPEAK/E
i.	giralaŋ-ga			
☞	a.	A[gí.ra.làŋ-ga		
	b.	A[gì.ra.láŋ-ga		*!
ii.	gabada:-ga			
	a.	A[gá.ba.dà:-ga	*!	
☞	b.	A[gà.ba.dá:-ga		*

Having incorporated NonFinality, Align/L, and AlignPeak/E into the constraint set, the proposal in Figure 2 is revised to that in Figure 3. In the next chapter, I discuss the ways in which these constraints interact with other constraints on stress, such as *Lapse and *Clash.

Figure 3: illustration of the proposed fixed rankings in Con (version 2, to be revised)



2.7. A learnability-based alternative

In the previous sections, we constructed a theory of stress assignment in which all edge-sensitive constraints, with the exception of Align/L and NonFinality, refer to a single active edge. The set of stress patterns that this theory generates overlaps with previous grid-only theories, but it is different in that it correctly excludes all types of midpoint patterns.

A study by Stanton (2016) offers an alternative explanation for the absence of midpoint patterns, according to which such patterns are thus far unattested because they are harder to learn compared to other patterns. The hypothesis pursued in the previous sections and the one pursued in Stanton's study are stated in (49) as Hypothesis 1 and Hypothesis 2, respectively.

(49) Hypotheses concerning the absence of midpoint patterns

Hypothesis 1: midpoint patterns are unattested because the edge-specific constraints that can generate them are not a part of speakers' grammars

Hypothesis 2: midpoint patterns are unattested because they are harder to learn compared to (at least most) attested patterns

One factor that may affect the difficulty of learning is the minimal number of syllables required in order to infer the pattern. Midpoint patterns that arise due to high-ranked *LAPSE/L and *LAPSE/R require four syllables to be learned; those that arise due to a combination of one disyllabic ESAL constraint (e.g., *LAPSE/L) and one trisyllabic ESAL constraint (e.g., *EXTLAPSE/R) require five syllables; and those that arise due to two ESAL constraints against extended lapses, i.e., *EXTLAPSE/L and *EXTLAPSE/R, require six syllables. Stanton labels these types of patterns *limited midpoint*, *mixed midpoint,* and *extended midpoint*, respectively.

To test the plausibility of Hypothesis 2, Stanton compares the ways in which a computational learner of phonology, the Gradual Learning Algorithm (GLA; Boersma 1997; Boersma and Hayes 2001; Magri 2012), infers midpoint patterns compared to other stress patterns. The constraints available to the learner are those in Gordon (2002), in which each alignment and ESAL constraint refers to a specific edge, i.e., the left edge or the right edge. The degree to which a pattern is hard to learn is measured by counting *trials*, where each trial corresponds to one word that is presented to the learner and one update to the learner's grammar. The premise is the following: the more trials on average the GLA needs to see before a pattern is learned, the harder to learn the pattern is. This means that a pattern α is considered to be harder to learn than pattern β if the average number of trials that the GLA sees before inferring α is higher than the average number of trials that the GLA sees before inferring β.

The GLA was exposed to five types of toy languages which roughly corresponded to real languages in the relative frequency of words of different lengths. For example, one language had a distribution of word lengths similar to English, and another had a distribution similar to Portuguese.[28] The relevant difference between these English and Portuguese is that English tends to have shorter words than Portuguese. Each type of language was presented to the learner several times, each time with a different stress pattern. The stress patterns that were used were initial stress, antepenultimate stress, limited midpoint, mixed midpoint, and extended midpoint.

The results are as follows. As expected, there was an inverse correlation between the frequency of long words in the language and the number of trials required for the learner to infer the target pattern. For example, GLA needed fewer trials to infer an antepenultimate pattern in an English-like language (in which long words are relatively infrequent) than to infer the same pattern in a Portuguese-like language (in which long words are a bit more frequent).

The interesting finding is that across language types, the GLA needed more trials to learn each of the three midpoint patterns than to learn initial stress or antepenultimate stress. This means that inferring any midpoint pattern in a language like English required more trials than inferring an antepenultimate or an initial stress pattern in the same language. This was also found to be true for the Portuguese-like language and the other language types tested. Under the premise that the number of trials that the GLA goes through before learning a pattern is positively correlated with how hard this pattern is to learn, this finding lends support to the plausibility of Hypothesis 2.

There are two problems with this argument. The first is that it is impossible to find a consistent threshold of GLA trials which would distinguish between attested and unattested languages. To see why, consider the specific number of trials reported for the English-like and Portuguese-like languages: the GLA needed 58 trials to converge on a grammar generating antepenultimate stress in a language like English, but only 39 trials to converge on a grammar generating one of the midpoint patterns (limited midpoint) in a language like Portuguese. If humans do acquire antepenultimate stress in English-like languages, it is unclear why there are no Portuguese-like languages with a midpoint stress pattern.

The second problem concerns the specific attested patterns that the midpoint patterns were compared to. These patterns included only cases in which the distance between the edge and the stress was invariable, specifically always on the initial or always on the antepenult. As noted by

[28] The other languages were Haitian, which has relatively short words, and Ganda and Inuktitut, which have short as well as very long words.

Stanton (e.g., p. 774), the stress patterns attested in human languages are much more diverse; this includes more complex patterns such as patterns sensitive to stress-attracting properties (e.g., long vowels), various types of rhythmic alternations, nonfinality effects, bidirectional patterns, and so forth. To argue that a pattern is absent from the typology because it is hard to learn by some metric, it is necessary to show that the other patterns in the typology (or at least those frequent enough) are not hard to learn by the same metric.

At the moment, only Hypothesis 1 provides a clear-cut account for the absence of midpoint patterns and makes falsifiable predictions. Nevertheless, Hypothesis 2 is still on the table, and more work needs to be done to test its explanatory power.

CHAPTER 3: HOW TO ALIGN?

3.1. Introduction

The requirement that stress be assigned close to a specific edge has been implemented in a variety of ways in OT. The goal of this chapter is to characterize the three predominant formulations of such constraints in the literature and to argue that only one of them is a part of CON. The basis for the argument is a set of unattested stress phenomena that arise in theories that incorporate either of the other two variants.

McCarthy and Prince (1993), building on work in Prince and Smolensky (1993/2004), model this requirement with the Generalized Alignment constraint schema (henceforth: "GA"), defined in (50).[29] GA constraints penalize distances between edges of determinate types of constituents (α,β) by assigning violations for intervening constituents of some type (γ).

(50)	ALIGN(α,E1,β,E2,γ)	Let α, β, γ be types of constituents and E1,E2 be *R* (right) or *L* (left) or *A* (active). For each E1 of α, assign one * for each γ separating it from the nearest E2 of β

In grid-based representations, each grid column represents a basic, abstract timing unit, indivisible for purposes of stress assignment. For this reason, grid columns do not have edges in any meaningful sense. The schema of GA in (50) is therefore reformulated as (51), which refers to symbols beyond (but also including) constituent edges (cf. Walker 1996, Gordon 2002). The symbols relevant to stress assignment in grid-based approaches to stress include grid marks of specific levels (x_0, x_1, etc.) and edges of the grid (right, left, or active).

(51)	ALIGN(α,β,γ)	Let α, β, γ be symbols. For each α, assign one * for each γ separating it from the nearest β

The schema in (51) lends itself to two types of constraints that penalize distances between grid marks and grid edges, variants of which are often employed in tandem in the literature. Here I will

[29] GA is defined here based on a formulation in McCarthy (2003), with the addition of active edge as a possible value for the E parameters.

assume for simplicity that individual grid columns correspond to syllables (see Chapter 1) and will focus on constraints that refer to the active edge of prosodic words. The first constraint is given as ALIGN/E in (52a), standing for ALIGN(A,x_1,x_0) (cf. McCarthy and Prince 1993, 93; also see FIRSTSTRESSLEFT and LASTSTRESSRIGHT in Heinz, Kobele, and Riggle 2005). This constraint penalizes every syllable located between the active edge and the nearest stressed syllable, which is defined as the stressed syllable that is not separated from the active edge by another stressed syllable. Here, each individual syllable can incur maximally one violation, because there is only one word edge and only one stressed syllable that is the nearest. An alternative is given as ALIGNALL/E in (52b), standing for ALIGN(x_1,A,x_0). This constraint is the more ubiquitous in the literature on stress, both in foot-based theories (e.g., McCarthy and Prince 1993, 94; Kager 1999, 45) and in grid-based (e.g., Gordon 2002, 497). The number of violations of ALIGNALL/E is the sum of the distances (in syllables) between each stressed syllable in the word and the active edge. An individual syllable may incur more than one violation; specifically, the number of the violations that a syllable incurs equals to the number of stressed syllables to its right or left, whichever is opposite to the active edge. The meaningful difference between ALIGNALL/E and ALIGN/E that will be relevant in this chapter is the following: the latter "attracts" only one stress, specifically the one closest to the active edge, while the former "attracts" *all* stresses in the word, regardless how far and how many other stresses intervene.

(52) Two variants of stress alignment

a.	ALIGN/E	Assign one * for each syllable separating the active edge from the nearest stressed syllable
b.	ALIGNALL/E	For each stressed syllable, assign one * for each syllable separating it from the active edge

The difference between the two constraints is illustrated in (53). In candidate (a), the peripheral syllable at the active edge is stressed, and there are no other stressed syllables. This candidate violates neither ALIGN/E nor ALIGNALL/E because no syllable intervenes between a stressed syllable and the active edge. Candidate (b) violates each of these constraints exactly twice, because there is one stressed syllable and there are two syllables that separate it from the active edge. The violation patterns of the two constraints diverge whenever there is more than one stressed syllable in the word. In candidate (c), ALIGN/E is satisfied because there are no syllables intervening between the active edge and the closest stressed syllable, which is the ultima. Unlike ALIGN/E, ALIGNALL/E is also sensitive to the other stressed syllable in the word, the antepenult, and thus assigns one violation mark for each syllable intervening between the antepenult and the active edge. Candidate (d) violates both ALIGN/E and ALIGNALL/E, but to a different extent. ALIGN/E is violated twice, because there are two syllables separating the active edge from the nearest stress, which is on the antepenult. ALIGNALL/E is violated six times: two violations are incurred because there are two syllables separating the stressed antepenult from the active edge, and additional four violations are incurred because four syllables separate the stressed initial syllable from the active edge.

(53) Violation profiles of two variants of stress alignment constraints

			ALIGN/E	ALIGNALL/E
☞	a.	σσσσ**σ́**]A		
	b.	σσ**σ́**σσ]A	**	**
	c.	σσ**σ́**σ**σ́**]A		**
	d.	**σ́**σ**σ́**σσ]A	**	**,****

Other theories of stress employ edge-sensitive constraints which are violated maximally once per word (McCarthy 2003; Kager 2001; 2004; 2005b; 2005a; Buckley 2009, also see INITIALGRIDMARK in Hyde 2002 and HAVEINITIALSTRESS in Heinz, Kobele, and Riggle 2005).[30] The counterpart of ALIGNALL/E and ALIGN/E in this class would be STRESS/E, defined in (54). Tableau (55) is an expanded version of (53) which also includes STRESS/E. The assignment of violations is simple: candidates a and c do not violate STRESS/E because the peripheral syllable at the active edge is stressed; candidates b and d do violate it because the syllable in this position is unstressed.

(54) STRESS/E Assign one * for an unstressed syllable at the active edge

[30] McCarthy (2003) and Kager (2001; 2004; 2005b; 2005a) use the term *categorical* to refer to these specific constraints. I do not use this term because it collapses two distinct properties, locality and locus dependence, which I discuss below.

(55) Violation profiles of three variants of stress alignment constraints

			STRESS/E	ALIGN/E	ALIGNALL/E
☞	a.	σσσσ**σ́**]^A			
	b.	σσ**σ́**σσ]^A	*	**	**
	c.	σσ**σ́**σ**σ́**]^A			**
	d.	**σ́**σ**σ́**σσ]^A	*	**	**,****

The three constraints discussed so far differ along two dimensions. The first dimension is locality. Locality has received many interpretations in the phonological literature (e.g., McCarthy and Prince 1993; Halle and Vergnaud 1987; Heinz 2007; Heinz 2009; Buckley 2009; Chandlee 2014; Chandlee and Heinz 2018; Graf and Mayer 2018; also see Kenstowicz 1994, 597). Here I focus on the notion of *Strict k-Locality* (SL_k), a computational property drawn from formal language theory (McNaughton and Papert 1971; Rogers and Pullum 2011; Rogers et al. 2013; Lambert and Rogers 2019), defined in (56a). I characterize the constraints which I consider local in (56b).

(56) a. A SL_k definition is a set of blocks of *k* adjacent symbols drawn from a vocabulary of symbols, augmented with symbols denoting the beginning and ending of an expression (Jäger and Rogers 2012)

b. A constraint is *local* iff its definition is SL_k for some *k*

The expressions in (57) represent the sequences prohibited by each of the three variants of alignment (unstressed syllables are denoted as σ̊; subscript numbers are read as “at least n”), such that each unique substring of the word which matches these expressions incurs one violation of the constraint. STRESS/E is a local constraint because the sequence that it prohibits consists of two adjacent symbols – an active edge and an unstressed syllable.[31] The definitions of the other two constraints, ALIGN/E and ALIGNALL/E, are not local. This is because their prohibited structural descriptions do not have a fixed length: ALIGN/E penalizes every syllable which is preceded (or followed, depending on the location of the active edge) by *any* number of unstressed syllables and the active edge; and ALIGNALL/E penalizes every unique sequence combining the active edge, a

[31] The prohibited sequence of STRESS/E may also be interpreted as a disjunction of two SL_2 expressions, depending on how directionality is assessed with respect to active edges. The edge-specific counterparts of STRESS/E, i.e., STRESS/R and STRESS/L, would be SL_2 either way.

stressed syllable, and some other syllable located between them, irrespective of the distance of the latter from each of the former two.

(57) Classification of alignment constraints by locality[32]

a.	STRESS/E	σ̊ A	local
b.	ALIGN/E	σ̊ $\mathring{\sigma}_0$ A	not local
c.	ALIGNALL/E	σ́ σ_0 σ σ_0 A	not local

I will refer to the second dimension as *locus-counting*, formulated in (58) after McCarthy's (2003) definition of constraint categoricity.[33] Locus-counting constraints are those which assign maximally one violation to a single element (constituent, grid mark, autosegment, etc.) based on some condition. Such constraints may assign multiple violations to a single candidate, but only if multiple loci satisfy the relevant condition.

(58) A constraint is *locus-counting* iff its definition can be stated in the following schema:
*Assign one * for each locus λ satisfying condition C*

STRESS/E is locus-counting: the locus is a syllable, and the condition is that it be unstressed and adjacent to the active edge (the locus may also be taken to be the active edge, in which case the condition would be that it be adjacent to an unstressed syllable). For example, in candidate (d) in tableau (55), there is exactly one syllable that meets this condition, namely the ultima, and therefore STRESS/E is violated once. ALIGN/E is also locus-counting: the locus is a syllable, and the condition is that no stressed syllable intervene between it and the active edge (and possibly also that there be at least one stressed syllable in the word).[34] In candidate (d), the ultima the penult

[32] These expressions can be written more compactly; I use these expressions for transparency with respect to the constraint definition.
[33] I use the term *locus-counting* instead of *categorical* because some constraints that meet this definition are inconsistent with the use of the latter term in the literature. In fact, ALIGN/E is consistent both with McCarthy's definition of *categorical* and that of *horizontally gradient*, contra the typical assumption that these properties are incompatible with one another.
[34] McCarthy (2003 fn. 25) identifies another case in which nonlocal constraints are locus-counting, specifically those that attracts the peak to a certain edge (like ALIGNPEAK/E). For such constraints, the locus would be a syllable, and the condition would be that it intervene between the peak and some specific edge. Each syllable may trigger maximally one violation because there is only one peak and one relevant edge in the word. McCarthy tentatively suggests that this constraint should be rejected because it is nonlocal.

meet this condition, and therefore two violations are incurred. The respective loci and conditions relevant to STRESS/E and ALIGN/E are shown in (59).

