

CHAPTER 5  
PROMINENCE MAXIMIZATION

5.1 Introduction

In the preceding chapters of this dissertation, I have shown that positional faithfulness constraints are essential to the analysis of three distinct but related asymmetries in phonological behavior: positional neutralization, positional resistance to phonological processes, and positionally-determined triggering of phonological processes. Positional privilege, in the guise of enhanced faithfulness, holds of a variety of different structural positions. In Chapter 2, I discussed positional faithfulness in root-initial syllables and syllable onsets, focusing on Shona and Tamil. Stressed syllable faithfulness effects were highlighted in Chapter 3, and in Chapter 4, I considered root/affix asymmetries in light of positional faithfulness.

All of the cases examined above involve high-ranking positional IDENT(F) constraints, which regulate the *featural* faithfulness of segments which appear in the privileged positions. In this chapter, I will provide evidence for a different type of positional faithfulness constraint, positional MAX, which regulates *segmental* deletion.<sup>1</sup> The extension of positional faithfulness to the MAX constraint family provides evidence for the symmetrical structure of the faithfulness constraint system — positional faithfulness is not limited to the realm of featural identity, but extends as well to constraints against phonological deletion. The pervasiveness of positional faithfulness is further instantiated by the relativized DEP constraints of Alderete (1995), which require that elements in a prominent position in the output have an input correspondent.

The MAX constraint family requires complete correspondence of input and output representations, militating against deletion of input material. The context-free formulation of MAX given in McCarthy & Prince (1995) is shown below.

- (1) MAX  
Every element of  $S_1$  has a correspondent in  $S_2$ .  
Domain( $\leftarrow$ ) =  $S_1$

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<sup>1</sup> Positional MAX constraints, with a slightly different character, are also explored in Casali (1997).

The context-free constraint (1) militates against segmental deletion in the input-output or output-output relation, or against non-copying in reduplication.

The cases to be examined in this chapter call out for positional variants of (1), as schematized in (2).

- (2) *MAX-Position*  
Every element of  $S_1$  has a correspondent in some position P in  $S_2$ .  
Domain( $\leftarrow$ ) =  $S_1$

Positional *MAX* constraints do not simply favor full correspondence between  $S_1$  and  $S_2$ ; they favor full correspondence, with all  $S_2$  correspondents appearing in a privileged position. In essence, positional *MAX* constraints favor maximal packing of input structure into a prominent output position.<sup>2</sup> Such output maximization occurs in a number of cases in which non-canonical prosodification is associated with positional prominence, as in English ambisyllabicity, which is determined largely by stress placement.

I will begin in by examining the interaction of the syllable markedness constraint *NoCODA* with a *MAX-Position* constraint. As we will see, when *MAX-Position* » *NoCODA*, prominent positions are maximally filled with input segments, even at the expense of a canonical CV.CV syllabification. The resulting syllabifications are not consistent with the principle of Onset First/Maximal Onset (Kahn 1976; Steriade 1982; Selkirk 1982; Clements & Keyser 1983), either because an intervocalic consonant is affiliated with coda rather than onset

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<sup>2</sup> An alternative formulation of positional *MAX* constraint is also possible, and perhaps necessary:

- (i) *MAX-Position*  
Any element appearing in position P in  $S_1$  has a correspondent in position P in  $S_2$ .  
Domain( $\leftarrow$ ) =  $S_1$

This formulation differs crucially from that in (2) by requiring only that segments in prominent positions in  $S_1$  appear in the same prominent position in  $S_2$ ; it does *not* require that all  $S_1$  segments appear in  $S_2$ . For example, *MAX-ONSET*, formulated as in (i), will require that any segment which has an onset syllabification in  $S_1$  retain that onset syllabification in  $S_2$ . By contrast, the (2) formulation of *MAX-ONSET* will require that all segments have an onset syllabification, regardless of their prosodic affiliation (or lack thereof) in  $S_1$ .

While positional *MAX* constraints formulated on the template in (i) are unexceptional in cases of output-output correspondence in which syllabification is necessarily present in both strings, they are potentially problematic for input-output relations, as syllabification and prosodic structure cannot be assumed to be present in the input. In the absence of input prosodic structure, constraints of the (i) variety will be irrelevant. The extent to which such constraints are necessary is a matter for future research; I will not address it here.

(CVC.V) or because the consonant is ambisyllabic, affiliated with both coda and onset. In §5.5, I consider the interaction of positional  $M_{AX}$  with  $*C_{OMPLEX}$ , the constraint which prohibits complex syllable margins. Through domination of  $*C_{OMPLEX}$ , positional  $M_{AX}$  will generate otherwise illicit complex codas or onsets in prominent syllables. This will be demonstrated with an analysis of Tamil, which allows complex codas only in root-initial syllables, due to the ranking of  $M_{AX}-\sigma_1 \gg *C_{OMPLEX}$ . Before turning to the case studies of positional  $M_{AX}$ , I will review syllable theory in OT.

## 5.2 Background: Syllable Structure in Optimality Theory

An explanatory theory of syllabification and syllable typology is one focal point of Prince & Smolensky's (1993) exposition of Optimality Theory. The key observation concerning syllable typology, made by Jakobson (1962), is that a markedness relation holds among the syllable shapes attested cross-linguistically: onsetless syllables are more marked than syllables with onsets, and closed syllables stand in a similar relation to open syllables. There are languages which have only open syllables, or syllables with onsets, but there are no languages in which all syllables lack an onset, or are closed. The distributional possibilities are summarized in (3) below (adapted from Prince & Smolensky: 85). Each cell represents a possible language type.

### (3) Jakobsonian syllable typology

		<b>Onsets:</b>	
		required	optional
<b>Codas:</b>	forbidden	CV	(C)V
	optional	CV(C)	(C)V(C)

Prince & Smolensky (1993) argue that this typology of syllable shapes reflects the interaction of two syllable markedness constraints of UG:  $ONSET$  and  $NOCODA$ . Together with basic faithfulness constraints,  $ONSET$  and  $NOCODA$  derive exactly the attested syllable inventories. The core constraints which generate the Jakobsonian typology are shown in (4) below. (I have adapted the Prince & Smolensky constraints to the Correspondence Theoretic model assumed here, replacing their  $PARSE$  and  $FILL$  with  $M_{AX}$  and  $DEP$ , respectively.)

Following McCarthy & Prince (1993b), I adopt “NoCODA” in place of Prince & Smolensky’s nomenclature, –COD.)

(4) Basic syllable typology: Relevant constraints

Markedness:

ONSET: Syllables must have onsets.

NoCODA: Syllables must not have a coda.

Faithfulness:

MAX: Every segment in  $S_1$  has a correspondent in  $S_2$ .

DEP: Every segment in  $S_2$  has a correspondent in  $S_1$ .

Through interaction, the constraints in (4) generate the four-way array of languages diagrammed in (3). This is schematized in (5), adapted from Prince & Smolensky. ( $\mathbf{F}$  represents the set of faithfulness constraints {MAX, DEP}, and  $F_n$  denotes a member of this set.)