(59) Locus-counting variants of stress alignment

a. STRESS/E — $\lambda = \sigma$
C = unstressed & adjacent to the active edge

b. ALIGN/E — $\lambda = \sigma$
C = unstressed & there is no intervening stressed syllable between it and the active edge

Unlike the previous two constraints, ALIGNALL/E is not locus-counting. To see why, consider the three types of elements that participate in determining the number of violations assigned by the constraint: an active edge, a stressed syllable, and another syllables (stressed or unstressed). The locus cannot be an active edge, because individual active edges may trigger more than one violation, specifically whenever there is more than one stressed syllable they are not adjacent to. This is the case in candidate (d), where one active edge triggers six violations: two due to the third syllable, and four due to the initial syllable, both of which are stressed. The locus also cannot be a stressed syllable, because individual stressed syllables would trigger multiple violations whenever they are separated from the active edge by two syllables or more. In candidate (d), the stressed syllable in the third position triggers two violations because it is separated from the active edge by two syllables, and the stressed syllable in the initial position triggers four violations for a similar reason. Finally, the locus also cannot be simply a syllable, because individual syllables may trigger multiple violations whenever they intervene between the active edge and more than one stress. In candidate (d), the ultima triggers two violations, once because the third syllable is stressed, and once because the initial syllable is stressed. The penult triggers two violations for the same reason. Since ALIGNALL/E cannot be defined with respect to any locus that would trigger maximally one violation, it is not locus-counting.

Alongside one or more of the constraints in (52) and (54), grid-based approaches also make use of another class of constraints that attract stress to the edges, namely ESAL constraints. In Gordon (2002), ESAL constraints are interpreted as local. Constraints against short lapses at some edge are SL_3; for example, *LAPSE/L assigns one violation to candidates with the contiguous threesymbol sequence #σ̊σ̊ (# marks word edge). Constraints against long lapses at some edge are SL_4; for example, *EXTLAPSE/L penalizes the contiguous four-symbol sequence #σ̊σ̊σ̊.

More recently, Steriade (2019) proposed a nonlocal interpretation of these constraints, such that the number of violations is proportionate to the distance of the nearest stress from the relevant edge (I will return to this in §3.4). The local and nonlocal interpretations of the ESAL constraint *LAPSE/E are given in (60a) and (60b), respectively.

(60) Two interpretations of ESAL constraints

a. L|*LAPSE/E — Assign * for a sequence of two unstressed syllables at the active edge

b. NL|*LAPSE/E — Assign * for each unique sequence of two unstressed syllables separating the active edge from the nearest stressed syllable

The ways in which violations are assigned by each variant are illustrated in (61). Both constraints are satisfied by candidates in which one or both of the two syllables closest to the active edge are stressed, like candidate (a). In candidate (b), there is exactly one unique lapse between the active edge and the nearest stressed syllable, and therefore this candidate violates both L|*LAPSE/E and NL|*LAPSE/E exactly once. In candidate (c), there are two unique lapses separating the active edge from the nearest stress. The local L|*LAPSE/E assigns only one violation to this candidate, because it is blind to the properties of any syllables located outside of the disyllabic window at the active edge. In contrast, NL|*LAPSE/E assigns two violations, one for each of the unique lapses.

(61) Violation profiles of two variants of *LAPSE/E

<table>
<tr><th></th><th></th><th></th><th>L|*LAPSE/E</th><th>NL|*LAPSE/E</th></tr>
<tr><td>☞</td><td>a.</td><td>σσσσ́σ]^A</td><td></td><td></td></tr>
<tr><td></td><td>b.</td><td>σσσ́σσ]^A</td><td>*</td><td>*</td></tr>
<tr><td></td><td>c.</td><td>σσ́σσσ]^A</td><td>*</td><td>**</td></tr>
</table>

Both of the constraints in (60) are locus-counting. For (60a), the locus may be an active edge and the condition may be that it be adjacent to a sequence of two unstressed syllables.[35] (60b) is also locus-counting, albeit with a more elaborate condition: the locus is a syllable, and the condition is that it be unstressed and that no stressed syllable intervene between it and another unstressed syllable adjacent to an active edge.

The goal of this chapter is to identify which of the constraints in (52) and (54) yields better typological predictions. I start in §3.2 with a description of stress-repelling properties of syllables, which will play a role in some of the pathologies considered in this chapter. In §3.3 and §3.4 I present two types of pathological patterns that arise under local variants of alignment constraints, like STRESS/E, but not under nonlocal variants, like ALIGN/E and ALIGNALL/E. In the same sections I also show that local ESAL constraints (e.g., 60a) give rise to similar patterns. In §3.5 I compare ALIGN/E and ALIGNALL/E using an argument from Kager (2001) against constraints of the latter type.[36] I conclude the chapter in §3.6.

3.2. Stress-repelling properties

The pathological patterns in the following two sections involve the interaction of some constraints which refer to word edges with constraints which refer to stress-repelling properties of syllables. One example for a typologically common stress-repelling property is a nucleus occupied by a schwa (Kenstowicz 1997; de Lacy 2002; 2004; 2006; Gordon 2006).[37] The stress-repelling effect of schwas has been reported for French, Sarangani Manobo, Javanese, Mari, and Au, among other languages (see Gordon 2006).

In French, stress is assigned to the final syllable of the word (62a-c), unless it contains a schwa, in which case it is assigned to the penult (62d-f). French generally does not allow two consecutive syllables with schwas on the surface, so stress is limited to the two last syllables (Dell 1970; Walker 1975; Anderson 1982).

[35] Another possibility is that the locus is a syllable, and the condition is that it be unstressed and located between an active edge and another unstressed syllable.
[36] Kager's original argument is formulated with foot-based constraints which are similar to ALIGNALL/E. Here I present a grid-only interpretation of this argument.
[37] These papers also describe other types of effects of sonority on stress. Some aspects of these descriptions have been challenged by later work (Rasin 2018; Shih 2016; 2018a; 2018b; Shih and de Lacy 2019), however the descriptive avoidance of stress on schwa is generally agreed upon.

(62) Schwa avoidance in French (Indo-European; Walker 1975)

a. ivέʁ 'winter'
b. paʁadí 'paradise'
c. dyplikasjɔ̃́ 'duplication'

d. kúplə 'couple'
e. ʁέglə 'rule'
f. kupáblə 'guilty'

Sarangani Manobo is similar to French, but the default position of stress is the penult. Stress falls on the penult (63a-d), unless it contains a schwa, in which case it falls on the final (63e-g). Sarangani Manobo also allows consecutive syllables with schwas, and if this is the case in the last two syllables, stress returns to its default position, the penult, even if there are preceding non-schwa vowels (63h-j).

(63) Schwa avoidance in Sarangani Manobo (Austronesian; DuBois and DuBois 1964; DuBois 1976)[38]

a. bá.sa 'read'
b. dá.qət̚ 'bad'
c. mə.á.ma 'man'
d. pa.na.nó.qo 'sit down'

e. bə.gás 'hulled rice'
f. qa.tə.báj 'sister'
g. bi.nə.lə.sán 'borrowed'

h. də́l.ləg 'proceed'
i. bə́ŋ.ŋət̚ 'shave'
j. qi.sə́l.ləm 'morning'

Another example for a stress-repelling property comes from certain dialects of Central Alaskan Yupik, in which stress is prohibited on open syllables with a short vowel (Krauss 1985; Hayes 1995, 239–60). The typical repair for open syllables with an underlying short vowel is vowel

[38] Evidence that stressed-triggered post-schwa gemination is a productive phenomenon comes from reduplicated forms, e.g., *pədəŋ-pə́ddəŋ* 'blink'.

lengthening (e.g., /qajani/→[qajáːni] 'his own kayak').[39] Other repairs are also found, specifically when the open syllable contains a schwa: in some dialects, like the Unaliq subdialect of Norton Sound, the syllable becomes closed through gemination of the following consonant (e.g., /atəpik/→[atə́ppik] 'real name'); in other dialects, the syllable is eliminated through schwa deletion (e.g., /atəpik/→[átpik]).[40]

The two stress-repelling properties relevant to the phenomena described above are given in (64). *STRESSEDSCHWA prohibits stress on a syllable whose nucleus contains a schwa and is the trigger for syllable skipping in French and Sarangani Manobo. SWP prohibits stress on light syllables and is responsible for vowel lengthening, gemination, and schwa deletion in Yupik.

(64) Stress-repelling constraints

*STRESSEDSCHWA	Assign one * for each stressed syllable whose nucleus contains a schwa (cf. Elenbaas and Kager 1999, 301)
SWP	Assign one * for each stressed light syllable (Prince 1990)

A caveat is in order. Schwa-skipping effects like those in French and Sarangani Manobo are sometimes attributed to a prohibition on schwas that project a grid column, which replaces the constraints like *STRESSEDSCHWA (Kager 1989; Halle and Idsardi 1995; Féry 1996; and more recently Rasin 2018; Shih 2018a; 2018b; Shih and de Lacy 2019). I will not try to compare the two interpretations of schwa unstressability here; the argument presented in the remainder of this chapter is applicable as long there are stress-repelling constraints in CON in general, like SWP. A non-projection interpretation of open vowels with a short syllable in Yupik is unlikely: such syllables are counted for purposes of clash assessment, and they are typically repaired to become eligible to carry stress (by lengthening the vowel).

[39] Open syllables with underlyingly long vowels may also undergo lengthening under some conditions in some speakers, presumably to preserve the length contrast.
[40] For a detailed account of the dialectal differences concerning schwa in Yupik see Hayes (1995, 255–56).

3.3. The conditional boundedness problem

Theories of stress which incorporate into CON local interpretations of alignment and at least one stress-repelling constraint generate unattested patterns that fall under the CONDITIONAL BOUNDEDNESS PATHOLOGY, defined in (65). In conditionally bounded patterns, stress may only be assigned within a certain domain at a specific word edge (i.e., bounded), but if all syllables in the domain have a stress-repelling property and there is at least one syllable outside of the domain which does not, the stressable domain changes to include all non-stress-repelling syllables in the word (i.e., unbounded).

(65) CONDITIONAL BOUNDEDNESS PATHOLOGY: a family of patterns in which stress is bounded to a domain at a word edge, unless all syllables in the domain repel stress and at least one other syllable does not, in which case stress is unbounded

The hypothetical pattern in (66) illustrates a conditionally bounded system in which the default stressable domain includes only one syllable. Stress is restricted to the ultima when it is stressable (66a), but if the ultima has a stress-repelling property, stress is allowed on any syllable in the word which is not stress-repelling (66b). If all syllables in the word are stress-repelling, stress falls on the ultima (66c). Compare this pattern with French in (62), in which the final stress shifts to the penult if the final has a schwa.

(66) Conditional boundedness with a default monosyllabic window

a. σ σ σ σ {**σ**}
b. {**σ σ σ σ**} σ̆
c. σ̆ σ̆ σ̆ σ̆ {**σ̆**}

This pattern arises when a stress-repelling constraint ("REP" for "Repel") dominates STRESS/E, which in turn dominates a constraint that attracts stress to syllables with a certain designated property, like a long vowel or an underlying accent ("DPS" for "Designated Property to Stress", following Kager 2012). Tableau (67) illustrates the evaluation of pentasyllabic candidates in which the peninitial carries a stress-attracting property, denoted with a dot diacritic (σ̇). In (67-i), none of the syllables are stress-repelling, and therefore REP is not violated by any of the candidates.

STRESS/E, however, is violated by all candidates except the one with stress on the ultima (candidate a), which becomes the winner. In (67-ii), the ultima has the stress-repelling property targeted by REP. Thus, the candidate with final stress (candidate a) is eliminated by REP. STRESS/E does not distinguish among all other candidates, and therefore stress is no longer attracted to the edge. Instead, the candidate with peninitial stress (candidate d) wins because all other forms violate DPS.

(67) Grammar generating the conditional boundedness pattern in (66)

			REP	STRESS /E	DPS
i. σσ̇σσσ					
☞	a.	σσ̇σσ**σ́**]A			*
	b.	σσ̇σ**σ́**σ]A		*!	*
	c.	σσ̇**σ́**σσ]A		*!	*
	d.	σ**σ̋**σσσ]A		*!	
	e.	**σ́**σ̇σσσ]A		*!	*
ii. σσ̇σσσ̆					
	a.	σσ̇σσ**σ̋**]A	*!		*
	b.	σσ̇σ**σ́**σ̆]A		*	*!
	c.	σσ̇**σ́**σσ̆]A		*	*!
☞	d.	σ**σ̋**σσσ̆]A		*	
	e.	**σ́**σ̇σσσ̆]A		*	*!

Such pattern cannot be generated if the local STRESS/E is replaced with the nonlocal ALIGN/E. This is because the violations assigned by ALIGN/E are proportionate to the distance of the nearest stress to the edge. Tableau (68-i) is very similar to (67-i), because in both cases the ultima is stressable, and the candidate with final stress (candidate a) is the only one that incurs no violations to the alignment constraint. In (68-ii), final stress (candidate a) is excluded by REP, like (67-ii), but this grammar is different in that the constraint responsible for attracting the stress to the edge distinguishes among the other candidates. The winner is the form in which stress shifts only one syllable to the left (candidate b), because it incurs fewer violations of ALIGN/E than the candidates in which the stress is farther from the active edge (candidates c-e).

(68) Grammar with nonlocal alignment avoiding conditional boundedness

		REP	ALIGN/E	DPS
i.	σσ̇σσσ			
☞ a.	σσ̇σσ**σ́**]^{A}			*
b.	σσ̇σ**σ́**σ]^{A}		*!	*
c.	σσ̇**σ́**σσ]^{A}		*!*	*
d.	σ**σ̆́**σσσ]^{A}		*!**	
e.	**σ́**σ̇σσσ]^{A}		*!***	*
ii.	σσ̇σσσ̆			
a.	σσ̇σσ**σ̆́**]^{A}	*!		*
☞ b.	σσ̇σ**σ́**σ̆]^{A}		*	*
c.	σσ̇**σ́**σσ̆]^{A}		**!	*
d.	σ**σ̆́**σσσ̆]^{A}		**!*	
e.	**σ́**σ̇σσσ̆]^{A}		**!**	*

Unlike the conditionally bounded pattern generated in (67), which is unattested, the grammar in (68) generates a pattern which is attested in multiple languages, including French (Dell 1970; Walker 1975) and Chuvash (Turkic; Krueger 1961; Dobrovolsky 1999).

Other conceivable conditionally bounded systems include a stress window spanning over two or three syllables at some edge. The hypothetical pattern in (69) has a disyllabic stress window at the right edge. As long as at least one of the syllables in the window is stressable, stress is limited to the window, within which its position may be determined by a designated property. However, if both syllables are stress-repelling, and there is at least one non-stress-repelling vowel in the word, all non-stress-repelling syllables become eligible to carry the stress.

(69) Conditional boundedness with a default disyllabic window

a. σ σ σ {**σ σ**}
b. σ σ σ σ̆ {**σ**}
c. {**σ σ σ**} σ̆ σ̆

The hypothetical pattern in (69) arises in theories with a local ESAL constraint like L|*LAPSE/E from (60a). This is illustrated in (70) with pentasyllabic forms with a stress-attracting property in the peninitial position. In (70-i), none of the syllables are stress-repelling, so REP does not eliminate any of the candidates. The next constraint, L|*LAPSE/E, eliminates candidates (c-e) because their stress falls outside of the disyllabic window at the right edge, including the candidate in which the stress is associated with a stress-attracting property (candidate d with peninitial stress). Between the two remaining candidates, the one with penultimate stress (candidate b) wins because it satisfies NONFINALITY while its competitor with final stress (candidate a) does not. The input in (70-ii) is identical except that the penult has a stress-repelling property, and therefore the candidate with stress on the penult (candidate b) is eliminated by REP. Candidates (c-e) are again eliminated because they violate L|*LAPSE/E, and the only remaining candidate is the one with final stress (candidate a), which is therefore the winner. In (70-ii) both the ultima and the penult are stress-repelling, and therefore both candidates with stress in the disyllabic window (candidates a and b) are eliminated by REP. Since all the remaining candidates have the same number of violations of L|*LAPSE/E, it no longer affects stress placement. The winning candidate is the one with stress on the peninitial (candidate d), because it is the only one that satisfied DPS.

(70) Grammar generating the conditional boundedness pattern in (69)

			REP	L|*LAPSE/E	NONFIN	DPS
i.		σσ̇σσσ				
	a.	σσ̇σσ**σ́**]^{A}			*!	*
☞	b.	σσ̇σ**σ́**σ]^{A}				*
	c.	σσ̇**σ́**σσ]^{A}		*!		*
	d.	σ**σ̇́**σσσ]^{A}		*!		
	e.	**σ́**σ̇σσσ]^{A}		*!		*
ii.		σσ̇σσ̆σ				
☞	a.	σσ̇σσ̆σ́]^{A}			*	*
	b.	σσ̇σ**σ̆́**σ]^{A}	*!			*
	c.	σσ̇**σ́**σ̆σ]^{A}		*!		*
	d.	σ**σ̇́**σσ̆σ]^{A}		*!		
	e.	**σ́**σ̇σσ̆σ]^{A}		*!		*
iii.		σσ̇σσ̆σ̆				
	a.	σσ̇σσ̆**σ̆́**]^{A}	*!		*	*
	b.	σσ̇σ**σ̆́**σ̆]^{A}	*!			*
	c.	σσ̇**σ́**σ̆σ̆]^{A}		*		*!
☞	d.	σ**σ̇́**σσ̆σ̆]^{A}		*		
	e.	**σ́**σ̇σσ̆σ̆]^{A}		*		*!

Tableau (71) illustrates an identical grammar to (70), except that the ESAL constraint is interpreted nonlocally (NL|*LAPSE/E from 60b). In both grammars, whenever at least one of the last two syllables is not stress-repelling (i and ii in each tableau), stress falls within the disyllabic window. The two grammars differ in words in which both the penult and the ultima are stress-repelling (iii in each tableau): while in (70-iii) stress shifts to a distant syllable with a designed property (candidate d), in line with the conditional boundedness pathology, in (71-iii) stress shifts to the antepenult (candidate c). This is shifting the stress by only one syllable minimizes the number of violations incurred to NL|*LAPSE/E relative to all other remaining candidates.

(71) Grammar with nonlocal ESAL constraints avoiding conditional boundedness

	REP	NL|*LAPSE/E	NONFIN	DPS
i. σσ̇σσσ				
a. σσ̇σσ**σ́**]^A			*!	*
☞ b. σσ̇σ**σ́**σ]^A				*
c. σσ̇**σ́**σσ]^A		*!		*
d. σ**σ̇́**σσσ]^A		*!*		
e. **σ́**σ̇σσσ]^A		*!**		*
ii. σσ̇σσ̆σ				
☞ a. σσ̇σσ̆σ́]^A			*	*
b. σσ̇σ**σ̆́**σ]^A	*!			*
c. σσ̇**σ́**σ̆σ]^A		*!		*
d. σ**σ̇́**σσ̆σ]^A		*!*		
e. **σ́**σ̇σσ̆σ]^A		*!**		*
iii. σσ̇σσ̆σ̆				
a. σσ̇σσ̆**σ̆́**]^A	*!		*	*
b. σσ̇σ**σ̆́**σ̆]^A	*!			*
☞ c. σσ̇**σ́**σ̆σ̆]^A		*		*
d. σ**σ̇́**σσ̆σ̆]^A		**!		
e. **σ́**σ̇σσ̆σ̆]^A		**!*		*

It is hard to assess which formulation of ESAL constraints is the correct one on typological grounds. Neither the window-based conditionally bounded pattern in (69), generated by L|*LAPSE/E, nor its counterpart in (71), generated by NL|*LAPSE/E, are attested in the typological surveys. This is not surprising, because the set of languages in which such patterns could logically arise is limited to languages which not only enforce a stress-repelling property and a polysyllabic stress window with a designated property, but also allow adjacent stress-repelling syllables. Even if these conditions are met, the shape of the word that would distinguish between the two patterns is very specific: it would need to consist of at least four syllables, with stress-repelling syllables in the penultimate and final positions, a neutral syllable in the antepenultimate position, and a stress-attracting syllable further to the left (…σ̇…σσ̆σ̆), or the mirror image of this configuration (σ̆σ̆σ…σ̇…). While I cannot offer an empirical argument for either formulation of ESAL constraints, I hope that the clear diverging predictions may be useful in future studies, when a language that has these properties is discovered.

As for STRESS/AE (and its edge-specific counterparts), theories of stress that reject these local alternatives to alignment provide a better fit to the typology, specifically because they exclude conditional boundedness. Such theories capture the cross-linguistic generalization that stress-repelling syllables like in French and Sarangani Manobo can only shift stress to a nearby syllable, and never eliminate an otherwise present stress-attracting effect of the word edge.

3.4. The conditional edge selection problem

The pathological pattern considered in the previous section is a part of a broader overgeneration problem triggered by local variants of alignment. This problem can be characterized as follows: the theory generates grammars which assign stress to a default position (or a default window), but when the default position is unavailable due to a stress-repelling property, the language appeals to a radically different stress-assignment strategy. In the case of conditional boundedness, this strategy is to assign stress based on a designated stress-attracting property, like long vowels or underlying accents. This strategy is chosen because a specific DPS constraint is ranked just below the one(s) responsible for the default stress assignment. In this section, I will consider a similar problem, which arises when other constraints replace DPS in a similar ranking hierarchy.

The conditional edge selection pathology, introduced in §2.4 and reformulated in (72), is similar to conditional boundedness in that whenever the default position for stress is unavailable, another stress assignment strategy is adopted. What characterizes conditional edge selection is that this independent strategy concerns the attraction of stress to the opposite edge of the word. The pattern in (73) is an illustration of conditional edge selection, in which the default position of stress is the ultima (73a), but when the ultima has a stress-repelling property, stress falls on the initial (73b). If both the ultima and the initial have stress-repelling properties, then stress falls on some other syllable based on other considerations, e.g., the penult (73c).

(72) CONDITIONAL EDGE SELECTION PATHOLOGY: a family of patterns in which stress is bounded to a domain at one word edge, unless all syllables in the domain repel stress, in which case it is bounded to a domain at the opposite edge

(73) Conditional edge selection

a. σ σ σ σ **σ́**
b. **σ́** σ σ σ σ̆
c. σ̆ σ σ **σ́** σ̆

This pathology arises due to local variants of alignment constraints that attract stress to opposite edges. This is shown in (74) with two edge-specific local constraints that target a peripheral syllable, STRESS/R and STRESS/L.[41] First, (74-i) illustrates stress assignment in a word with no stress-repelling syllables. None of the relevant candidates violate REP for obvious reasons. The candidate with stress on the ultima (candidate a) is the only candidate that satisfies the next constraint in the hierarchy, STRESS/R, and is therefore the winner. In contrast, in (74-ii), the ultima has a stress-repelling property, and therefore the candidate with stress on the ultima is not selected due to violation of REP. The next constraint in the hierarchy, STRESS/R, is violated exactly once by candidates b-e because their final syllable is not stressed; among these, the candidate with initial stress (candidate e) wins because it is the only one that satisfies the next constraint in the hierarchy, STRESS/L.

[41] The active-edge approach with a local alignment constraint can also generate the pattern in (73), but only if an edge-specific STRESS/L is included (see §2.5.2). The pattern would arise in grammars with an active right edge and the ranking REP>>STRESS/E>>STRESS/L>>other constraints.

(74) Grammar generating the conditional edge selection pattern in (73)

		REP	STRESS /R	STRESS/L
i. σσσσσ				
☞	a. σσσσ**σ́**			*
	b. σσσ**σ́**σ		*!	*
	c. σσ**σ́**σσ		*!	*
	d. σ**σ́**σσσ		*!	*
	e. **σ́**σσσσ		*!	
ii. σσσσσ̆				
	a. σσσσ**σ̆́**	*!		*
	b. σσσ**σ́**σ̆		*	*!
	c. σσ**σ́**σσ̆		*	*!
	d. σ**σ́**σσσ̆		*	*!
☞	e. **σ́**σσσσ̆		*	

McCarthy (2003, 117) identifies a specific case of the conditional edge selection pathology, which arises from an interaction between local constraints on primary stress placement and a non-finality constraint specifically targeting primary stress. The three relevant constraints, translated into grid-based terms, are given in (75).

(75) ENDRULE/R — Assign one * if the primary stress does not coincide with the right-most stressed syllable

ENDRULE/L — Assign one * if the primary stress does not coincide with the left-most stressed syllable

NONFINALITYPEAK — Assign one * if the primary stress falls on the ultima

The relevant pattern arises in a grammar with the ranking NONFINALITYPEAK >> ENDRULE/R >> ENDRULE/L, illustrated in (76), with assumed left-to-right stress assignment starting from the initial (determined by higher-ranked constraints). In the unattested pattern, the primary stress shifts from one edge of the word to the opposite edge as a function of the length of the word, specifically depending on whether it has an odd or an even number of syllables. In even-parity words (76-i) the right-most stress coincides with the penultimate syllable. Since the candidate with primary stress on the penult (candidate a) satisfies ENDRULE/R and does not violate the higher-ranked

NONFINALITYPEAK, it is selected as the winner over the two other candidates, which do violate ENDRULE/R. In odd-parity words (76-ii), the right-most stress coincides with the ultima. Although the candidate with final primary stress (candidate a) is the only one that satisfies ENDRULE/R, it also violates the higher-ranked NONFINALITYPEAK, and is therefore eliminated. The next constraint in the hierarchy, ENDRULE/L, is only satisfied by the candidate with initial primary stress (candidate b), which is therefore the winner.

(76) McCarthy's case of conditional edge selection

	NONFINPEAK	ENDRULE/R	ENDRULE/L
i. σσσσσ			
☞ a. σ̀σσ̀**σ́**σ			*
b. **σ́**σσ̀σσ̀σ		*!	
c. σ̀σ**σ́**σσ̀σ		*!	*
ii. σσσσ			
a. σ̀σσ̀σ**σ́**	*!		*
☞ b. **σ́**σσ̀σσ̀		*	
c. σ̀σ**σ́**σσ̀		*	*!

Despite this, McCarthy advocates for constraints like ENDRULE/R and ENDRULE/L, and deals with the overgeneration problem by rejecting (the foot-based counterpart of) NONFINALITYPEAK as part of CON.[42] Whether or not this move is correct, this solution does not extend to other local constraints on stress, specifically those discussed in this and the previous section.[43]

A related pathological pattern is identified by Steriade (2019). The pathology involves patterns with some designated stress-attracting property (in Steriade's example, an underlying accent) and maximally one stress per word. The unattested behavior is as follows: among all syllables with the designated property, those near *both* edges have a privileged status over the rest of the word.

Consider the pattern in (77), in which the window size at each edge only includes one syllable. By default, stress falls on the ultima (77a). If the initial has the designated property and the ultima

[42] McCarthy (2003, 119) mentions English as a potential counterexample, which has been claimed to assign primary stress to the right-most nonfinal stressed syllable (Schane 1975, 251), but suggests that the generality of this rule is questionable.
[43] For McCarthy's solution to work, one would also need to adopt the assumption that there are no stress-repelling constraints that single out primary stress other than NONFINALITYPEAK. This is because a similar pattern would arise if the ultima had a different property that repels primary stress. I am not aware of data that bear on this question.

does not, stress falls on the initial (77b). If both the initial and the ultima have the designated property, stress shifts back to the default position, the ultima (77c). The example in (77d) is the crucial one: among non-final syllables, the initial receives priority over any other nonfinal syllable in the word. This essentially describes a situation in which both the right edge and the left edge are privileged (with a hierarchy between them) over other syllables, such that syllables in the middle of the word only receive the stress if they have the designated property and both the ultima and the initial do not (77e).

(77) Both edges are privileged

a. σ σ σ σ **σ́**
b. **σ̇́** σ σ σ σ
c. σ̇ σ σ σ **σ̇́**
d. **σ̇́** σ σ̇ σ σ
e. σ σ **σ̇́** σ σ

Pattern (77) arises when a DPS constraints outranks local constraints that attract stress to the edges. The evaluation of a word like (77c), in which there is a stress-attracting syllable at both word edges, is shown in (78-i). The candidate without the designated property (candidate b) is eliminated by DPS. Between the other two candidates, only the one with stress on the ultima (candidate a) satisfies the next constraint in the hierarchy, STRESS/R, and is therefore the winner. Tableau (78-ii) shows the evaluation of (77d), in which the ultima does not have the designated property but the initial and the third syllable do. In this case, the candidate with final stress (candidate a) is eliminated by DPS because there are other candidates which do not violate this constraint. Both remaining candidates (b and c) have primary stress on a stress-attracting syllable; however, STRESS/L prefers the candidate with initial stress (candidate c), which is therefore the winner. Overall, the result is that in (77c) primary stress falls on the stress-attracting syllable closest to the right edge, while in (77d) it falls on the one closest to the left edge.

(78) Both edges are privileged

	DPS	STRESS/R	STRESS/L
i. σ̇σσσσ̇			
☞ a. σ̇σσσ**σ̇́**			*
b. σ̇σ**σ̇́**σσ̇	*!	*	*
c. **σ̇́**σσσσ̇		*!	
ii. σ̇σσ̇σσ			
a. σ̇σσ̇σ**σ́**	*!		*
b. σ̇σ**σ̇́**σσ		*	*!
☞ c. **σ̇́**σσ̇σσ		*	

The same problem arises with disyllabic and trisyllabic windows at word edges, imposed by local variants of ESAL, such as L|*LAPSE/E in (60a). This lead Steriade to put forth the idea that ESAL constraints might be evaluated in a nonlocal manner, like NL|*LAPSE/E in (60b).

Recall that the goal of this chapter is to identify the correct way to impose the attraction of stress to the edges in OT, and especially to evaluate the predictive success of STRESS/E, ALIGN/E, and ALIGNALL/E. In this and the preceding section, I argued for the exclusion of STRESS/E from CON based on a set of pathological patterns that are predicted to arise if it was a part of speakers' grammars. In the next section, I focus on distinguishing between ALIGN/E and ALIGNALL/E.

3.5. Why not ALIGNALL?

Among the constraints presented at the beginning of this chapter (specifically in 52 and 54), ALIGNALL/E is the most powerful. First, it is nonlocal (as shown above). The string over which violations are counted is unbounded: the number of violations triggered by a single stressed syllable is equal to n-1 where n is any integer reflecting the position of that syllable counting from the active edge. Second, it is also not locus-counting (also shown above). The number of violations triggered by a single intervening syllable (the locus) is equal to the number of stressed syllables that follow it when counting from the active edge. Recall that the difference between ALIGNALL/E and ALIGN/E is that the latter attracts only the stress closest to the active edge, while the former attracts *all* stresses in the word.

The goal of this section is to motivate the exclusion of ALIGNALL/E from CON. To achieve this, I present an argument from Kager (2001; 2004; 2005b; 2005a) against constraints of the ALIGNALL type. The heart of the argument lies in the consequences of ALIGNALL on the predicted typology of lapses and clashes. Here I will focus on a subset of the cases discussed by Kager, specifically cases that will become relevant in Chapter 4.

In languages with bidirectional stress, whenever the two fixed stresses are separated by an even number of syllables, perfect rhythm is impossible. In such cases, words must inevitably contain either a stress lapse or a stress clash. The schematic examples in (79) show words with seven syllables with two fixed stresses, one on the initial and the other on the penult, such that the two stresses are separated by an even number of syllables (specifically, four). In both examples, an intermediate stress is assigned to the fourth syllable, separated by exactly one syllable from the right-most fixed stress. Assigning an additional intermediate stress, e.g., to the second syllable, would avoid a stress lapse, but leave a stress clash (79a). The alternative is to not assign an additional intermediate stress and leave a stress lapse (79b). I will refer to languages which opt for a stress clash in such cases as *bidirectional plus clash*, and to those which opt for a stress lapse in such cases as *bidirectional plus lapse* (cf. Gordon 2002, 527–30).

(79) a. σ́σ́σσ́σσ́σ
b. σ́σσσ́σσ́σ

Garawa (Garawan; Furby 1974) belongs to the class of bidirectional plus lapse languages. In Garawa (in 80), the primary stress falls on the initial, and secondary stresses are assigned to every other syllable from the right starting from the penult.[44] The exception is the second syllable, which is never stressed, and would otherwise create a clash with the initial primary stress (*ká**ma**larìn^{j}i* ‘wrist’, **ká**mà**larìn^{j}i)*. As a result, in long words with an odd number of syllables the syllable with main stress is followed by a lapse.