(5) Deriving the Jakobsonian typology

		<b>Onsets:</b>	
		ONSET » $F_i$	$\mathbf{F}$ » ONSET
<b>Codas:</b>	NoCODA » $F_j$	CV	(C)V
	$\mathbf{F}$ » NoCODA	CV(C)	(C)V(C)

The domination of faithfulness by markedness constraints favors unmarked syllable structure, while the opposite ranking permits the more marked syllable shapes to occur. Notably, there is no ranking of the four constraints in (4) which will generate only the marked syllable shapes (for example, only VC, but not CV and CVC). For more extensive discussion, see Prince & Smolensky (1993: Chapter 6).

The OT constraints which provide the basic account of syllable typology also derive a well-known aspect of syllabification, the principle of Onset First (also known as Maximal Onset) originally noted by Kahn (1976:41); see also Steriade (1982), Selkirk (1982), Clements & Keyser (1983) and Itô (1986).

(6) Onset Maximization

“In the syllable structure of an utterance, the onsets of syllables are maximized, in conformance with the principles of basic syllable composition of the language.” (formulation due to Selkirk 1982:359)

In derivational theories of syllabification, the principle in (6) governs the order in which segments are associated to syllables. Wherever possible, consonants must be associated to a

syllable node to the right, rather than to the left. (See, for example, the Onset First Principle of Clements & Keyser 1983: 37.) This will account for the finding that intervocalic consonants are typically onsets, rather than codas. The syllabification in (7a) is preferred to that of (7b), almost universally.

(7) a. b.

In the OT treatment of syllable theory developed in Prince & Smolensky (1993), the onset maximizing structure in (7a) is favored, due to the nature of the constraints contained in UG. The markedness constraints  $O_{\text{NSET}}$  and  $N_{\text{OCODA}}$  both rule in favor of (7a), and against (7b). In fact, given the mini-inventory of constraints in (5), the syllabification in (7b) *cannot* be generated. Consider the chart in (8), where the constraints are not crucially ranked.

(8) Onset maximization is always favored<sup>3</sup>

	/CVCV/	$N_{\text{OCODA}}$	$O_{\text{NSET}}$	$M_{\text{AX}}$	$D_{\text{EP}}$
a.	CV.CV				
b.	CVC.V	*	*		

No matter what the ranking of the four constraints may be, the syllabification in (8a) will always be favored by the grammar. There is no constraint in the system which can compel the syllabification in (8b). This is an impressive result: an alleged universal of syllabification follows from independently motivated markedness constraints.  $O_{\text{NSET}}$  and  $N_{\text{OCODA}}$ , which account for the implicational relations which hold among syllables of various shapes, also favor onset maximization.

Unfortunately for the OT theory sketched above, onset maximization in ...VCV strings is not an inviolable universal of syllabification. The phonological and descriptive literature is replete with examples of syllabifications of ...VCV strings that do not respect the principle of

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<sup>3</sup> Given a /CVCV/ input. Many more constraints will be relevant to the syllabification of intervocalic clusters; these include the SYLLABLE CONTACT LAW (see the discussion of Tamil in Chapter 2), SONORITY SEQUENCING and \*COMPLEX. Given the appropriate ranking of such constraints with  $O_{\text{NSET}}$  and  $N_{\text{OCODA}}$ , a non-maximal onset may be favored by the grammar.

onset maximization. In one set of cases, intervocalic consonants are *ambisyllabic*; they syllabify in both coda and onset position. This is shown in (9).

(9) Ambisyllabicity

English is perhaps the best-known example of ambisyllabicity in the phonological literature, though others have been documented.

In a second set of cases, the intervocalic consonant in a ...VCV string syllabifies only as the coda of the leftmost syllable, as in (10). (Selkirk 1982 argues for this treatment of English, as well.)

(10) Coda-only syllabification

Representative examples of both types of case are listed in the table below.

(11) Violations of Onset Maximization, ...VCV input string

<b>Language:</b>	<b>OM violation:</b>	<b>Diagnostic(s):</b>
English (Kahn 1976, Selkirk 1982) <sup>4</sup>	C in V <sub>1</sub> CV <sub>2</sub> is ambisyllabic if V <sub>1</sub> is stressed.	C is not aspirated, though syllable -initial obstruents in English are aspirated If C is /t, d/, flapping occurs
Danish (Borowsky et al. 1984, Clements & Keyser 1983)	Medial C in V <sub>1</sub> CV <sub>2</sub> is ambisyllabic if V <sub>1</sub> is stressed.	Lenited allophone of C appears in VICV <sub>2</sub> , otherwise only in coda position Grave allophone of V <sub>1</sub> occurs in V <sub>1</sub> CV <sub>2</sub> if C is grave; otherwise only in a syllable closed by grave C Stød (glottalization) is realized on sonorant C in V <sub>1</sub> CV <sub>2</sub> ; otherwise only on a sonorant coda C
Efik (Welmers 1973, Clements & Keyser 1983)	C in V <sub>1</sub> CV <sub>2</sub> is ambisyllabic.	Centralized, closed-syllable allophones of vowels appear as V <sub>1</sub> in V <sub>1</sub> CV <sub>2</sub> C is flapped
Ibibio (closely related to Efik) (Akinlabi & Urua 1993)	C in ...V <sub>1</sub> CV <sub>2</sub> is ambisyllabic, if V <sub>1</sub> is in the root-initial syllable.	Centralized, closed-syllable allophones of vowels appear as V <sub>1</sub> in V <sub>1</sub> CV <sub>2</sub> C is lenited
Scots Gaelic (several dialects, incl. Lewis & Barra) (Børgstrom 1940, Clements 1986)	C in #(C)V <sub>1</sub> CV <sub>2</sub> is syllabified as a coda. <i>Stress is initial.</i>	Observation and transcription by Børgstrom (1940) Native speakers report VC.V syllabification (Børgstrom 1940)

<sup>4</sup> Selkirk (1982) argues that the consonants in question are not ambisyllabic, but exhaustively syllabified in the coda of the leftmost syllable. Regardless of which analysis is correct, the principle of Onset Maximization is violated by the surface syllabification.

In each of the cases above, the failure of onset maximization is correlated with positional prominence: stressed or root-initial syllables attract a following consonant into coda position. These ambisyllabic and coda-only intervocalic consonants violate  $\text{NoCODA}$ , but maximize the number of input segments which surface in the stressed or root-initial syllable. In this chapter, I will argue that the prosodic maximization of privileged positions results from a high-ranking positional  $\text{MAX}$  constraint. For example, Ibibio ambisyllabicity arises from high-ranking  $\text{MAX-}\sigma_1$ , which favors maximal syllabification of root-initial syllables:

- (12)  $\text{MAX-}\sigma_1$   
 $\forall x, x \in S_1, y$  such that  $y \in S_2, x \leftarrow y$  and  $y$  appears in the root-initial syllable.  
 “Every element of the input has a correspondent in the root-initial syllable in the output.”