[44] The non-primary stresses preceding the penult are described as tertiary (Furby 1974, 10).

(80) Garawa bidirectional stress plus lapse (Garawan; Furby 1974)

a.	já.mi	‘eye’
b.	pú.nʲa.la	‘white’
c.	wá.tʲim.pà.ŋu	‘armpit’
d.	ká.ma.la.rì.nʲi	‘wrist’
e.	já.ka.là.ka.làm.pa	‘loose’
f.	ŋán.ki.ri.kì.rim.pà.ji	‘fought with boomerangs’
g.	ná.ri.ŋin.mù.ku.nʲì.na.mì.ra	‘at your own many’

A similar pattern is found in Piro (Arawakan; Matteson 1963), in (81), where the fixed stresses also fall on the initial and the penult, and stress clashes are prohibited (*sàlwajehkákna* ‘they visit each other’, **sàlwàjehkákna*). Piro differs from Garawa in two ways. First, while in Garawa the initial syllable carries the primary stress, in Piro the primary stress falls on the penult. Second, while in Garawa long words with an odd number of syllables have a lapse near the initial (e.g., *ŋán**kiri**kìrimpàji* ‘fought with boomerangs’, **ŋánkirì**kirim**pàji*), in Piro such words have a lapse near the penult (e.g., *rùslunò**tini**tkána* ‘their voices already changed’, **rùs**luno**tìnitkána*). This difference can also be stated in terms of the directionality of stress assignment: Garawa assigns stresses to every other even syllable from right to left, and Piro to every odd syllable from left to right (up to the penult).

(81) Piro bidirectional stress plus lapse (Arawakan; Matteson 1963)

a	wá.lo	‘rabbit’
b	ru.txí.txa	‘he observes taboo’
c	tʃì.ja.há.ta	‘he cries’
d	sà.lwa.je.hká.kna	‘they visit each other’
e	pè.tʃi.tʃhì.ma.tló.na	‘they say they stalk it’
f.	rù.slu.nò.ti.ni.tká.na	‘their voices already changed’
g	kà.xruː.kà.khi.mà.na.ta.tká.na	‘they were joking together then, it is said’

The positions of the stress lapses in Garawa and Piro follow a cross-linguistically predictable pattern (Kager 2001). Generally, lapses in words with two fixed stresses are found near the stress peak (“The Bidirectionality Asymmetry” in Kager 2001). In Garawa, primary stress falls on the initial, and lapses, when unavoidable, always span over the second and third syllables, which immediately follow. In Piro, primary stress falls on the penult, and when stress lapses are present, they always span over the immediately preceding two syllables. This generalization is stated in (82), reformulated from Kager (2001, 3).[45]

(82) **Generalization**: in bidirectional languages, lapses tend to be placed near the primary stress

We now turn to bidirectional plus clash languages, in which clashes are tolerated and lapses are avoided. One example is Southern Paiute (Uto-Aztecan; Sapir 1930), repeated in (83) from §2.5.2. In Southern Paiute, the primary stress falls on the peninitial and another fixed secondary stress falls on the penult. Other non-primary stresses are assigned to every even-numbered syllable counting from the left up to the penult; this includes the antepenult, if in even-numbered position, even though stressing the antepenult creates a clash with the fixed stress on the penult (e.g., m*aróo̥***qwàjʔìq***q̥w̥ḁ* 'stretch it').

(83) Southern Paiute penultimate and peninitial stress (Uto-Aztecan; Sapir 1930)

a. ŋ̊u̥.qwín.ti̥ 'stream'
b. tḁ.ʃíp.pàx.xu̥ 'when it was evening'
c. qa.nít.ti.rì.ḁ 'camping places'
d. ma.ró.o̥.qwàj.ʔìq.qw̥ḁ 'stretch it'
e. ti.ná.ḁ.tì.ɣa.à.ʀi̥ 'hunting-leader'
f. c͡ça.áq.qa.ìp.pɯ.ɣà.ìn.nɪ̥ 'cold thrill going through head'

Another example is Tauya (Trans New Guinean; MacDonald 1990), repeated in (84) from §2.5.2, where primary stress falls on the ultima and a fixed secondary stress falls on the initial. Other non-primary stresses are assigned to every odd-numbered syllable counting from the right up to the initial, even when this creates a clash, which happens when the second syllable is in odd-numbered position (e.g., ***mòmù****nepá* 'X sat and X…').

[45] The original formulation of the generalization in Kager (2001, 3) is as follows: "Secondaries run toward the main stress in bidirectional systems. (Or: in bidirectional systems, the edges of the fixed foot and the End Rule match.)"

(84) Tauya initial and final stress (Trans New Guinean; MacDonald 1990)

a. nò.nó 'child'
b. ʔù.ne.tá 'mat'
c. mò.mù.ne.pá 'X sat and X…'
d. jà.po.tì.ja.fó 'my hand'

Kager (2001) notes that the position of clashes in Southern Paiute and Tauya is representative of a typological generalization, according to which stress clashes in bidirectional languages do not involve the primary stress (as long as there are at least two non-primary stress that may clash instead). The dispreference for clashes with stress peaks (or otherwise higher degrees of stress) over other types of clashes has been previously observed in English, notably by Liberman & Prince (1977, 285) and later work, including Hammond (1984, 93), Halle & Vergnaud (1987, 238), Plag (1999, 176), and Pater (2000, 246), among others. The generalization, adapted from Kager (2001, 9), is stated in (85).[46]

(85) **Generalization**: in bidirectional languages, clashes tend to not involve the primary stress

The position of the intermediate stresses in bidirectional languages (and hence, the position of an unavoidable lapse or clash) cannot be determined by a constraint like ALIGN/E (or its edge-specific counterparts), which counts the distance only between a word edge and the nearest stress, because the sum of its violations is unaffected by any of the stresses. Instead, the position of intermediate stresses is derived by many theories with constraints similar to ALIGNALL/E, which penalize the distance of *every* stress (or foot) with respect to a word edge (e.g., McCarthy and Prince 1993, 94; Kager 1999, 45; Gordon 2002, 497). The edge-specific instantiations of ALIGNALL are stated in

[46] Kager's original formulation of the generalization did not capture cases like *tḁʃíppàxxu̥* in Southern Paiute (83b) and *nònó* in Tauya (84a), where the clash is allowed between the two fixed stresses. The original formulation is repeated here (Kager 2001, 9): "Clashes do not involve the main stress (that is, if there is a single main stress)." The reformulation in (85) correctly includes (83b) and (84a).

(86); I will consider their active edge variant later on and it will become clear why I start with the edge-specific versions.[47,48]

(86) ALIGNALL/R For each stressed syllable, assign one * for each syllable separating it from the right edge

ALIGNALL/L For each stressed syllable, assign one * for each syllable separating it from the left edge

To see the effect of ALIGNALL in bidirectional languages, consider the location of the stress lapses in Garawa (80) and Piro (81). Languages in which ALIGNALL/R dominates ALIGNALL/L will prefer that the stress lapse be near the left-most fixed stress, because this would minimize the sums of the distances of all stresses from the right edge. This ranking fits the profile of Garawa and is illustrated in (87). Candidate (a) violates ALIGNALL/R ten times, calculated as follows: the stress on the penultimate syllable incurs one violation because it is separated from the right edge by one other syllable; the stress on the preantepenultimate syllable incurs three violations because it is separated from the right edge by three syllables; finally, the stress on the initial incurs six violations because it is separated from the right edge by six syllables. The individual violation marks are shown in brackets, where violations incurred by different stressed syllables are separated by commas; the sum of these violations is written as a number. The violations for candidate (b) are calculated in a similar fashion; since candidate (b) incurs one more violation of ALIGNALL/R compared to candidate (a), the latter is the winning candidate.

[47] ALIGNALL/R and ALIGNALL/L correspond to Gordon's ALIGN(x_2, R, level 0, ω) and ALIGN(x_2, L, level 0, ω), respectively. The formulations given in (86) are refinements which make explicit the way in which violations are assigned for each stress in the word, i.e., that the number of violations incurred by each stress equals to the number of syllables separating it from the relevant edge.

[48] Violations of ALIGNALL can also be eliminated by removing stresses. Many theories of stress in OT rely on ALIGNALL constraints, or a foot-based version thereof, to derive single-stress and dual-stress languages, e.g., Elenbaas and Kager 1999; Gordon 2002. As I show below, ALIGNALL cannot capture the typology of lapses and clashes; I instead adopt a different approach for deriving single-stress and dual-stress languages, spelled out in Chapter 4.

(87) Garawa lapse placement with ALIGNALL

		ALIGNALL/R	ALIGNALL/L
☞ a.	σ́σσσ̀σσ̀σ	10* (*,***,******)	8* (***,*****)
b.	σ́σσ̀σσσ̀σ	11*! (*,****,******)	7* (**,*****)

In languages in which ALIGNALL/L dominates ALIGNALL/R, lapses will be placed near the right-most fixed stress, because this would minimize the sums of the distances of all stresses from the left edge. This is the case in Piro, illustrated in (88).

(88) Piro lapse placement with ALIGNALL

		ALIGNALL/L	ALIGNALL/R
a.	σ̀σσσ̀σσ́σ	8*! (***,*****)	10* (*,***,******)
☞ b.	σ̀σσ̀σσσ́σ	7* (**,*****)	11* (*,****,******)

Under the ALIGNALL approach, a similar computation would determine the position of the stress clashes in Southern Paiute (83) and Tauya (84). In Southern Paiute, the fact that the clash involves the right-most stress would be derived with the ranking ALIGNALL/R >> ALIGNALL/L (in 89).

(89) Southern Paiute clash placement with ALIGNALL

		ALIGNALL/R	ALIGNALL/L
a.	σσ́σ̀σσ̀σ	8*! (*,***,****)	7* (*,**,****)
☞ b.	σσ́σσ̀σ̀σ	7* (*,**,****)	8* (*,***,****)

The clash involving the left-most stress in Tauya would be derived with the opposite ranking, with ALIGNALL/L dominating ALIGNALL/R (in 90).

(90) Tauya clash placement with ALIGNALL

	ALIGNALL/L	ALIGNALL/R
☞ a. σ̀σ̀σσ́	4* (*,***)	5* (**,***)
b. σ̀σσ̀σ́	5*! (**,***)	4* (*,***)

Kager (2001) shows that although ALIGNALL/R and ALIGNALL/L can derive the stress patterns above, they miss the generalizations in (82) and (85) (also see van Urk 2013). This is because the effect of these constraints on the position of lapses and clashes is fully independent from the position of the primary stress. The corresponding unattested patterns are described in (91).

(91) a. LAPSE AVOIDANCE OF PRIMARY STRESS: patterns in which stress lapses tend to avoid being adjacent to primary stress

b. CLASH ATTRACTION TO PRIMARY STRESS: patterns in which stress clashes tend to involve the primary stress

The hypothetical mirror-Garawa (92) is an example for lapse avoidance of peaks. In mirror-Garawa, internal lapses tend to be placed far from the peak whenever possible.

(92) A hypothetical mirror-Garawa

a. σ́σ
b. σ́σσ
c. σ́σσ̀σ
d. σ́σσσ̀σ
e. σ́σσ̀σσ̀σ
f. σ́σσ̀σσσ̀σ
g. σ́σσ̀σσ̀σσσ̀σ

In Mirror-Garawa, stresses are attracted to the left edge due to the ranking ALIGNALL/L >> ALIGNALL/R, illustrated in (93). Candidate (a) is eliminated because it incurs one additional violation of ALIGNALL/L compared to candidate (a). This is because the medial stress is placed on the fourth syllable in candidate (a) and on the third in candidate (b). Thus, the unattested candidate (b) is selected.

(93) Unattested lapse placement in a hypothetical mirror-Garawa

	ALIGNALL/L	ALIGNALL/R
a. σ́<u>σσ</u>σ̀σσ̀σ	8*! (***,*****)	10* (*,***, ******)
☞ b. σ́σσ̀<u>σσ</u>σ̀σ	7* (**,*****)	11* (*,****, ******)

If ALIGNALL/L and ALIGNALL/R are replaced with a counterpart that attracts all stresses to the active edge (ALIGNALL/E), the problem becomes worse: in bidirectional plus lapse languages, the lapse will tend to be far from the peak (at least when the peak is assigned to the stressed syllable closest to the active edge), because this would reduce the sum of distances between all stresses and the active edge; in bidirectional plus clash languages, the clash will tend to be closer to the peak for the same reason. These tendencies are incompatible with the generalizations in (82) and (85), respectively.

To remedy this problem, Kager proposes an alternative theory of the distribution of stresses within the word, which eliminates ALIGNALL/R and ALIGNALL/L from CON and instead posits constraints that directly refer to prohibited sequences of lapses and clashes with respect to different levels of stress (peak vs. non-peak).[49] The constraints responsible for the generalizations in (82) and (85) are defined in (94). In bidirectional plus lapse languages, the location of lapse is governed by *LAPSE-IN-TROUGH (and possibly by other local constraints); in bidirectional plus clash languages, the location of the clashes is determined by *CLASH-AT-PEAK (also possibly by other local constraints).[50]

[49] This is a part of a more general proposal for a theory of CON, the Rhythmic Licensing Theory, which relies both on constraints that refer to feet and ones that refer to stresses. Since our interest is in grid-only theories of stress, I will only adopt the constraints which belong to the latter type.
[50] The other local constraints which are relevant are those that refer to either stress-attracting or stress-repelling properties of syllables.

(94) Peak-sensitive constraints against clashes and lapses (Kager 2001; 2005b; 2005a)

*LAPSE-IN-TROUGH	Assign one * for each sequence of two unstressed syllables surrounded by syllables bearing secondary stresses[51]
*CLASH-AT-PEAK	Assign one * for each sequence of two stressed syllables if one of them bears the peak

The effect of the *LAPSE-IN-TROUGH is illustrated in (95). Candidate (b) violates *LAPSE-IN-TROUGH because it contains a stress lapse between two syllables bearing secondary stress, specifically the third and sixth syllables; in contrast, candidate (a) does not violate *LAPSE-IN-TROUGH because its only lapse has a secondary stress on one side and a primary stress on the other. For this reason, candidate (b) is correctly eliminated and candidate (a) wins.

(95) The effect of *LAPSE-IN-TROUGH in Garawa

			*LAPSE-IN-TROUGH
☞	a.	$\acute{\sigma}\underline{\sigma\sigma}\grave{\sigma}\sigma\grave{\sigma}\sigma$	
	b.	$\acute{\sigma}\sigma\grave{\sigma}\underline{\sigma\sigma}\grave{\sigma}\sigma$	*!

The count of violations of *CLASH-AT-PEAK works similarly and is illustrated in (96). Candidate (a) violates *CLASH-AT-PEAK because it contains a clash involving the primary stress, namely between the second and third syllables, and is thus eliminated. The winner is candidate (a), in which the only clash is between two secondary stresses.

(96) The effect of *CLASH-AT-PEAK in Southern Paiute

			*CLASH-AT-PEAK
	a.	$\sigma\underline{\boldsymbol{\acute{\sigma}}\grave{\sigma}}\sigma\grave{\sigma}\sigma$	*!
☞	b.	$\sigma\boldsymbol{\acute{\sigma}}\sigma\underline{\grave{\sigma}\grave{\sigma}}\sigma$	

[51] Adapted from Kager (2005a, 14):

*LAPSE-IN-TROUGH No lapse occurs between secondary stresses

See Kager (2005a, 14–15) for a comparison between *LAPSE-IN-TROUGH and an earlier precursor, LAPSE-AT-PEAK, which penalizes any lapse that is not adjacent to a peak (Kager 2001; 2004; 2005b).

3.6. Concluding remarks on alignment

The goal of this chapter was to compare three types of constraints that attract stress to word edges. I showed that a local and locus-counting variant of alignment, STRESS/E (in 54), gives rise to a set of pathological patterns, specifically when it interacts with constraints that refer to stress-repelling properties of syllables (§3.3. and §3.4). I then considered a constraint that utilizes the full power of Generalization Alignment, ALIGNALL/E (52b), and concluded that it is inadequate because it fails to capture the typology of lapses and clashes, based on an argument developed in Kager (2001 and subsequent work) (§3.5).