The candidate which best satisfies (12) will be that in which all input segments have output correspondents in the root-initial syllable. Danish ambisyllabicity derives from a similar constraint,  $\text{MAX-}\sigma'$ , which favors packing of stressed syllables.

In the absence of such a constraint, an ambisyllabic or coda-only syllabification can never be optimal. The markedness constraints  $\text{ONSET}$  and  $\text{NoCODA}$  favor simple CV syllabification, in accordance with the principle of onset maximization; ambisyllabicity and coda-only affiliations of a consonant deviate from the preferred open syllable pattern.

- (13) CV.CV syllabification only

/CVCV/	$\text{NoCODA}$	$\text{ONSET}$
a.		
b.	*	*!
c.	*!	

As in (8) above, the coda-only syllabification in (13b) can never be optimal, as both  $\text{ONSET}$  and  $\text{NoCODA}$  are violated. The ambisyllabic consonant in (13c) satisfies  $\text{ONSET}$ , but violates  $\text{NoCODA}$ . The simple CV.CV syllabification of (13a) should always be selected by such a grammar. However, high-ranking  $\text{MAX-}\sigma_1$  or  $\text{MAX-}\sigma'$  can militate in favor of (13b) or (13c), as schematized in (14) below. ( $\text{MAX-}\sigma_1$  is assumed for the purposes of illustration.)

(14)  $M_{AX-\sigma_1}$  overrides onset maximization

/CVCV/	$M_{AX-\sigma_1}$	$N_{OCODA}$	$O_{NSET}$
a.	C!, V		
b.	V	*	*
c.	V	*	

The choice between (14b) and (14c) will rely on the relative ranking of  $O_{NSET}$  and a syllable-level instantiation of the constraint  $U_{NIQUE}$  which requires segments to have a single syllabic host (Benua 1996; see the discussion of featural  $U_{NIQUE}$  in Chapter 2 above).<sup>5</sup> If  $O_{NSET} \gg U_{NIQUE-\sigma}$ , (14b) will be optimal; the opposite ranking will favor (14c). The key point, however, is that high-ranking  $M_{AX-\sigma_1}$  favors maximally filled initial syllables, a pattern which otherwise cannot be optimal.

In the next section, I will present the analysis of Ibibio ambisyllabicity, showing that  $M_{AX-\sigma_1}$  crucially dominates  $N_{OCODA}$ , forcing a consonant which follows the nucleus of the root-initial syllable to be ambisyllabic. In §5.4, I will examine stress-related violations of onset maximization in Scots Gaelic, arguing that they arise from high-ranking  $M_{AX-\sigma'}$ .

### 5.3 Ibibio ambisyllabicity: Evidence for Root-Initial Maximization

As noted in Chapter 4, Ibibio is a Nigerian language, belonging in the Benue Congo branch of the Niger-Congo family. Ibibio is closely related to Efik, another language of Nigeria which exhibits similar ambisyllabicity phenomena; see Welmers (1973) and Clements & Keyser (1983) for discussion. I have focused on Ibibio here because the data presented in Akinlabi & Urua (1993) are more extensive than the Efik data available elsewhere. (The analysis developed by Akinlabi & Urua 1993 differs substantially from the account presented below; for details, the reader is referred to the original source.)

Ibibio presents evidence for the interaction of positional faithfulness constraints of several types, and at several levels. As I showed in Chapter 4, the ranking

<sup>5</sup> See also the discussion of  $CRISPEDGE$  in Itô & Mester (1994).



IDENT- $\sigma_1$ (Place,Manner) » IDENT-ROOT(Place,Manner), IDENT-ONSET(Place,Manner) » IDENT(Place,Manner) must hold in Ibibio; this ranking is responsible for the assimilation of syllable onsets to preceding codas in the root-initial syllable, contrary to the usual pattern of coda-to-onset assimilation found crosslinguistically. Turning our attention to a different set of facts from the language, we will see that MAX- $\sigma_1$  is also high-ranking.

Verb roots in Ibibio are typically monosyllabic, and may have CV, CVC or CVVC shapes.<sup>6</sup> Representative examples are given in (15).

(15) Monosyllabic verb roots (Akinlabi & Urua 1993)

wà	‘sacrifice’	wàt	‘paddle’	wààk	‘tear’
sé	‘look’	dép	‘buy’	déép	‘scratch’
kpø̀	‘carry’	kø̀~	‘knock (on the head)’	kø̀ø̀~	‘hang up (a dress)’
nø̀	‘give’	dóm	‘bite’	fáák	‘wedge between 2 obj.’
dá	‘stand’	dát	‘take/pick up’	μø̀ø̀n	‘crawl’

The preceding forms show examples of each of the non-high vowels in the language.

The vowel system of Ibibio is composed of six vowel qualities, symmetrically arrayed at three heights:

(16) Ibibio vowel system

High:	i	u
Mid:	e	o
Low:	a	ø

Much of the interesting evidence for ambisyllabicity in the language derives from the behavior of the high vowels. Before turning to the ambisyllabicity data, a brief excursus on the vowel inventory and allophonic alternations will be necessary.

The high vowels *i* and *u* exhibit a common allophonic alternation: in open syllables and long vowels, they surface as [+ATR] [i] and [u], but in closed syllables, they are lax and centralized. (Short open syllables may occur both medially and finally; see fn. 6.) Here I adopt

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<sup>6</sup> The absence of a contrast between surface CVV and CV roots is striking. Akinlabi & Urua (1993) discuss various analytic alternatives, including the suggestion that CV forms are derived from bimoraic CVV by a rule of post-lexical truncation. No clear conclusions are reached, but the discussion makes it clear that the CV structures are not restricted to phrase-final position. This is not obviously a case of final shortening, though such an analysis may be possible, given additional information about the syntax of the language. I will not provide an analysis of this gap in the root inventory.

the transcriptions employed by Akinlabi & Urua (1993); *v* is described as being centralized, delabialized and lowered, relative to *u*.

(17) Allophonic variants of high vowels (Akinlabi & Urua 1993:8)

kùùk	‘shut doors’	kv`k	‘shut (door)’
dùùt	‘drag many things’	dv`t	‘drag’
bíí̃k	‘be wicked many times’	b <sub>I</sub> `k	‘be wicked’
fí̃p	‘suck on s.t.’	f <sub>I</sub> `p-pé	‘remove sucked obj. from the mouth’
wúúk	‘drive s.t. in’	wv`k-kø'	‘remove an obj. driven in’
dí	‘come’	d <sub>I</sub> `p	‘hide’
kpí̃	‘cut’	b <sub>I</sub> `t	‘spread a mat’
		dv`k	‘enter’
		kv`p	‘cover (with lid)’

(18) Impossible Ibibio surface forms

*Cv̄vC	*CuC
*C <sub>I</sub> ̄C	*C <sub>I</sub> C
*Cv̄	
*C <sub>I</sub> ̄	

These alternations are entirely regular, and parallel to cases of closed-syllable laxing found in other languages such as Klamath (Blevins 1993) and Javanese (Benua 1996).<sup>7</sup> This allophony reflects a high-ranking markedness constraint which forbids [+ATR] vowels in closed syllables, as in (19).

(19) CHECKED<sub>R</sub>TR

CHECKED<sub>R</sub>TR must dominate the articulatorily grounded H<sub>I</sub>GH/ATR constraint of (20), as well as the faithfulness constraint IDENT(ATR). (See Chapter 3 for extensive discussion of the grounded constraints on height/ATR combinations.)

(20) H<sub>I</sub>GH/ATR: \*[+high, -ATR]

The ranking of CHECKED<sub>R</sub>TR » H<sub>I</sub>GH/ATR will force high vowels in closed syllables to be [-ATR], though high [-ATR] vowels are crosslinguistically more marked than high [+ATR] vowels. This is demonstrated in (21).

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<sup>7</sup> The lowering and unrounding effect is perhaps more unusual, and suggestive of the contextual allophony exhibited in Tamil (see Chapter 2). As these aspects of closed syllable vocalism are tangential to the main point, that high vowels have lax allophones in closed syllables, I will not pursue the matter further here.

(21) Retraction in closed syllables

	/dɪp/	CHECKED <sub>RTR</sub>	H <sub>IGH</sub> /ATR	I <sub>DENT</sub> (ATR)
a.	dɪ̠p	*!		
b.	dɪp		*	*

This ranking of CHECKED<sub>RTR</sub> and H<sub>IGH</sub>/ATR will not affect the realization of high vowels in open syllables, however:

(22) [+ATR] vowels in open syllables

	/dɪ̠/	CHECKED <sub>RTR</sub>	H <sub>IGH</sub> /ATR	I <sub>DENT</sub> (ATR)
a.	dɪ̠̠			
b.	dɪ̠'		*!	*

Candidate (22a), with a [+ATR] high vowel, is preferred in this configuration. Laxing is unmotivated in open syllables, and hence does not occur. [+ATR] high vowels will occur in this environment even if the input vowel is lax, due to the influence of H<sub>IGH</sub>/ATR » I<sub>DENT</sub>/ATR.

(23) Input [ATR] is irrelevant

	/dɪ/	CHECKED <sub>RTR</sub>	H <sub>IGH</sub> /ATR	I <sub>DENT</sub> (ATR)
a.	dɪ̠̠			*
b.	dɪ'		*!	

The unfaithful (23a) is optimal, rather than (23b), because the markedness constraint H<sub>IGH</sub>/ATR dominates the faithfulness constraint I<sub>DENT</sub>(ATR).

Long high vowels in Ibibio are invariably [+ATR]. This, too, may be attributed to a high-ranking structural markedness constraint which dominates I<sub>DENT</sub>(ATR); long high lax vowels in the input must surface as [+ATR] vowels in the output. There are no *C<sub>II</sub>* or *C<sub>VV</sub>* forms in the language.

(24) LONG/ATR

Such a constraint is operative in other languages, as well; for example, English does not permit long lax vowels. LONG/ATR must dominate both I<sub>DENT</sub>(ATR) and CHECKED<sub>RTR</sub> in order to yield the attested surface forms.

(25) Long high vowels are [+ATR]


	/wúúk/	LONG/ATR	CHECKED <sub>RTR</sub>	H <sub>IGH</sub> /ATR	I <sub>DENT</sub> (ATR)
a.	wúúk		*		

b.	wv'v'k	*!		*	*
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Undominated LONG/ATR forces the long high vowel to surface as [+ATR], even in a closed syllable; CHECKEDRTR is violated in order to satisfy higher-ranking LONG/ATR, as in (25a).

Even an input long [-ATR] high vowel cannot be faithfully reproduced in surface forms:

(26) Long [-ATR] vowels must be unfaithful<sup>8</sup>

	/wv'v'k/	LONG/ATR	CHECKEDRTR	HIGH/ATR	IDENT(ATR)
a. 	wúúk		*		*
b.	wv'v'k	*!		*	

Here, as above, LONG/ATR favors the [+ATR] variant of the high vowel.

The mid and low vowels apparently do not exhibit allophonic alternations of any kind in closed syllables, or under length. This absence of alternation is not predicted by the constraints examined thus far. In order to prevent tensing of  $\phi$  and  $a$  under length, or laxing of  $e$  and  $o$  in closed syllables, the constraints in (27) must dominate LONG/ATR and CHECKEDRTR.

Furthermore, through domination of IDENT(ATR), the constraints in (27) account for the basic shape of the vowel inventory: mid vowels are [+ATR] and low vowels are [-ATR].


(27) Mid and low vowel constraints

MID/ATR: \*[-high, -low, -ATR]<sup>9</sup>

LOW/RTR: \*[+low, +ATR]

The effect of each constraint is shown in the tableaux below.

(28) Mid vowels must be [+ATR]

	/w''/	MID/ATR	LONG/ATR	CHECKEDRTR	HIGH/ATR	ID(ATR)
a. 	wee					*
b.	w''	*!	*			

<sup>8</sup> The absence of forms such as (26b) in Ibibio makes it clear that we are not dealing with high-ranking IDENT-LONGV(ATR). While such a constraint would account for the absence of laxing in closed syllables, assuming a tense input, it cannot account for the lack of lax, long high vowels in the language.

<sup>9</sup> This constraint represents a departure from the system of height/ATR constraints presented in Chapter 3. There, I suggested that constraints of this form are unnecessary to describe the behavior of vowel inventories. The facts of Ibibio do require that the mid vowels be treated distinctly from the high vowels, as their behavior in closed syllables is different. Simply ranking NONLOW/ATR » CHECKEDLAX » HIGH/ATR will not account for the allophony here, as this ranking would result in uniformly tense high and mid vowels in closed syllables. I am assuming MID/ATR for the purposes of demonstration here. As an alternative, we might consider a closed syllable laxing constraint which is sensitive to duration; as high vowel are intrinsically of shorter duration than mid vowels, they may be more susceptible to laxing in a closed syllable environment, where vowel duration is typically shorter than in open syllables. I leave this matter for further research.

	/wek/				
a.	w <sub>ɛ</sub> k			*	
b.	w <sup>ɪ</sup> k	*!			*

(29) Low vowels must be [-ATR] (small caps represent [+ATR] low vowels)

	/waa/	LOW/RTR	LONG/ATR	CHECKEDRTR	HIGH/ATR	ID(ATR)
a.	w <sub>AA</sub>	*!				
b.	w <sub>ɛ</sub> aa		*			*

	/wAk/					
a.	w <sub>A</sub> k	*!		*		
b.	w <sub>ɛ</sub> ak					*

In each case, the implicational markedness constraints select in favor of the actual output form, overriding the influence of the allophony-causing constraints LONG/ATR and CHECKEDRTR.