I conclude that the remaining version of alignment, ALIGN/E (52a), is the most appropriate constraint for modeling the attraction of stress to word edges, because it does not give rise to the pathologies discussed here. At this time, I am not aware of arguments that disfavor ALIGN/E compared to its alternatives.

Alongside variants of alignment, I also discussed ESAL constraints, which are responsible in grid-based theories for enforcing stress windows. I showed that the local version of ESAL constraints runs into similar problems to STRESS/E, while their nonlocal counterparts do not.

CHAPTER 4: EDGE OVER RHYTHM

4.1. Introduction

In the previous two chapters, I argued for a specific set of constraints which are responsible for regulating the distance of stress from one active word edge. Among those, alignment and ESAL constraints attract stresses to the active edge, while non-peripherality constraints repel stresses from the active edge. This chapter is concerned with the interaction of these constraints with another set of constraints, namely those which are responsible for governing rhythmic alternations by prohibiting lapses and clashes. I refer to the former type of constraints as ACTIVE EDGE constraints, and the latter type as RHYTHM constraints.[52] Edge-specific constraints, like ALIGN/L and NONFINALITY, do not belong to either category and will be addressed separately in §4.4.

Three constraints that belong to the RHYTHM category are listed in (97). *LAPSE and *EXTLAPSE penalize sequences of two and three unstressed syllables, respectively. They differ from the anti-lapse constraints in the ACTIVE EDGE category, such as *LAPSE/E, in that their effect is not limited to syllables near a word boundary. *CLASH penalizes sequences of two stressed syllables, also regardless of their position in the word. Other RHYTHM constraints are introduced later in the chapter.

(97) RHYTHM constraints

*LAPSE	Assign one * for a sequence of two unstressed syllables
*EXTLAPSE	Assign one * for a sequence of three unstressed syllables
*CLASH	Assign one * for a sequence of two stressed syllables

[52] Cf. the distinction between *Stress*^{EP} (edge prominence) and *Stress*^{R} (rhythm) in van der Hulst's 2012 Accent-First theory. Van der Hulst's distinction differs from the one presented here in that his *Stress*^{EP} specifically refers to non-primary stress, whereas the Active Edge category here includes ALIGNPEAK/E.

The presence of rhythmic alternation is determined by the relative ranking of *LAPSE and *EXTLAPSE on the one hand, and a stress-minimizing constraint on the other. The stress-minimizing constraint that fulfills this function will be ONESTRESS, defined in (98).[53]

(98) ONESTRESS Assign one * for each syllable with non-primary stress

The goal of this chapter is to support the view that constraints in the ACTIVE EDGE category universally dominate those in the RHYTHM category. I discuss two overgeneration problems that bear on this issue, specifically because they arise only when the opposite ranking holds. The first problem, presented in §4.2, concerns a family of pathological patterns which have some shared properties with the midpoint patterns from Chapter 2 and which arise when ALIGN/E is dominated by *LAPSE or *EXTLAPSE. The second problem, presented in §4.3, concerns pathological patterns of primary stress assignment which arise when peak-sensitive constraints against lapses and clashes dominate ALIGNPEAK/E (Alber 2005; Kager 2005b). §4.4 outlines the proposal for a universal ranking between ACTIVE EDGE and RHYTHM, including its consequences for the various constraints discussed thus far. I conclude the chapter in §4.5 by introducing the last RHYTHM constraint that will be used for computing the factorial typology in Chapter 5, which is responsible for the typologically privileged positions of lapses relative to word edges (Kager 2001; Heinz, Kobele, and Riggle 2005; van Urk 2013).

Note that while both of the overgeneration problems discussed in this chapter are framed within the active-edge approach, they are equally applicable to theories with edge-specific constraints. The range of applicable solutions to the problems, however, may differ across theories.

[53] The elimination of non-primary stresses is derived in different ways in the literature on stress. For example, ALIGNALL constraints (see Chapter 3) can minimize the number of stresses because they penalize all stressed syllables not adjacent to a specific edge. Another way to derive stress minimization is available in theories that employ edge-specific ALIGNPEAK constraints (see Chapter 2), because the only candidates that satisfy both constraints simultaneously are the single-stress candidates. Both types of constraints are not adopted here for reasons discussed in the preceding two chapters.

4.2. The quasi-midpoint problem

The two constraints against non-contextual lapses, *LAPSE and *EXTLAPSE, can be satisfied in at least two conceivable ways. The trisyllabic form in (99a) has a stress on the initial syllable and a lapse spanning over the second and third syllables. One way to eliminate this lapse is to add another stress on the third syllable, as in (99b). This would violate some competing constraints, notably stress-minimizing constraints such as ONESTRESS. Another way to eliminate this lapse is to shift the stress to the second syllable, as in (99c). This would violate alignment constraints which prefer that the stress be closer to the left edge.

(99)	a. σ́σσ	Violation of *LAPSE
	b. σ́σσ́	Repair 1: adding stress
	c. σσ́σ	Repair 2: shifting stress

Although *LAPSE does not refer to word edges, in (99c) it causes the stress to be drawn towards the middle of the word. This effect resembles the midpoint patterns triggered by ESAL constraints in §2.2, but the two are not identical. While in midpoint patterns the attraction of the stress to the middle of the word is limited to words of specific length and does not occur in longer words, *LAPSE and *EXTLAPSE continue to prefer that the stress be away from the edges in any words exceeding a certain length.

This effect of *LAPSE and *EXTLAPSE generates a family of unattested patterns which I will refer to as the QUASI-MIDPOINT PATHOLOGY, defined in (100). A special case of the quasi-midpoint pathology has also been previously identified by Gordon (2002, 510–11 fn. 26).[54]

(100) QUASI-MIDPOINT PATHOLOGY: a family of patterns in which stress is repelled by the word edges in words exceeding a certain length

[54] The characterization of the pathology in (70) differs from that in Gordon (2002). Gordon's characterization referred to the tendency "to shift the location of the stress(es) as a function of number of syllables in the word". The refinement in (40) is meant to capture a more restricted type of patterns. For example, Gordon's definition can also in principle characterizes counting languages like Creek, in which the position of stress near some edge depends on the parity of the number of syllables in the word (cf. §2.6).

Two hypothetical quasi-midpoint patterns are shown in (101), both unbounded and quantity-sensitive with one stress per word. In both patterns, heavy syllables attract the stress because WSP dominates ALIGN/E, and thus stressing a heavy syllable is more important than the proximity of stress to a word edge. In pattern (101a), WSP is dominated by *LAPSE. As a result, in words with three or more syllables, heavy syllables attract stress everywhere except the initial and the ultima, because if the stress falls on one of these two positions, *LAPSE would be violated. Pattern (101b) is similar, except that it is *EXTLAPSE that dominates WSP. In this case, stress-repelling effects at the edges start in four-syllable words, in which either the second or the third syllable must be stressed in order to satisfy *EXTLAPSE. In longer words, heavy syllables attract stress anywhere except the first two and last two syllables.

(101) Two quasi-midpoint patterns

a. Limited quasi-midpoint[55] *LAPSE >> WSP >> ALIGN/E	b. Extended quasi-midpoint *EXTLAPSE >> WSP >> ALIGN/E
{**σ σ**}	{**σ σ**}
σ {**σ**} σ	{**σ σ σ**}
σ {**σ σ**} σ	σ {**σ σ**} σ
σ {**σ σ σ**} σ	σ σ {**σ**} σ σ
σ {**σ σ σ σ**} σ	σ σ {**σ σ**} σ σ

The grammar generating pattern (101a) is illustrated in (102) for four quadrisyllabic words, each with one heavy syllable. In all four cases, the candidate with more than one stress (candidate a) is eliminated by ONESTRESS. Had ONESTRESS been ranked below *LAPSE, the quasi-midpoint pattern would not have arisen, because shifting the stress would have been sub-optimal. The candidates with stress on a peripheral syllable, i.e., on the ultima (candidate b) or the initial (candidate c), are eliminated by *LAPSE regardless of syllable weight, because they incur one additional violation of *LAPSE relative to candidates with non-peripheral stress and because *LAPSE dominates WSP. Finally, the choice among the two candidates with a non-peripheral stress

[55] Pattern (101a) resembles a pathological pattern discussed in §2.5.2, in which both edges repel stress due to the rankings NONPERIPH/E, NONFINALITY >> ALIGN/E, WSP, plus an active edge on the left. That pattern is different in the that in disyllabic words, only one of the two syllables can attract stress (whichever satisfies the higher ranked constraint among NONPERIPH/E and NONFINALITY).

(candidates d and e) depends on syllable weight and proximity to the active edge. If one of the two non-peripheral syllable is heavy and the other is not, the heavy syllable attracts the stress (102-ii,iii). Otherwise, the stress is assigned to the one closer to the active edge, i.e. the third syllable (102-i,iv).

(102) Grammar generating pattern (101a) with quadrisyllabic words which have exactly one heavy syllable

		OneStress	*Lapse	WSP	Align/E
i. σσσσ̄					
a.	σ**σ́**σ**σ̄́**]^A	*!			
b.	σσσ**σ̄́**]^A		**!		
c.	**σ́**σσσ̄]^A		**!	*	***
☞ d.	σσ**σ́**σ̄]^A		*	*	*
e.	σ**σ́**σσ̄]^A		*	*	**!
ii. σσσ̄σ					
a.	**σ́**σ**σ̄́**σ]^A	*!			
b.	σσσ̄**σ́**]^A		**!	*	
c.	**σ́**σσ̄σ]^A		**!	*	***
☞ d.	σσ**σ̄́**σ]^A		*		*
e.	σ**σ́**σ̄σ]^A		*	*!	**
iii. σσ̄σσ					
a.	σ**σ̄́**σ**σ́**]^A	*!			
b.	σσ̄σ**σ́**]^A		**!	*	
c.	**σ́**σ̄σσ]^A		**!	*	***
d.	σσ̄**σ́**σ]^A		*	*!	*
☞ e.	σ**σ̄́**σσ]^A		*		**
iv. σ̄σσσ					
a.	**σ̄́**σ**σ́**σ]^A	*!			
b.	σ̄σσ**σ́**]^A		**!	*	
c.	**σ̄́**σσσ]^A		**!		***
☞ d.	σ̄σ**σ́**σ]^A		*	*	*
e.	σ̄**σ́**σσ]^A		*	*	**!

The pairwise rankings that give rise to the quasi-midpoint pathology are stated in (103). First, some constraint or combination of constraints that penalize stresses must outrank both *Lapse and *ExtLapse (103a). This limits the space of possible repairs of lapses to shifting the stress and excludes the alternative of adding a stress. In the constraint set advocated here, the only constraint that has this effect is ONESTRESS. Second, either *LAPSE or *EXTLAPSE must outrank the alignment constraints that penalize the distance between edges and stressed syllables (103b). In the active-edge approach, this set includes ALIGN/E and ALIGN/L (but not ALIGNPEAK/E).

(103) Quasi-midpoint crucial rankings:

a. ONESTRESS >> *LAPSE, *EXTLAPSE
b. *LAPSE or *EXTLAPSE >> ALIGN/E

There are at least two conceivable ways to minimally change the theory in order to exclude grammars generating quasi-midpoint patterns. The first is the elimination of the ranking in (103a) from the hypothesis space. This is a non-starter: such ranking is crucial in grammars with only one stress per word. The other possibility is to eliminate the rankings in (103b) from the hypothesis space, that is, postulate that neither of the two anti-lapse constraints may dominate ALIGN/E. Unlike the ranking in (103a), it is not at all clear that (103b) is a crucial ranking in any attested language.[56]

In the remainder of this chapter, I will pursue the latter possibility, according to which the ranking (103b) is not a part of the space of possible grammars. The universal ranking that would exclude this ranking is stated in (104).

[56] Another conceivable possibility is that there exists a conditional universal over rankings, according to which (103a) and (103b) cannot be true simultaneously. Gordon derives this conditional slightly differently. His system does not include ONESTRESS, however (the counterparts of) ALIGNPEAK/R and ALIGNPEAK/L have a similar effect when both of them outrank *LAPSE and *EXTLAPSE. This is because the only way to satisfy ALIGNPEAK/R and ALIGNPEAK/L simultaneously is to have only one stressed syllable in the word; this way, the peak is both on the right-most and the left-most stressed syllable. To eliminate quasi-midpoint languages from the space of possible grammars, Gordon postulates a disjunctive universal, according to which either ALIGNPEAK/R or ALIGNPEAK/L must be ranked below the other stress constraints, including *LAPSE and EXTLAPSE (pp. 510–11, fn. 26). The only other type of constraints in his system that have a stress-minimizing effect is the alignment constraints, as they penalize *all* stresses not aligned with the edge (ALIGNALL in Chapter 3). They do not give rise to quasi-midpoint patterns, because they cannot both dominate and be dominated by *LAPSE and *EXTLAPSE.
I will not pursue this solution here for two reasons. First, because positing this universal prevents the theory from generating quantity-sensitive single-stress languages (or single-stress languages sensitive to any other designated stress-attracting property), which are very common typologically. The problem stems from the fact that in order to ensure that there be only one stress in the word, either ALIGNALL/R or ALIGNALL/L must outrank DPS (the constraint demanding that all syllables with the designated property be stressed); however, systems in which stress is attracted to a designated property require that DPS outrank both ALIGNALL/R and ALIGNALL/L. The second reason I do not pursue this solution is because it relies on an interpretation of alignment which is incompatible with the typology of lapses and clashes (§3.5).

(104) ALIGN/E >> LAPSE, *EXTLAPSE

In the next section, I discuss another family of unattested patterns that points to a universal hierarchy among ACTIVE EDGE constraints and RHYTHM constraints. Specifically, I consider an argument from Kager (2005b) for a fixed ranking between an alignment constraint responsible for primary stress assignment (here, ALIGNPEAK/E) and peak-sensitive constraints against lapses and clashes introduced in Chapter 3.

4.3. The peak shifting problem

The two constraints in (105), repeated from §3.5, penalize clashes and lapses in certain positions relative to the level of stress of the syllables involved or of adjacent syllables (Kager 2001; 2004; 2005b; 2005a). *LAPSE-IN-TROUGH penalizes lapses between two non-primary stresses. *CLASH-AT-PEAK penalizes clashes that involve the primary stress. This section is concerned with a family of pathological patterns that arise under some conditions in grammars in which one of these two constraints dominates ALIGNPEAK/E, previously identified by Alber (2005).[57]

(105) Peak-sensitive constraints against clashes and lapses (Kager 2001; 2005b; 2005a)

*LAPSE-IN-TROUGH	Assign one * for a sequence of two unstressed syllables between syllables bearing secondary stresses[58]
*CLASH-AT-PEAK	Assign one * for a sequence of two stressed syllables if one of them bears the peak

[57] Alber (2005) illustrates the peak shifting problem with a different peak-sensitive constraint against lapses, which penalizes any lapse not adjacent to a peak (LAPSE-AT-PEAK, proposed in Kager 2001). In later work, Kager (2005a) shows that replacing LAPSE-AT-PEAK with *LAPSE-IN-TROUGH eliminates the peak shifting pattern described by Alber. As I show in this section, this change does not solve other instances of peak shifting, specifically those that arise due to stress-repelling properties. See Alber (2005, 531–34) and Kager (2005a, 14–15) for details.

[58] Adapted from Kager (2005a, 14):

*LAPSE-IN-TROUGH No lapse occurs between secondary stresses

See Kager (2005a, 14–15) for a comparison between *LAPSE-IN-TROUGH and an earlier precursor, LAPSE-AT-PEAK, which penalizes any lapse that is not adjacent to a peak (Kager 2001; 2004; 2005b).

There is more than one possible repair to occurrences of lapses and clashes that violate the constraints in (105). Consider the form in (106a), which violates *LAPSE-IN-TROUGH, and some possible repairs that would satisfy it in (106b-d). The first possible repair, (106b), avoids a lapse between two secondary stresses by moving one of the stresses to a nearby syllable. This is the strategy adopted in bidirectional plus lapse languages like Garawa, where lapses near the peak are tolerated. Another possible repair for *LAPSE-IN-TROUGH is to eliminate the lapse altogether by assigning an additional stress to one of the syllables in the lapse, as in (106c). This option is attested in bidirectional plus clash languages like Southern Paiute, where clashes are tolerated. Finally, the illicit sequence can also be repaired by shifting the peak to a different syllable by promoting the stressed syllable closest to the opposite edge, as in (106d).[59] The latter repair is unattested, and was identified by Alber (2005) as an overgeneration problem caused by the constraints in (105).