This completes the basic outline of the Ibibio vowel inventory and the constraints which determine its makeup. The property of the system which is crucial to the discussion of positional maximization is the retraction of high vowels in closed syllables, implemented by the ranking of CHECKEDRTR » HIGH/ATR » IDENT(ATR). Keeping this distributional generalization in mind, consider the data in (30) below.

(30) [-ATR] high vowels in derived forms (Akinlabi & Urua 1993:37)

s <sub>I</sub> 'n	'put on (e.g. dress)'	s <sub>I</sub> 'né	'put on oneself'
d <sub>I</sub> 'p	'hide'	d <sub>I</sub> 'ɛ	'hide oneself'
fv'k	'cover (with cloth)'	fv'©ø'	'cover oneself'

In the left-hand column, the bare roots exhibit the allomorphy which is expected; high vowels are retracted in closed syllables. However, the vowels in the right-hand column are mysterious. In each CV<sub>1</sub>CV<sub>2</sub> string, V<sub>1</sub> is realized as the closed syllable allophone. Yet the principle of onset maximization, derived from the interaction of the constraints NOCODA and ONSET, predicts that both syllables should be open. The [-ATR] allophones of the high vowels should not appear in this context; rather, we expect \*s<sub>I</sub>né, \*d<sub>I</sub>'ɛ and \*fv'©ø'. Because the words in question are derived forms, the data in (30) suggest that output-output faithfulness effects of the sort examined in Benua (1997) are relevant. Under such an analysis, the vowels in d<sub>I</sub>'ɛ, fv'©ø' and similar words are [-ATR] by virtue of high-ranking IDENT-OO(ATR), a constraint requiring identity between the base form (d<sub>I</sub>'p, fv'k, etc.) and the related derived word.

However, such an analysis cannot be correct, because the same anomalous [-ATR] allophone appears in synchronically *underived* disyllabic roots. In (31), as above, the [-ATR] vowel seems to occur in an open syllable:

- (31) [-ATR] high vowels in disyllabic roots (Akinlabi & Urua 1993:37)
- |        |                    |
|--------|--------------------|
| fv`@ø' | 'pass by, surpass' |
| tv`nø' | 'discipline'       |
| nɪ'@é  | 'tickle'           |
| fɪ'@é  | 'forget'           |

Here there is no underived base word with a CVC shape that can enforce output-output identity. Rather, the high vowels are surfacing as though they are contained in closed syllables, because they *are* contained in closed syllables. The intervocalic consonant in the data above is *ambisyllabic*, parallel to the situation in Efik (Welmers 1973). This ambisyllabicity arises from high-ranking  $M_{AX-\sigma_1}$ :

- (32)  $M_{AX-\sigma_1}$   
 If  $\alpha \in S_1$ , then there exists some  $\beta \in S_2$  such that  $\alpha \leftarrow \beta$  and  $\beta$  appears in  $\sigma_1$ .  
 "Every input segment has an output correspondent in the root-initial syllable."

$M_{AX-\sigma_1}$ , through domination of NOCODA, will compel ambisyllabification of the intervocalic consonants in (31) and similar examples. This is shown in tableau (33) below, where  $M_{AX-\sigma_1}$  violations are assessed segmentally. (The ranking of  $M_{AX-\sigma_1} \gg \text{ONSET}$  is arbitrarily imposed for the sake of simplicity; reversing the ranking would not affect the end result.)

- (33)  $M_{AX-\sigma_1}$  compels ambisyllabicity in Ibibio

	/fɪ'té/	$M_{AX-\sigma_1}$	ONSET	NOCODA
a.		t, e!		
b.		e	*!	*
c.		e		*

Each of the candidates incurs at least one violation of  $M_{AX-\sigma_1}$ . The interesting comparison here is between (33a) and (33c). The onset maximizing syllabification in (33a) suffers from two violations of  $M_{AX-\sigma_1}$ , one for each input segment which is not dominated by the root-initial syllable. (33a) therefore cannot be optimal, because the ambisyllabic consonant of (33c) incurs

only violation of  $M_{AX-\sigma_1}$ . In addition, it satisfies  $O_{NSET}$  by virtue of the ambisyllabic consonant, in contrast to (33b).

The [-ATR] realization of the high vowels in ambisyllabic contexts further demonstrates that  $M_{AX-\sigma_1} \gg H_{IGH/ATR}$ , as shown in (34).

(34) [-ATR] vowels in ambisyllabic contexts

/fíté/	CHECKEDLAX	$M_{AX-\sigma_1}$	HIGH/ATR
a.		e	*
b.	*!	e	
c.		t, e!	

With ambisyllabicity enforced by high-ranking  $M_{AX-\sigma_1}$ , the [-ATR] alternant of (34a) is predicted. However, were the ranking of  $M_{AX-\sigma_1}$  and  $H_{IGH/ATR}$  reversed, the grammar would favor candidate (34c), with neither ambisyllabicity nor a [-ATR] high vowel.

Further evidence for the ambisyllabicity analysis, beyond the vowel allophony, may be found in the consonant system of the language. In Ibibio, “[t]he stops [p, t, k] are productively weakened to [ʔ, @, ©] respectively in intervocalic position, comprising either second consonant of a disyllabic (CVCV) verb...or the final consonant of a closed syllable followed by any vowel initial morpheme...” (Akinlabi & Urua 1993:19). We have seen some examples of lenition above; additional forms are given in (320).

(35) Stop lenition (Akinlabi & Urua 1993:19)

a.	tòʔ	‘make an order’		
	tɪ`@é	‘stop’		
	fè©é	‘run’		
b.	dwòp	‘ten’	dwòʔ è bà	‘twelve’ (ten plus two)
	èfɪ`t	‘fifteen’	èfɪ`@ è nàà~	‘nineteen’ (fifteen plus four)
	úfò`k	‘house’	úfò`© î bà	‘two houses’

The forms in (35a) are underived disyllabic roots, and the forms in (35b) are phrases.<sup>10</sup>

Consonant lenition occurs in both roots and derived forms, including phrasal contexts; in each case, the leniting consonant falls under the influence of high-ranking  $MAX-\sigma_1$ .

Crucially, however, lenition does not apply in *every* intervocalic context. It applies only to consonants which may be affected by  $MAX-\sigma_1$ : those which occur immediately following the first (or only) syllable of a root. Contrast the forms in (30), (31) and (35) with those below.


Lenition does not apply to a root-initial intervocalic stop, as shown in (36).

(36) Lenition does not occur between prefix and root

é-táp	‘saliva’	*é@áp
é-tó	‘stick’	*é@ó
ĩ-kø't	‘bush’	*ĩ@ø't
ø'-kø'	‘fence’	*ø'@ø'

The failure of lenition is predicted by the analysis developed here: root-initial consonants satisfy  $MAX-\sigma_1$  simply by being in the onset of the syllable. An ambisyllabic consonant here will incur a gratuitous violation of  $NOCODA$  (as well as violations of  $IDENT(continuant)$  and  $IDENT(voice)$ ):

(37) Root-initial stops are not ambisyllabic

/é-táp/	$MAX-\sigma_1$	ONSET	$NOCODA$
a. 	e		*
b.	e		**!

Candidate (37a) is optimal; there is simply no motivation, in the form of a high-ranking constraint, for the ambisyllabic structure of (37b). Consequently, the additional violation of  $NOCODA$  which it incurs is fatal.

Lenition also fails to apply to stops which fall outside of the root-initial syllable window.

This is highlighted by the behavior of negative verb forms. The negative in *Ibibio* is marked by a

<sup>10</sup> Although Akinlabi & Urua (1993) do not provide morpheme-by-morpheme glosses for these examples, I assume that the initial vowels of *eft*, *uføk* and *iba* are prefixal, and that the *e* of ‘fifteen’ and ‘nineteen’ is a conjunction. Akinlabi & Urua (1993:19) do state that nouns are productively derived from verbs by prefixation of a vowel, and that they assume all initial vowels in nouns are prefixes.



CV suffix which requires a minimally bimoraic base.<sup>11</sup> When the verb root is monosyllabic, the suffix-initial consonant undergoes lenition as expected, even though the root vowel is long. (This shows that consonant ambisyllabicity is not a means of satisfying a bimoraic minimum on roots; it occurs even when the root is already bimoraic.) Representative data are given in (38).

(38) Monosyllabic root + negative suffix

sé	‘look’	n'-séé-©é	‘I am not looking’
nø	‘give’	n'-nø ø`-©ø'	‘I am not giving’
dó	‘be (copula)’	n'-dóó-©ó	‘I am not’
dá	‘stand’	n'-dáá-©á	‘I am not standing’

In the context of a disyllabic root, however, the consonant of the negative suffix does not lenite.

(39) Disyllabic root + negative suffix

dáppá	‘dream’	...dáppá-ké	‘...not dreaming’	*dáppa-©é
dámmá	‘be mad’	...dámmá-ké	‘...not being mad’	*dámamá-©é
sà~á	‘walk’	...sà~á-ké	‘...not walking’	*sà~á-©é
kø~ø'	‘choke’	...kø~ø'-ké	‘...not choking’	*kø~ø'-©é

Lenition of an intervocalic consonant occurs if and only if the consonant in question is in the orbit of the root-initial syllable coda; otherwise, the input stop surfaces as a stop in the output.


This distribution of lenited stops constitutes additional evidence for the role of  $M_{AX-\sigma_1}$  in the grammar of Ibibio.<sup>12</sup> Ambisyllabicity, of which stop lenition is a diagnostic, is predicted to occur only if such a syllabification will better satisfy  $M_{AX-\sigma_1}$ .<sup>13</sup> Beyond the initial syllable of the root, an ambisyllabic consonant cannot serve this purpose. Consider the tableau in (40).

<sup>11</sup> See Akinlabi & Urua (1993) for extended discussion of the prosodic requirements imposed by Ibibio affixes.

<sup>12</sup> Akinlabi & Urua (1993) take these facts to indicate that the rule of lenition is foot-bounded, with a disyllabic trochee initiated by the root-initial syllable, noting that there is no stress prominence (presumably indicated by increased amplitude and duration) in the language. Phonological processes which appear to be restricted in application to the level of the foot are quite rare; it seems likely that all such effects may be subsumed under the rubric of positional faithfulness. (See the analysis of Guaraní in Chapter 3 for additional evidence in support of this claim.)

<sup>13</sup> A coda-only analysis of Ibibio lenited stops, parallel to the analysis of English flaps offered in Selkirk (1982), is possible. Such an analysis requires that  $MAX-\sigma_1, UNIQUE-\sigma \gg ONSET$ . Under this approach, lenition would affect only coda consonants. In order to account for the absence of lenition in word-final codas, we must assume that lenition affects only released coda consonants, where release is possible only before a sonorant segment. Word-final coda consonants, not preceding a sonorant, are not released; therefore, they are not subject to lenition. Such an analysis raises the question of why only released segments should undergo a lenition process which renders them unfaithful to their input correspondents in [continuant] and [voice], particularly given the arguments in Lombardi (1995a), and Padgett (1995b) that

(40) No ambisyllabicity beyond  $\sigma_1$

/sã́ á-ke/	$M_{AX}-\sigma_1$	ONSET	NOCODA
a. 	a, k, e		*
b.	a, ɔ́, e		**!

The two candidates tie on both  $M_{AX}-\sigma_1$  and ONSET, passing the decision to low-ranking NOCODA. Multiple ambisyllabic consonants, as in (40b), incur multiple, unmotivated violations of NOCODA. The intervocalic dorsal stop, which has no access to the root-initial syllable, has no motivation to syllabify ambisyllabically. Candidate (40a) is optimal.

The facts of Ibibio provide evidence that  $M_{AX}-\sigma_1$  is high-ranking in the grammar. The distribution of high vowel allophones, crucially related to syllable structure, indicates that the root-initial syllables are closed in forms such as  $n_I' \text{ } \textcircled{e}$  and  $fv` \text{ } \textcircled{\emptyset}$ . Furthermore, the limited occurrence of lenited stops is predicted by the positional  $M_{AX}$  analysis set out above: intervocalic consonants are lenited in just those contexts in which the consonant may better satisfy  $M_{AX}-\sigma_1$ , by means of an ambisyllabic affiliation to higher-level prosodic structure.

The theory outlined here is not solely a theory of root-initial faithfulness, but rather a theory of faithfulness in a variety of prominent positions. Consistent with the broad purview of positional faithfulness theory, there is evidence in other languages that  $M_{AX}-\sigma'$  plays an important role in generating syllabifications which are inconsistent with onset maximization.

#### 5.4 Stressed Syllable Maximization in Scots Gaelic

Ibibio, and the closely-related language Efik, provide compelling evidence that  $M_{AX}-\sigma_1$  is enforcing an otherwise aberrant ambisyllabification of intervocalic consonants. Through domination of NOCODA,  $M_{AX}-\sigma_1$  forces root-initial syllables to be maximally filled with segmental material present in the input. We might expect, in a fully elaborated theory of positional  $M_{AX}$  constraints, to find evidence of prosodic maximization in other privileged

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faithfulness is preferentially enforced on [+release] segments. A full understanding of contextual allophony is beyond the purview of this dissertation, so I will leave this matter for future research.

positions. Just such evidence is provided by the phonology of Scots Gaelic, which shows stressed syllable maximization effects resulting from high-ranking  $M_{AX}-\sigma'$ .

In Barra and Lewis Gaelic, two dialects of Scots Gaelic spoken in the Outer Hebrides, intervocalic consonants exhibit an unusual pattern of syllabification. Following a short vowel in the stressed initial syllable, an intervocalic consonant regularly syllabifies in coda position, rather than as an onset (Børgstrom 1940: 55).