(106) a. Illicit form **σ́**σσ̀$\underline{\sigma\sigma}$σ̀
b. Repair 1: **σ́**$\underline{\sigma\sigma}$σ̀σσ̀
c. Repair 2: **σ́**σσ̀σ̀σσ̀
d. Repair 3: σ̀σ**σ́**σ$\underline{\sigma}$σ̀

I refer to the family of patterns which shift the primary stress to satisfy *LAPSE-IN-TROUGH or *CLASH-AT-PEAK as the PEAK SHIFTING PATHOLOGY ("licensor attraction" in Alber 2005 and Kager 2005b; 2005a; also see Heinz, Kobele, and Riggle 2005 and van Urk 2013). The pathology is characterized in (107).

(107) PEAK SHIFTING PATHOLOGY: a family of patterns in which the position of lapses or clashes affects which stressed syllable is promoted to be the peak

The hypothetical language in (108) illustrates a case of peak shifting. It is a bidirectional plus lapse language, in which both the initial and the ultima are stressed, the primary stress is assigned to the initial by default, and stress on syllables with some stress-repelling property (σ̆) is prohibited, such as nucleus schwas (§3.2). In most words with an even number of syllables, which inevitably

[59] Other repairs are also possible, e.g., shifting the peak to the stressed syllable closest to its default position.

contain a lapse, the lapse is placed near the initial syllable to satisfy *LAPSE-IN-TROUGH, as in (108a). However, when the antepenult has a stress-repelling proprety, as in (108b), a lapse near the ultima is inevitable. To satisfy *LAPSE-IN-TROUGH, the primary stress shifts to the third syllable (108c).

(108) A hypothetical case of peak shifting

a. **σ́**σσ̀σσ̀
b. **σ́**σσσ̀σσ̀
c. σ̀σ**σ́**σ̆σσ

Peak shifting patterns arise only in grammars in which ALIGNPEAK/E is dominated by *LAPSE-IN-TROUGH or *CLASH-AT-PEAK and some stress-repelling constraint. This is shown in tableau (109) with the pattern in (108). The input to (109-i), corresponding to the form in (108b), has no stress-repelling syllables, so REP doesn't play a role. Candidate (b) violates *LAPSE-IN-TROUGH because it contains a lapse between two secondary stresses. Candidate (c) violates ALIGNPEAK/E because it is separated from the active edge by another stress. The winning candidate is a, which violates neither. The input to (109-ii) corresponds to the form in (108c), in which the antepenult is a stress-repelling syllable. Since REP is undominated, the candidate with stress on the stress-repelling syllable (candidate a) is eliminated. As in (109-i), candidate (b) is eliminated because it violates *LAPSE-IN-TROUGH. The winner is the peak shifting candidate, candidate (c), in which the peak is assigned to the next-to-leftmost stressed syllable, thus violating ALIGNPEAK/E.

(109) Lapse-triggered peak shifting

			REP	*LAPSE-IN-TROUGH	ALIGNPEAK/E
i.	σσσσσσ				
☞	a.	A[**σ́**σσσ̀σσ̀			
	b.	A[**σ́**σσ̀σσσ̀		*!	
	c.	A[σ̀σ**σ́**σσσ̀			*!
ii.	σσσəσσ				
	a.	A[**σ́**σσσ̆̀σσ̀	*!		
	b.	A[**σ́**σσ̀σ̆σσ̀		*!	
☞	c.	A[σ̀σ**σ́**σ̆σσ̀			*

Based on the absence of peak shifting patterns, Kager (2005b) suggests a universal over rankings, according to which some ALIGNPEAK constraint must occupy the top stratum. His system includes edge-specific versions of ALIGNPEAK, so the universal is stated as a disjunction, such that only one of ALIGNPEAK/R and ALIGNPEAK/L occupies the top stratum. In the next section, I suggest that Kager's universal over rankings is a part of a broader pattern.[60,61]

4.4. ACTIVE EDGE over RHYTHM

What is common to the quasi-midpoint pathology and the peak shifting pathology is that they both demonstrate the limited influence that rhythmic considerations have on other stress constraints. In the unattested quasi-midpoint patterns, rhythmic considerations (specifically *LAPSE and *EXTLAPSE) affect the position of stress in single-stress languages. In the unattested peak shifting patterns, rhythmic considerations (specifically *LAPSE-IN-TROUGH and *CLASH-AT-PEAK) affect the selection of the stressed syllable which carries the peak.

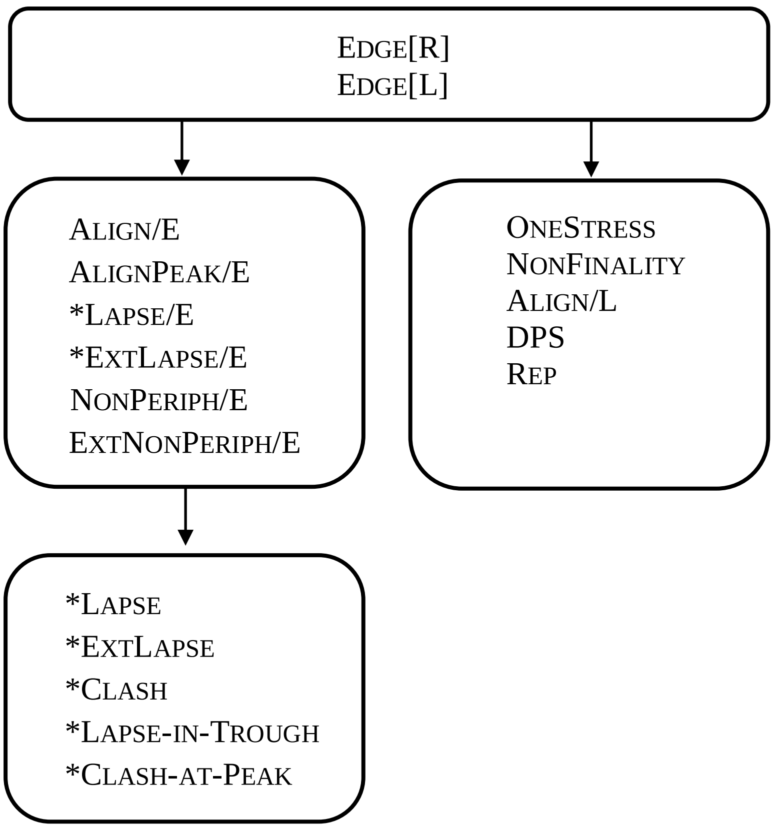
This echoes a view advocated in van der Hulst (1997; 2012) and van der Hulst and Goedemans (2014), according to which the placement of the peak ("accent") is independent from rhythmic stress assignment cross-linguistically, though here I do not assume that the stress bound to the active edge necessarily bears the peak. In the context of the approach considered here[62], I reframe this view as follows: there are no languages which require that a rhythmic constraint dominate a constraint sensitive to the active edge (recall that in the system advocated here, single-stress languages are derived with the ranking ONESTRESS>>*(EXT)LAPSE).

I therefore propose that ACTIVE EDGE constraints and RHYTHM constraints belong to two distinct sets of strata in the ranking hierarchy, such that constraints in the former category universally

[60] In §2.6 I showed that ALIGNPEAK/E must be violable, because there are languages in which the peak is sometimes assigned to a medial stress due to a peak-attracting property. I therefore interpret Kager's universal in a narrower sense, namely a universal ranking between some ALIGNPEAK constraint and a particular set of constraints that includes *LAPSE-IN-TROUGH and *CLASH-AT-PEAK.
[61] Heinz, Kobele, and Riggle (2005) offer a different solution to the peak shifting problem; I comment on this in §4.5, fn. 66.
[62] Van der Hulst (1997; 2012) advocates for an architecture of grammar in which the stress peak ("Accent") and the rhythmic stresses ("Rhythm") have independent representations and are assigned by separate modules.

dominate the constraints in the latter category.[63] This ranking hierarchy is illustrated in Figure 4, along with the hierarchy established in the previous chapter among Edge[R] and Edge[L] and the other constraints.

Figure 4: illustration of the proposed fixed rankings in Con (version 3, to be revised)



In Chapter 2 I argued that alongside the constraints that refer to active edges, Con also includes two edge-specific constraints, namely NonFinality and Align/L. It is fairly evident that these *can* be dominated by rhythmic considerations. To see this, consider the data in (110) from Maranungku (Daly; Tryon 1970), in which stress is assigned in all odd-numbered positions, including the ultima. Had the ultima not been stressed in words with an odd number of syllables (as in 111b,c,e), the last two syllables would be unstressed, violating *Lapse. In order to avoid

[63] To exclude the pathologies discussed in this section from the hypothesis space, it is only necessary that (most) rhythmic constraints be dominated by Align/E and AlignPeak/E. I adopt the stronger view that all Active Edge constraints behave as a natural class in this respect.

this, NONFINALITY is violated instead. The pattern in Maranungku thus requires the crucial ranking *LAPSE>>NONFINALITY, illustrated in (111).

(110) Maranungku binary alternation (Daly; Tryon 1970) (see Gordon 2002, 523)

a.	tí.ralk	‘saliva’
b.	mǽ.ræ.pæ̀t	‘beard’
c.	mú.lʲiŋ.kìn	‘salt-water turtle’
d.	já.ŋar.mà.ta	‘the Pleiades’
e.	ŋál.ti.rì.ti.rì	‘tongue’

(111) Final stress is tolerated to avoid a lapse

			*LAPSE	NONFINALITY
	a.	σ́σσ̀σσ	*!	
☞	b.	σ́σσ̀σσ̀		*

The mirror image, in which stresses are assigned in perfect alternation from right to left, shows that ALIGN/L can also be dominated by rhythmic constraints. Consider the data from Urubu-Kaapor (Tupí-Guaraní; Kakumasu 1986) in (112). In words with four syllables (112d,e), stress on the initial would cause a clash with a rhythmic stress on the peninitial, or a lapse if clashes are avoided. In such cases, the initial syllable is not stressed. The grammar that generates this pattern is one in which *LAPSE and *CLASH dominate ALIGN/L, illustrated in (113).

(112) Urubu-Kaapor (Tupí-Guaraní; Kakumasu 1986)

a.	ta.tá	‘fire’
b.	wà.ru.wá	‘mirror’
c.	ù.ru.má	‘duck’
d.	mi.rà.ra.ʔír	‘small tree’
e.	a.rà.pu.há	‘deer’

(113) Unstressed initial is tolerated to avoid a lapse or a clash

			*LAPSE	*CLASH	ALIGN/L
	a.	σ̀σσσ́]A	*!		
	b.	σ̀σ̀σσ́]A		*!	
☞	c.	σσ̀σσ́]A			*

4.5. Completing the set of Rhythm constraints

Alongside the RHYTHM constraints introduced in Chapters 2 and 3, the factorial typology in the following chapter includes one other anti-lapse constraint familiar from the literature. While in some languages lapses tend to land near the primary stress, like the bidirectional languages in §3.5, in other languages the preferred position of lapses is at the end of the word (Kager 2001; 2004; 2005b; 2005a). To account for this fact, Kager proposes a constraint that penalizes lapses which are not at a word edge. I will refer to this constraint as *LAPSE/_σ (cf. Kager's LAPSE-AT-END) and provide a (reformulated) definition in (114).[64,65]

(114) *LAPSE/_σ   Assign one * for a sequence of two unstressed syllables followed by another syllable

Note that there is an overlap between the effect of the *LAPSE/_σ and that of EXTNONFINALITY (in §2.5.1, excluded from CON): when there is a single lapse in the word, both prefer forms in which the lapse is word-final (Buckley 2009, 398). However, these two constraints differ in that the latter can be violated even in forms with no lapse anywhere in the word (e.g., σ́σσ́σσ́σ,) while the former cannot not. In §2.5.1 I suggested that there is little evidence for extended non-finality effects otherwise; I therefore adopt *LAPSE/_σ for the calculation of the factorial typology in Chapter 5.

In line with the universal ranking between ACTIVE EDGE constraints and RHYTHM constraints proposed in §4.4, I take *LAPSE/_σ to be outranked by the constraint sensitive to the active edge. Since this constraint does not play a role in any of the pathologies considered in this dissertation, I will not discuss it any further; however see (Kager 2001; 2004; 2005b; 2005a) for motivation and further discussion, as well as Heinz et al. (2005) and van Urk (2013) for alternatives.[66]

[64] Kager (Kager 2005a, 8) defines this constraint as a licensing constraint as follows:

LAPSE-AT-END   Lapse must be adjacent to the right edge.

[65] Kager (2001) also discusses a potential typological tendency for clashes to be placed near the edge (and possibly just near the left edge) and proposes a constraint to that effect (CLASH-AT-EDGE, p. 11). Since I do not have sufficient data to evaluate this generalization, I will exclude this constraint from the factorial typology in Chapter 5.

[66] Heinz, Kobele, and Riggle (2005) suggest an alternative constraint, which penalizes lapses within the last three syllables with one violation mark, and other lapses with two violation marks. This change was meant to address the peak shifting problem, which were assumed to arise specifically from an interaction between *LAPSE/_σ and LAPSE-AT-PEAK (or its successor *LAPSE-IN-TROUGH). However, as I show in §4.3, the peak shifting problem arises from interactions of *LAPSE-IN-TROUGH with other constraints as well.

CHAPTER 5: FACTORIAL TYPOLOGY AND DISCUSSION

5.1. Introduction

In Chapters 2-4, I argued for a set of properties that grid-based constraints on stress assignment must have to avoid a variety of overgeneration problems. In Chapter 2, I proposed that most edge-sensitive constraints refer to a single active edge. I also adopted an asymmetrical set of two edge-specific constraints, ALIGN/L and NONFINALITY, which account for the limited set of stress phenomena that require reference to both word edges. In Chapter 3, I compared three ways in which edges may attract stress and showed that only one of those does not overgenerate, namely a nonlocal constraint penalizing syllables that occur between the edge and the nearest stress. Finally, in Chapter 4, I argued for a fixed ranking of constraints which are sensitive to the active edge above rhythmic constraints.

The present chapter has two goals. The first goal is to examine the factorial typology generated by the constraint set constructed in this thesis and to evaluating the fit of this constraint set to the observed typology, specifically, test whether it generates all observed languages (minimizes undergeneration) and assess the extent to which it avoids generating patterns that are very different from observed languages (minimizes overgeneration). The second goal is to compare this factorial typology to those generated by previous grid-only constraint sets proposed in the literature. The two constraint sets that I will focus on are those in Gordon (2002) and in Heinz, Kobele, and Riggle (2005; henceforth: "HKR"). These two constraint sets were chosen because they are comprehensive in the sense that they were designed to generate the full typology of stress patterns (originally only quantity-insensitive languages, but they extend to quantity-sensitive languages once the appropriate constraints are added, cf. Kager 2012).

The structure of this chapter is as follows. §5.2 provides a recap of the active-edge theory constructed in the preceding chapters. The next two sections describe the factorial typology generated by the proposed constraint set and the fixed rankings, starting with quantity-insensitive languages (§5.3) and proceeding with languages with stress-attracting and stress-repelling properties, which I will refer to as quantity-sensitive (§5.4).[67] In each of these sections, I will point out remaining issues and, where possible, potential solutions. Finally, in §5.5 I compare these results to the factorial typologies generated by previous grid-only proposals.

5.2. A recap: the active-edge theory of stress

The active-edge constraint set constructed in this thesis is summarized in (115). The constraints are divided into three categories. The ACTIVE EDGE constraints (115a) are all those which refer to the active edge, including the two constraints responsible for the position of the active edge (EDGE[R] and EDGE[L]). The RHYTHM constraints (115b) include all variants of anti-lapse and anti-clash constraints which do not explicitly refer to word edges in their definition. Finally, constraints that do not belong to either category are listed in (115c). As in the preceding chapters, I use the constraint DPS and REP as placeholders for constraints sensitive to stress-attracting (e.g., WSP) and stress-repelling (*STRESSEDSCHWA) properties of syllables, respectively. The ESAL constraints *LAPSE/E and *EXTLAPSE/E are defined as nonlocal (see Chapter 3).