(41) Coda syllabification of intervocalic consonants

bqødq. \x	‘old man’
ar.an	‘bread’
faL.u <sup>14</sup>	‘empty’

Børgstrom’s (1940) description makes it clear that the syllabification pattern in (41) is entirely regular. Intervocalic consonants are drawn into the stressed initial syllable, in violation of ONSET.

In contrast to the forms in (41), Børgstrom (1940) reports a second pattern of syllabification, exemplified in (42). (Examples are taken from Clements 1986, as well as from Børgstrom 1940.)

(42) Onset syllabification of intervocalic consonants?

ma.rav	‘dead’
a.ram	‘army’
βa.Lak	‘hunting’
ska.rav	‘cormorant’
ø.røm	‘on me’
bø.rø©	‘Borg’ (place name)

In each of these cases, the second vowel is an epenthetic copy of the first vowel. Underlying clusters of sonorant + heterorganic consonant are broken up by epenthesis, as Clements (1986) convincingly argues. Under such conditions, Børgstrom reports that the consonant in question syllabifies with the following syllable, rather than with the preceding.

We appear to have a simple surface contrast in syllabification, but the facts are slightly more complex. Børgstrom reports that native speakers treat examples such as (41) as

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<sup>14</sup> L represents a non-lenited dental lateral. Leniting consonant mutations are pervasive in all of the Gaelic languages; I will not address the contrast between lenited and non-lenited segments here.

disyllables, but data like those in (42) are considered to be *monosyllables*. Thus, Neil Sinclair, a Barra speaker, gave a syllable division between *N* and *a* in *fæ<Nak*, where the second vowel is underlying<sup>15</sup>. In the case of *βaLak*, where the second vowel is epenthetic, Sinclair indicated that “the *L* and the following *k* are so ‘close together’ that such a separation is impossible” (Børgstrom 1940: 153). Børgstrom concludes from this that “it is evident that for native speakers the type *m[ara]v* [with svarabhakti--JNB] is equivalent to a monosyllable.”

The monosyllabic analysis of svarabhakti forms is further supported by the facts of stress and tone distribution. Words in Barra and Lewis Gaelic are permitted one stress, which falls regularly on the initial syllable. This stress is marked by a “rising (high) tone, while unstressed syllables have a low (falling) tone” (Børgstrom 1940: 53). In words containing a svarabhaktic vowel, the “tone is rising on both vowels, which are both regarded as stressed”. This tone pattern is identical to that of long stressed vowels and diphthongs, which also bear high tone on both members.

These findings are further supported by the findings of Bosch & DeJong (1996), who recorded a native speaker of Barra producing both categories of words, those containing two vowels underlyingly (the *ar.an* type), and those containing a svarabhakti vowel (as in *a.ram*). Bosch & DeJong measured both the duration and the fundamental frequency of *V*<sub>1</sub> and *V*<sub>2</sub>. In the words conforming to the canonical stress and syllabification pattern, they found that the duration of *V*<sub>1</sub> was greater than that of *V*<sub>2</sub>, and that pitch declined rather sharply in *V*<sub>2</sub>. By contrast, in the svarabhakti words, the duration of *V*<sub>2</sub> was equal to or greater than that of *V*<sub>1</sub>—and pitch remained consistently high across both vowels, rather than decreasing on *V*<sub>2</sub>. Bosch & DeJong suggest that the epenthetic vowel in the svarabhakti forms is the stress-bearer, in contrast to the standard initial syllable stress pattern. While the monosyllabism of the svarabhakti forms remains difficult to establish, Bosch & DeJong’s data establish a difference in stress


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<sup>15</sup> Orthographic *feannag*, versus *sealg* for the following example. Svarabhakti vowels are nearly always ignored in the orthography.

placement in the two classes of words—a difference that correlates with different syllabification patterns for intervocalic consonants.

The canonical syllabification pattern for VCV sequences in Barra arises from the following ranking:  $M_{AX-\sigma}$ ,  $U_{NIQUE-\sigma}$  »  $NO_{CODA}$ ,  $O_{NSET}$ . The ranking of  $M_{AX-\sigma}$  over  $NO_{CODA}$  is responsible for the association of the intervocalic consonant to the initial, stressed syllable; the ranking of  $U_{NIQUE-\sigma}$  over  $O_{NSET}$  yields an exhaustive coda syllabification, rather than an ambisyllabic consonant. (Compare this with the Ibibio case in §5.3 above.)

(43) Canonical syllabification pattern


/aran/	$M_{AX-\sigma}$	$U_{NIQUE-\sigma}$	$NO_{CODA}$	$O_{NSET}$
a. 	a, n		**	**
b.	a, n	*!	**	*
c.	r!, a, n		*	*

Violations of  $M_{AX-\sigma}$  are incurred by every output segment which a) is the correspondent of an input segment, and b) does not appear in the stressed initial syllable. In candidates (43a) and (43b), there are two violations of  $M_{AX-\sigma}$ ; in the third candidate, there are three, and the third violation is fatal. Of the remaining two candidates, (43a) will be optimal, as it satisfies the constraint  $U_{NIQUE-\sigma}$ , which rules against ambisyllabicity by requiring that segments have a unique syllabic anchor.

In the svarabhakti cases, epenthesis occurs in heterorganic sonorant+consonant sequences, in order to prevent an illicit cluster. (The fact that epenthesis, rather than place assimilation or deletion, occurs indicates that  $D_{EP}$  must be ranked below  $M_{AX}$  and  $I_{DENT(Place)}$ ; with higher-ranking  $D_{EP}$ , epenthesis would not be the preferred repair strategy.) Stress in such forms falls on the epenthetic segment, rather than on the initial vowel. The intervocalic sonorant in these cases is syllabified in the onset of the second syllable precisely because the initial syllable does not bear the stress necessary to attract that consonant into the coda, via  $M_{AX-\sigma}$ . In fact, the placement of stress on the epenthetic vowel reinforces the onset

syllabification of the consonant, a syllabification favored by  $\text{ONSET}$  and  $\text{NoCODA}$ . This is shown in (44) below.

(44) Svarabhakti syllabification pattern

/arm/	$\text{MAX-}\sigma$	$\text{UNIQUE-}\sigma$	$\text{NoCODA}$	$\text{ONSET}$
a.	a, r!		**	**
b.	a	*!	**	*
c. 	a		*	*

In this case, the canonical pattern, with exhaustive coda syllabification of the intervocalic sonorant (44a) is non-optimal because two of the output segments are excluded from the stressed syllable. Candidates (44b) and (44c) fare better, excluding only the initial vowel from the stressed syllable. Of these, (44c) is selected as optimal because it avoids the violation of  $\text{UNIQUE-}\sigma$  incurred by (44b).