[67] Stress-repelling properties are sometimes, but not always, interpreted as restrictions concerning syllable weight. For expositional purposes, I use the term "quantity-sensitive factorial typology" to refer to one that incorporates both stress-attracting and stress-repelling properties.

(115) Final constraint set of the active-edge theory of stress

a. ACTIVE EDGE constraints

EDGE[R]	Assign one * if the right edge is inactive
EDGE[L]	Assign one * if the left edge is inactive
ALIGN/E	Assign one * for each syllable separating the active edge from the nearest stressed syllable
*LAPSE/E	Assign one * for each unique sequence of two unstressed syllables separating the active edge from the nearest stressed syllable
*EXTLAPSE/E	Assign one * for each unique sequence of three unstressed syllables separating the active edge from the nearest stressed syllable
NONPERIPH/E	Assign one * for a stressed syllable at the active edge
EXTNONPERIPH/E	Assign one * if either of the last two syllables bears stress and an additional * if the ultima bears stress
ALIGNPEAK/E	Assign one * for each stressed syllable separating the active edge from the primary stress

b. RHYTHM constraints

*LAPSE	Assign one * for each sequence of two unstressed syllables
*EXTLAPSE	Assign one * for each sequence of three unstressed syllables
*CLASH	Assign one * for each sequence of two stressed syllables
*LAPSE-IN-TROUGH	Assign one * for each sequence of two unstressed syllables between syllables bearing secondary stresses
* CLASH-AT-PEAK	Assign one * for each sequence of two stressed syllables if one of them bears the peak
*LAPSE/_σ	Assign one * for each sequence of two unstressed syllables followed by another syllable

c. Other constraints

NONFINALITY	Assign one * for a stressed syllable at the right edge
ALIGN/L	Assign one * for each syllable separating the left edge from the nearest stressed syllable
ONESTRESS	Assign one * for each syllable with non-primary stress
DPS	Assign one * for each unstressed syllable with a stress-attracting property
REP	Assign one * for each stressed syllable with a stress-repelling property

The definition of NONEXTPERIPH/E is revised from §2.3 and follows a similar constraint proposed by HKR (originally, NOFINALFOOT). The revised definition avoids a pathological pattern in which the two peripheral syllables are unstressable in long words, but in short words there is no stress-repelling effect at all. For example, consider the hypothetical pattern in (116), in which stress falls on the antepenult in words with three or more syllable but on the ultima in disyllabic words. This is generated by a constraint set in which NONEXTPERIPH/E does not distinguish between the ultima and the penult, but is avoided if stress on the ultima incurs more violations than stress on the penult.[68]

(116) Unattested reversal of non-finality

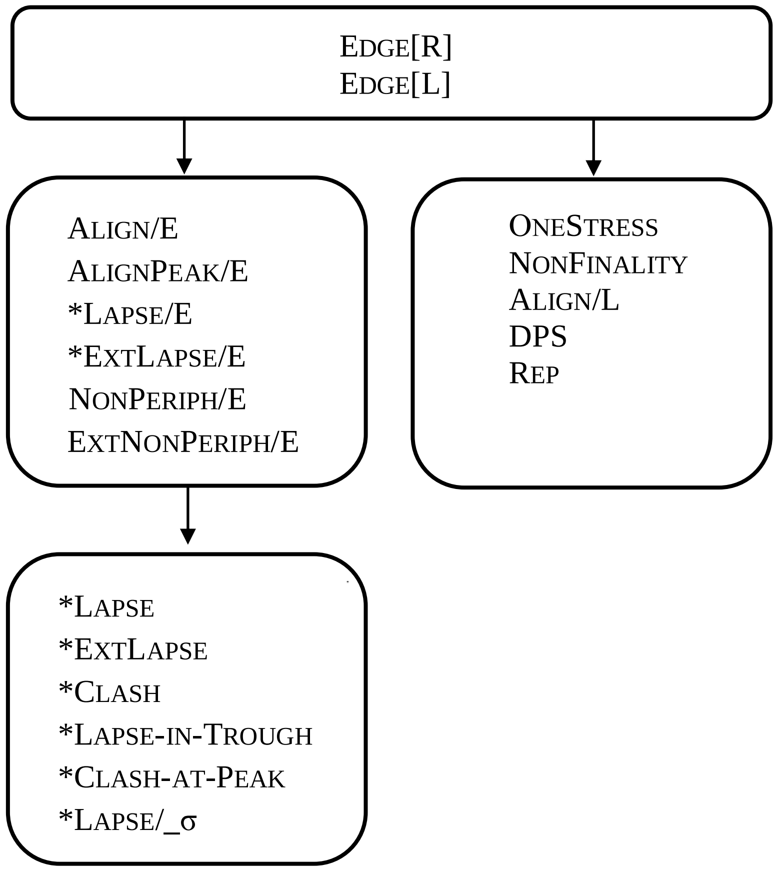
a. σ**σ́**
b. **σ́**σσ
c. σ**σ́**σσ
d. σσ**σ́**σσ

The proposed theory includes two types of fixed rankings. The first (117a) is a fixed ranking of the constraints responsible for the position of the active edge, EDGE[R] and EDGE[L], above all other constraints. The argument for this fixed ranking is described in §2.3, which shows that a theory that allows these constraints to be dominated by other stress constraints would generate patterns that shift stress from one edge to another in the presence of a stress-repelling property (the conditional edge selection pathology). The second fixed ranking (117b) was the main focus of Chapter 4. It holds between two classes of constraints, ACTIVE EDGE and RHYTHM, such that the former class dominates the latter. Taken together, the fixed rankings among all of the constraints in (115) are illustrated in FIGURE 5.

(117) a. EDGE[R], EDGE[L] >> All other constraints
b. ACTIVE EDGE >> RHYTHM

[68] The revised version of EXTNONPERIPH/E is the only constraint in the current proposal which is not formulated as locus-counting (§3.1). However, it can be restated as locus-counting, albeit in an admittedly complex way (this assumes that each syllable projects a level 0 grid mark, as in Chapter 1): Assign one * for each grid mark (=λ) if it is in the last column and there is a level 1 grid mark in at least one of the last two columns (=C).

FIGURE 5: illustration of the proposed fixed rankings in CON (final)



5.3. Quantity-insensitive stress systems

The factorial typology of the active-edge theory of stress has been generated using OTSoft (Hayes, Tesar, and Zuraw 2013), a software which takes in a set of constraints, their fixed rankings, and set of inputs with corresponding candidates, and prints all logically possible patterns that the system generates. The inputs that were considered were words with two to seven syllables. The sets of candidates included all combinations of stressed and unstresses syllables with one primary stress, as well as one active edge, either on the left or on the right. Since all logically possible combinations were included, each surface form corresponded to two candidates, one with an active edge on the right and one on the left. None of the syllables were assumed to have stress-attracting properties (like long vowels) or stress-repelling properties (like a schwa nucleus), which will be the focus of §5.4.

A total of 69 languages were generated: 9 were single-stress languages, 9 were dual-stress languages, and 51 were languages with alternating stresses (in long enough words). Among the languages in the latter group, 29 had only one fixed stress near one of the edges, and 22 were bidirectional (had two fixed stresses, one on the right and one on the left).

Of the pathologies discussed in this dissertation, the one relevant to quantity-insensitive system with no stress-repelling properties is the midpoint pathology, which specifically can arise in single-stress systems. None of the 9 single-stress languages generated belongs to the class of midpoint patterns. This means that the active edge constraint set has successfully avoided the midpoint problem with quantity-insensitive stress; as we will see in the next section, quantity-sensitive midpoint patterns are avoided as well.

Other generalizations relevant to quantity-insensitive systems concern bidirectional systems with alternating stresses, namely that lapses tend to be placed near the primary stress, and clashes with primary stress are avoided (§3.5). All 22 bidirectional languages with alternating stresses conformed to this generalization, specifically due to Kager's *LAPSE-IN-TROUGH and *CLASH-AT-PEAK.

The factorial typology did, however, diverge from the typology of attested languages in three ways. The first two concern specifically the location of primary stress in bidirectional languages, i.e., languages with fixed stresses at each of the two edges (with or without alternating stresses). The third problem concerns unstressability effects at word edges.

The first problem arises because the active-edge theory has only one constraint assigning primary stress, ALIGNPEAK/E, which is sensitive only to the active edge. In §2.5.2, I propose that most bidirectional languages arise when the right edge is active and the initial syllable must be stressed to satisfy ALIGN/L.[69] If the constraint assigning primary stress is sensitive only to the active edge, then the theory predicts that in (most) bidirectional languages the primary stress should fall on the right-most stressed syllable. This is true for languages like Sibutu Sama, repeated from §2.5.2 in (118), which has a primary stress on the penult and a secondary stress on the initial. However, this

[69] The exception to this generalization was instantiated by Southern Paiute (§2.5.2), where the left edge is active with peninitial stress, and a secondary penultimate stress is derived by a requirement to simultaneously satisfy *LAPSE and NONFINALITY.

is not true for languages like Watjarri (Pama-Nyungan; Douglas 1981) in (119), in which the initial syllable bears the primary stress and the penult bears a secondary stress.

(118) Sibutu Sama (Austronesian; Allison 1979; Kager 1997)

a. bis.sá.la 'talk'
b. bìs.sa.lá.han 'persuading'
c. bìs.sa.la.hán.na 'he is persuading'
d. bìs.sa.la.han.ká.mi 'we are persuading'

(119) Watjarri (Pama-Nyungan; Douglas 1981)[70]

a. gú.jì.bin^j 'curlew'
b. má.t^{j}am.bì.dan^j 'bat'
c. gá.t^{j}u.wi.là.da 'turtle'

The solution lies in a particular constraint proposed by Gordon, ALIGN/EDGES, adapted in (120). For each edge, this constraint assigns violations to every syllable separating it from its nearest stress. In words with one stress, e.g., σ**σ́**σσ, the distances are calculated with respect to the same syllable (here, 3 violation marks). In words with more than one stress, σ**σ́**σ**σ́**σσ, a different syllable is relevant for each edge (here, the second and fourth syllables, such that the sum of their distances from their respective edges also equals 3).

(120) ALIGN/EDGES Assign one * for each syllable separating an edge from the stressed syllable closest to it

The reason that this constraint solves the problem is that it generates bidirectional languages both when the left edge is active and when the right edge is active by requiring that there be a stressed syllable close to both edges. For example, the ranking in (121) generates the pattern of Watjarri in (119).

[70] The location of stresses is inferred from author's description of the pattern.

(121) Initial primary stress and penultimate secondary stress in Watjarri

	σσσσσ	NONFIN	ALIGN/EDGES	ALIGNPEAK/E
	a. A[**σ́**σσσσ		**!**	
	b. A[**σ́**σσσ**σ̀**	*!		
☞	c. A[**σ́**σσ**σ̀**σ		*	
	d. A[**σ̀**σσ**σ́**σ		*	*!

Introducing ALIGN/EDGES to the active-edge constraint set also solves an overgeneration problem which arises both in the active-edge theory and in Gordon's theory, but for different reasons. This problem also concerns primary stress in bidirectional languages and arises specifically in languages that repair clashes by removing a stress. Cross-linguistically, such cases follow a clear generalization: when a clash between a primary stress and a secondary stress is resolved by eliminating one of them, the position that remains stressed is the one which usually bears the primary stress (see Hammond 1985a). The unattested pattern, which is a problem shared by most theories of stress in OT (Gordon, 520–21), is one in which the position that is usually reserved to primary stress loses its stress in clash resolution, and instead primary stress shifts to the position usually occupied by a secondary stress. An example for an attested clash resolution pattern is found in Sibutu Sama (118), and its unattested counterpart is illustrated in (122).

(122) Unattested clash resolution in favor of the position of a secondary stress

a. **σ́**σσ
b. **σ̀**σ**σ́**σ
c. **σ̀**σσ**σ́**σ
d. **σ̀**σσσ**σ́**σ

In the active-edge theory, patterns like that in (122) are generated by grammars in which ALIGN/L is ranked above some or all ACTIVE EDGE constraints. Tableau (123-i) illustrates how stress is assigned in four-syllable words, which have two stressed syllables. In candidates a and b two of the syllables are stressed, while in candidates c and d only one is stressed. The undominated ALIGNPEAK/E is responsible for the elimination of candidate (a), because the candidate's primary stress is separated from the active edge by another stress. Since the two stressed syllables are not adjacent, *CLASH does not distinguish among the other candidates. ALIGN/L is responsible for eliminating candidates with no stress on the initial syllable and ALIGN/E is responsible for eliminating candidates with no penultimate stress (it is assumed that final stress is eliminated by a high-ranked NONFINALITY or NONPERIPH/E). The winner, candidate (b), has two stressed syllables, with primary stress on the penult and secondary stress on the initial, like in Sibutu Sama. In three-syllable words, shown in (123-ii), *CLASH eliminates candidates which keep both the initial and the penultimate stress (candidates a and b), because the two positions are adjacent. The choice between the two remaining candidates, c and d, is determined by the ranking between ALIGN/L and ALIGN/E: the former prefers stress on the initial, which in longer words bears a secondary stress, while the latter prefers stress on the penult, which in longer words bears the primary stress. Since ALIGN/L outranks ALIGN/E, the candidate with initial stress (candidate c) wins, resulting in the unattested clash resolution pattern.

(123) Unattested clash resolution with the active-edge constraint set

	*CLASH	ALIGNPEAK/E	ALIGN/L	ALIGN/E
i. σσσσ				
a. **σ́**σ**σ̀**σ] A		*!		*
☞ b. **σ̀**σ**σ́**σ] A				*
c. **σ́**σσσ] A				**!*
d. σσ**σ́**σ] A			**!	*
ii. σσσ				
a. **σ́σ̀**σ] A	*!	*		*
b. **σ̀σ́**σ] A	*!			*
☞ c. **σ́**σσ] A				**
d. σ**σ́**σ] A			*!	*

The same problem arises with the edge-specific constraint set in Gordon's theory. To see why, consider tableau (124). As in (123), here too candidates a and b have two stressed syllables and candidates c and d have only one stressed syllable. In four-syllable words (124-i), the initial and penultimate syllables are not adjacent, and therefore *CLASH is not violated if both are stressed. Candidate (a) is eliminated by ALIGNPEAK/R because its primary stress is followed by another stressed syllable. Candidates c and d, which have only one stressed syllable, are eliminated by ALIGN/EDGES because the competing dual-stress candidate (candidate b) incurs only one violation to this constraint, while each of the former candidates incurs three. The winner, then, is the candidate with primary stress on the penult and secondary stress on the initial (candidate b). In trisyllabic words (124-ii), *CLASH eliminates both of the candidates with stress on the initial and the penult, (candidates a and b) because these two syllables are adjacent. The two remaining candidates have only one stressed syllable, and therefore the sum of distances between each edge and their closest stressed syllable is equal. The next consonant in the hierarchy, ALIGNALL/L, prefers the candidate with initial stress (candidate c), which is the winner. We thus encounter the same undesirable result: the clash is resolved by eliminating stress from the position that usually bears the primary stress in favor of the position that usually bears a secondary stress.

(124) Unattested clash resolution with Gordon's constraint set

			*CLASH	ALIGNPEAK/R	ALIGN/EDGES	ALIGNALL/L
i.	σσσσ					
	a.	**σ́**σ**σ̀**σ		*!	*	**
☞	b.	**σ̀**σ**σ́**σ			*	**
	c.	**σ́**σσσ			**!*	
	d.	σσ**σ́**σ			**!,*	**
ii.	σσσ					
	a.	**σ́σ̀**σ	*!	*	*	*
	b.	**σ̀σ́**σ	*!		*	*
☞	c.	**σ́**σσ			**	
	d.	σ**σ́**σ			**	*!

A solution emerges when Gordon's ALIGN/EDGES is incorporated into the active-edge constraint set instead of ALIGN/L. The grammar in (125) is identical to that in (123), except that ALIGN/L is replaced by ALIGN/EDGES. In four-syllable words, candidate (a) is again eliminated because there is a stressed syllable separating the primary stress from the active edge. Among the remaining candidates, the one with dual stress (candidate b) incurs fewer violations to ALIGN/EDGES compared to those with only one stress, and is therefore the winner. The difference between this grammar and those in (123) and (124) becomes clear in trisyllabic words. As before, *CLASH eliminates candidates a and b because the initial and penult are adjacent and are both stressed. The two remaining candidates, c and d, have only one stressed syllable, and thus they incur the same number of violations to ALIGN/EDGES. Since there are no edge-specific constraints in the theory (other than NONFINALITY), it is the ACTIVE EDGE constraints that tip the scale in favor of the position closer to the active edge, which is also the position that usually bears primary stress due to ALIGNPEAK/E. In fact, candidate (c), in which the stress in the usual primary stress position (which is closer to the active edge) is removed and the stress in the usual secondary stress position (which is farther from the active edge) is kept is harmonically bounded. The desirable result has been achieved: the clash is resolved by unstressing the syllable that typically bears the secondary stress

(125) Unattested clash resolution avoided by the active-edge theory with ALIGN/EDGES

			*CLASH	ALIGNPEAK/E	ALIGN/EDGES	ALIGN/E
i.	σσσσ					
	a.	**σ́**σ**σ̀**σ] A		*!	*	*
☞	b.	**σ̀**σ**σ́**σ] A			*	*
	c.	**σ́**σσσ] A			**!*	***
	d.	σσ**σ́**σ] A			**!,*	*
ii.	σσσ					
	a.	**σ́σ̀**σ] A	*!	*	*	*
	b.	**σ̀σ́**σ] A	*!		*	*
	c.	**σ́**σσ] A			**	**!
☞	d.	σ**σ́**σ] A			**	*

5.4. Quantity-sensitive stress systems

The factorial typology described in the previous section does not include languages with stress-attracting or stress-repelling properties of syllables, which I will jointly call quantity-sensitive. Computing the factorial typology of such languages is necessary for identifying some of the pathologies discussed in Chapters 2-4. Certain midpoint patterns (§2.2) as well as quasi-midpoint patterns (§4.2) arise in languages which are sensitive to some stress-attracting property. Conditional edge selection (§3.4) and peak shifting (§3.5) arise in languages sensitive to a stress-repelling property. Finally, conditional boundedness (§3.3) arises in languages which are sensitive to both types of properties.

As with quantity-insensitive languages, this was done with OTSoft. The inputs were all possible words with two to seven syllables with maximally one stress-attracting syllable and maximally one stress-repelling syllable. This means that there were inputs with no stress-attracting or stress-repelling syllables, inputs with one but not the other, and inputs with both a stress-attracting syllable and a stress-repelling syllable. Individual syllables with both kinds of properties were not included. The reason that the number of syllables with each kind of property was limited to one is the computational complexity required for generating all logical combinations. For the same reason, the candidates were limited to words with one stress (marked as primary). As before, each surface form corresponded to two candidates, one with an active edge on the left and one on the right. While limited in scope, this factorial typology is sufficient for testing most of the pathologies mentioned above; the exception is the peak shifting pathology, which only arises in languages with alternating stresses.

A total of 305 distinct stress patterns were generated. As expected, none of these patterns instantiated the pathologies described in Chapters 2-4.

The resulting factorial typology did, however, include another type of unbounded patterns that do not seem to correspond to any attested language. Specifically, these are some patterns in which the stressable window includes all syllables in the word except some specific domain at one of the edges. The patterns in (126) illustrate this effect with four different unstressable domains: in (126a) the ultima is unstressable, in (126b) the initial, in (126c) the last two syllables, and in (126d) the first two syllables. Among these patterns, only the first pattern is attested – this is the Kashmiri pattern, discussed in §2.5.1 and repeated in (127), in which heavy syllables attract stress in all positions except the ultima (with some complications related to degree of weight).

(126) Four unbounded patterns with unstressable edge

a. last one σ EDGE[R], NONPER/E >>…	b. first one σ EDGE[L], NONPER/E >>…	c. last two σ EDGE[R], EXTNONPER/E >>…	d. first two σ EDGE[L], EXTNONPER/E >>…
{**σ**} σ]^{A}	^{A}[σ {**σ**}	{**σ**} σ]^{A}	^{A}[σ {**σ**}
{**σ σ**} σ]^{A}	^{A}[σ {**σ σ**}	{**σ**} σ σ]^{A}	^{A}[σ σ {**σ**}
{**σ σ σ**} σ]^{A}	^{A}[σ {**σ σ σ**}	{**σ σ**} σ σ]^{A}	^{A}[σ σ {**σ σ**}
{**σ σ σ σ**} σ]^{A}	^{A}[σ {**σ σ σ σ**}	{**σ σ σ**} σ σ]^{A}	^{A}[σ σ {**σ σ σ**}
{**σ σ σ σ σ**} σ]^{A}	^{A}[σ {**σ σ σ σ σ**}	{**σ σ σ σ**} σ σ]^{A}	^{A}[σ σ {**σ σ σ σ**}

(127) Kashmiri (Indo-European; Kachru 1969; Bhatt 1989)

a. pʰí.ki.ri ‘to understand’
b. ʃo.kɨ́r.vaːr ‘Friday’
c. ná.kɨ.voːr ‘nostril’
d. déː.vəː.liː ‘the Hindu festival of lights’

The avoidance of stress on the ultima in Kashmiri is attributed to NONFINALITY (see §2.5.1). There are two reasons why (126b-d) arise with the active-edge constraint set. First, PATTERN II, in which the initial syllable is unstressable, is generated because the constraint NONPERIPH/E can be sensitive to stress in the beginning of the word, specifically when the left edge is active. In this configuration, NONPERIPH/E imitates the undesirable effect of NONINITIALITY (§2.5.1), which we rejected on empirical grounds. Second, unstressability of two syllables at a specific edge is triggered by EXTNONPERIPH/E. In (126c), the right edge is active, and therefore the last two syllables are unstressable; in (126d), the left edge is active, and therefore the two first syllables are unstressable. (126b-d) are correctly excluded by Gordon’s edge-specific constraint set because it includes neither a constraint like NONPERIPH/E (or EXTNONPERIPH/E) nor NONINITIALITY.

Currently, there is no clear solution to this problem. Both NONPERIPH/E and EXTNONPERIPH/E are indispensable in the active-edge theory because they play a crucial role in deriving languages with fixed stress on the antepenult, peninitial, or postpeninitial (§2.3). This issue must be left to future work.[71]

5.5. Summary and theory comparison

The new factorial typology described in the preceding two sections avoids a set of overgeneration problems, some of which were thus far inevitable in the grid-only approach in OT. This section situates the active-edge theory with respect to two other grid-only theories, namely Gordon’s and HKR’s. After briefly presenting their respective constraint sets, I will compare their factorial typology to that of the active-edge constraint set.

[71] I refer the reader to Staubs (2014) on possible ways to model the asymmetries between the right edge and the left edge in unstressability effects as learning biases.

Gordon innovated a fully grid-based constraint set in OT that generates the full range of patterns in the typology of quantity-insensitive stress. Alongside alignment constraints, which have close counterparts in foot-based theories, Gordon also adopted edge-sensitive anti-lapse (ESAL) constraints (Alderete 1999), which capture bounded stress systems with non-peripheral stress. The constraint set in Gordon's theory is given in (128). Gordon originally did not include *EXTLAPSE/L (but did include *EXTLAPSE/R) because he was not aware of languages with systematic postpeninitial stress or an initial trisyllabic window; while these are relatively infrequent, they are indeed attested (Kager 2012)[72]

(128) Constraint set adapted from Gordon

ALIGNALL/R	For each stressed syllable, assign one * for each syllable separating it from the right edge
ALIGNALL/L	For each stressed syllable, assign one * for each syllable separating it from the right edge
ALIGN/EDGES	Assign one * for each syllable separating an edge from the stressed syllable closest to it
ALIGNPEAK/R	Assign one * for each stressed syllable separating the right edge from the primary stress
ALIGNPEAK/L	Assign one * for each stressed syllable separating the left edge from the primary stress
*LAPSE/R	Assign one * for a sequence of two unstressed syllables at the right edge
*LAPSE/L	Assign one * for a sequence of two unstressed syllables at the left edge
*EXTLAPSE/R	Assign one * for a sequence of three unstressed syllables at the right edge
*EXTLAPSE/L	Assign one * for a sequence of three unstressed syllables at the left edge
*LAPSE	Assign one * for a sequence of two unstressed syllables
*EXTLAPSE	Assign one * for a sequence of three unstressed syllables
*CLASH	Assign one * for a sequence of two stressed syllables

[72] Gordon also postulated a disjunctive fixed ranking that applies to the two ALIGNPEAK constraints, namely that in every grammar one of these constraints must be ranked below all others (p. 510). I exclude this fixed ranking from Gordon's factorial typology because otherwise the constraint set does not generate single-stress quantity-sensitive systems.

HKR developed a different grid-only constraint set, which overlaps with that of Gordon, but also differs from it in some significant ways. The constraints are given in (129).[73] The first difference is that HKR do away with ALIGNALL constraints altogether (§3.1 and §3.5). This is an important achievement for two reasons: first, the computational power of such constraints far exceeds that of other constraints which human languages seem to employ, and second, they give rise to unattested patterns, such as lapse avoidance of primary stress and clash attraction to primary stress (§3.5); also see Eisner (1997b). Another difference between Gordon's and HKR's constraint sets is that the latter includes constraints with varying degrees of violations, such that a single prohibited structure can incur different numbers of violations, depending on its context. For example, CLASH-AT-INITIAL penalizes all types of clashes with one violation, but initial clashes incur two violations.

(129) Constraint set adapted from HKR

FIRSTSTRESSLEFT	Assign two * for each syllable between the left edge and the leftmost stressed syllable. Assign an additional * if the leftmost stressed syllable bears secondary stress
LASTSTRESSRIGHT	Assign two * for each syllable between the right edge and the rightmost stressed syllable. Assign an additional * if the rightmost stressed syllable bears secondary stress
NONINITIALITY	Assign one * for a stressed syllable at the left edge
STRESS/L	Assign one * for an unstressed syllable at the left edge
NONFINALITY	Assign one * for a stressed syllable at the left edge
EXTNONFINALITY	Assign two * if the final syllable bears stress, and one * if the penultimate syllable bears stress and the final syllable does not
NOSTRESS	Assign one *for each stressed syllable
*EXTLAPSE	Assign one * for each sequence of three unstressed syllables
*EXTLAPSE/R	Assign one * for a sequence of three unstressed syllables at the right edge
CLASH-AT-INITIAL	Assign one * if there is clash between the initial and peninitial syllables, and two * if there is a clash elsewhere

[73] This constraint set includes those listed in HKR's appendix, with the addition of two constraints which are not listed but are implicit in their description of the system, namely modified versions of Kager's LAPSE-AT-PEAK and *CLASH-AT-PEAK. I formulated these constraints in a way that best matches their counterparts that refer to edges instead of the primary stress, e.g., LAPSE-NEAR-RIGHT.

CLASH-NEAR-RIGHT	Assign one * if there is a clash between the final and penultimate syllables, one * if there is a clash between the penultimate and antepenultimate syllables, and two * if there is a clash elsewhere
LAPSE-NEAR-LEFT	Assign one * if a lapse occurs between the first and second, or between the second or third syllables in a word. Assign two * for each lapse occurring elsewhere
LAPSE-NEAR-RIGHT	Assign one * if a lapse occurs between the final and penultimate syllables, or between the penultimate and antepenultimate syllables, or between the antepenultimate and pre-antepenultimate syllables. Assign two * for each lapse occurring elsewhere
*CLASH-AT-PEAK	Assign one * if there a clash occurs between two secondary stresses, and two * if there is a clash between a secondary and a primary stress
LAPSE-AT-PEAK	Assign one * if a lapse occurs next to a syllable bearing primary stress. Assign two * for each lapse occurring elsewhere

Since both constraint sets were designed to capture quantity-insensitive stress patterns, they did not include constraints that refer to stress-attracting or stress-repelling properties. For generating their respective factorial typologies, I added two constraints to each of them: DPS, which demands that syllables with a designated property bear stress, and REP, which demands that syllables with a stress-repelling property do not bear stress.

As with the active-edge constraints, the factorial typology was generated twice, once for quantity-insensitive languages and once for quantity-sensitive languages. The former included candidates with any number of stresses, but inputs did not have stress-attracting or stress-repelling properties. The latter incorporated inputs with stress-attracting and/or stress-repelling properties, but only considered candidates with a single stress. The inputs and candidates had between two to seven syllables and were generated as described in §4.3 and §4.4.

Given these parameters, Gordon's constraint set generated 294 patterns in the quantity-insensitive factorial typology, and 7874 in the single-stress quantity-sensitive factorial typology. With the same parameters, HKR's constraint set generated 334 patterns in the quantity-insensitive factorial typology, and 5929 in the single-stress quantity-sensitive factorial typology. Among all three constraint sets, the active-edge constraint set is strikingly more restrictive, with 68 patterns in the former category, and 305 in the latter category. This is a desirable result, as long as all attested languages are indeed generated (see §5.3 for a potential challenge that comes with this degree of restrictiveness and a potential solution, as well as §2.6 on the status of counting languages).

The various pathologies discussed in this dissertation are summarized in TABLE 1, along with the section number in which they were described and an indication of whether or not they are generated by each of the three constraint sets. Cells with the values "Generated" and "Avoided" are accompanied with white and shaded background, respectively. One cell is marked with a lighter grey background – this is the unattested resolution of clashes in favor of the position of secondary stress, which was described in §5.3; the reason for this is that there is a likely way to avoid this problem, described in the same section (specifically, to replace ALIGN/L with Gordon's ALIGN/EDGES). I did not mark this pattern as "Avoided" because the consequences of such a solution have not yet been sufficiently explored.

TABLE 1: summary of the pathologies and their status in each of the three theories

Pattern type	**Active Edge**	**Gordon (2002)**	**HKR (2005)**
Midpoint (§2.2)	Avoided	Generated	Generated
Quasi-midpoint (§4.2)	Avoided	Generated	Generated
Conditional boundedness (§3.3)	Avoided	Avoided[74]	Generated
Conditional edge selection (§3.4)	Avoided	Avoided[74]	Generated
Clash attraction to primary stress (§3.5)	Avoided	Generated	Avoided
Lapse avoidance of primary stress (§3.5)	Avoided	Generated	Avoided
Peak shifting* (§4.3)	Avoided	Avoided	Generated
Clash resolved to σ̀ (§5.3)	Generated (?)	Generated	Generated[75]
Non-initiality and/or similar effects (§5.4)	Generated	Avoided	Generated

*Not tested with OTSoft

[74] Gordon's constraint set does not generate conditional boundedness and conditional edge selection patterns which are triggered by one stress-repelling syllable. However, in Chapter 3 I alluded to the fact that local ESAL constraints can trigger similar patterns when multiple stress-repelling syllables are present. Since the status of such patterns is less clear, I do not take them into consideration here.

[75] HKR's constraint set generates such patterns specifically due to the constraint STRESS/L (in the source, HAVE INITIAL STRESS). This pattern arises in bidirectional languages in which primary stress is assigned to the right-most stressed syllable (LASTSTRESSRIGHT>>FIRSTSTRESSLEFT) but STRESS/L is undominated; thus, the initial syllable always keeps its stress, even if it normally bears a secondary stress.

The only pattern that was not tested using the method in §5.3-5.4 was the peak shifting pathology described in Chapter 4. This is because it requires the combination of alternating stresses, which were only included in the quantity-insensitive factorial typology, and stress-repelling syllables, which were only included in the single-stress quantity-sensitive factorial typology. Nevertheless, I marked the status of this pattern for each constraint set based on the reasoning in §4.3.

Overall, the active-edge theory achieves a tighter fit to the typology compared to its predecessors. In its current form, the theory still faces two pending overgeneration problems. The first is the problem of clash resolution in favor of secondary stress, described in §5.3. The second involves certain unstressability effects in unbounded languages, specifically patterns that prohibit stress only on the initial syllable, the first two syllables, or the last two syllables. This is described in §5.4. While there is a tentative solution available to the former, a solution to the latter must wait for future work.

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