Through interaction with  $\text{ONSET}$ ,  $\text{NoCODA}$  and  $\text{UNIQUE-}\sigma$ ,  $\text{Max}$  generates the two patterns of syllabification in Barra Gaelic, and in fact predicts their occurrence. These two patterns cannot both be generated by the core array of OT syllable structure constraints, as I showed in §5.2 above. Furthermore, there is no obvious alternative available; alignment constraints do not seem to provide a principled solution. Consider, for example, the segment-to-word alignment constraint of (45):

(45)  $\text{ALIGN}(\text{segment}, \text{L}, \text{PWd}, \text{L})$   
 “Every segment must be aligned at the left edge with a Prosodic Word.”

Given two candidates, *ar.an* and *a.ran*, (45) can force coda syllabification only if violations are assessed in terms of the number of syllables which intervene between a given segment and the left edge of the prosodic word; counting the segments which intervene between a given segment and the left edge of the word will be useless in distinguishing competing syllabifications.

Membership in the initial syllable must render a segment immune to violation in order to generate the correct result.

(46) Alignment forces prominence attraction?

/aran/	ALIGN-L
a.	a <sub>1</sub> : v r: v a <sub>2</sub> : σ n: σ
b.	a <sub>1</sub> : v r: σ! a <sub>2</sub> : σ n: σ

Under this interpretation, the coda syllabification is indeed preferred—but this syllabification will also be selected in the svarabhakti cases, as an inspection of (46) should make clear. This approach will be forced to divide the lexicon into two classes which are subject to different constraint rankings in order to prevent forms such as *a.ram* from syllabifying as in (46).

A more obvious alternative, again invoking an ALIGN constraint, would require alignment of segments to stressed syllables. It is the coda syllabification of the intervocalic consonant in forms such as *ar.an* which is problematic for the core constraints of syllable theory in OT, and we will need a constraint compelling this result. It is not clear that either right or left alignment will be sufficient, however. The ALIGN-L formulation is examined in (47) below, with violations assessed in terms of segments which intervene between the left edge of the stressed syllable and the left edge of the segment in question.

(47) Left alignment

/aran/	ALIGN(seg, L, σ', L)
a.	a <sub>1</sub> :   r: a <sub>1</sub> a <sub>2</sub> : r, a <sub>1</sub> n: a <sub>2</sub> , r, a <sub>1</sub>
b.	a <sub>1</sub> :   r: a <sub>1</sub> a <sub>2</sub> : r, a <sub>1</sub> n: a <sub>2</sub> , r, a <sub>1</sub>

The two key competitors in (47) fare equally well with respect to left alignment; this constraint cannot choose between them. NOCODA would actually favor (47b) over (47a).

Right alignment of segments and stressed syllables appears to achieve the desired result, however, as the array in (48) demonstrates.

(48) Right alignment

/aran/	ALIGN(seg, R, $\sigma'$ , R)
a.	a <sub>1</sub> : r r: v a <sub>2</sub> : r, a <sub>1</sub> n: a <sub>2</sub> , r, a <sub>1</sub>
b.	a <sub>1</sub> :   r: a <sub>1</sub> ! a <sub>2</sub> : r, a <sub>1</sub> n: a <sub>2</sub> , r, a <sub>1</sub>
/arm/	ALIGN(seg, R, $\sigma'$ , R)
c.	a <sub>1</sub> : r, a <sub>2</sub> , m r: a <sub>2</sub> , m a <sub>2</sub> : m m:
d.	a <sub>1</sub> : r, a <sub>2</sub> , m r: a <sub>2</sub> , m a <sub>2</sub> : m m:

Provided that we may assess violations on a segment-by-segment basis, the violation incurred by *r* in (48b) will be fatal, while the choice between candidates c and d will be made by NOCODA, as they tie with respect to ALIGN-R.

However, while an analysis employing alignment *is* possible, it is not without drawbacks. The ALIGN-R constraint required to generate the Barra pattern essentially requires coda syllabification, a kind of anti-NOCODA constraint. (Compare this with the alignment-based formulations of NOCODA and CODACOND in Itô & Mester 1994: ALIGN-R( $\sigma$ , V) and ALIGN-L(C,  $\sigma$ ), respectively.) Such an imperative for marked structure is somewhat unusual in the context of a theory which places a heavy emphasis on constraints against marked structure, and should be regarded with caution.

## 5.5 Tamil Complex Codas

### 5.5.1 Introduction



In the preceding sections, I examined cases of ambisyllabicity which derive from high-ranking positional  $M_{AX}$  constraints. In each example, the syllabification of intervocalic segments differs from the canonical CV pattern favored by the syllable markedness constraints  $O_{NSET}$  and  $NOCODA$ : consonants are drawn into the coda of a preceding syllable, rather than being exhaustively syllabified in onset position. Such a pattern can never be optimal in a theory which allows only  $O_{NSET}$ ,  $NOCODA$  and context-free  $M_{AX}$  constraints, but follows straightforwardly from a theory incorporating  $M_{AX-Position}$  constraints.

The influence of  $M_{AX-Position}$  constraints on the surface syllabification of a language extends beyond the realm of simple violations of onset maximization in VCV sequences. For example, high-ranking  $M_{AX-\sigma_1}$  accounts for an asymmetry in the availability of complex codas in Tamil: root-initial syllables may have complex codas, but non-initial syllables may not. This disparity arises from the ranking of  $M_{AX-\sigma_1}$  above  $*COMPLEX$ , which itself dominates  $DEP$ . Tamil thus exhibits a wide range of positional faithfulness effects, due to high-ranking positional  $IDENT$  and positional  $M_{AX}$  constraints.

In Chapter 2, I provided an extensive analysis of positional  $IDENT$  effects in Tamil phonology. There are two positional  $IDENT$  constraints which are sufficiently high-ranking to influence the phonology of the language:  $IDENT-O_{NSET}(Place)$  and  $IDENT-\sigma_1(Place)$ . The onset  $IDENT$  constraint, through domination of context-free  $IDENT(Place)$  and the place markedness subhierarchy, ensures that syllable onsets trigger place assimilation in coda-onset clusters; the relevant ranking is repeated in (49) below.

- (49) Positional neutralization of place distinctions, Tamil non-initial codas  
 **$IDENT-O_{NSET}(Place)$**  »  $*DORSAL$ ,  $*LABIAL$  »  $*CORONAL$  »  $IDENT(Place)$

The second positional  $IDENT$  constraint which is high-ranking in Tamil,  $IDENT-\sigma_1(Place)$ , prevents coronal codas in the root-initial syllable from assimilating to a following onset. This results in an independent coronal place specification in the root-initial syllable, via the ranking shown in (50).

- (50) Initial syllable faithfulness

$I_{D-ONSET}(\text{Place}) \gg *DORSAL, *LABIAL \gg I_{D-S_1}(\text{Place}) \gg *CORONAL \gg I_{D}(\text{Place})$

This ranking forces place assimilation of dorsal or labial codas (even in the initial syllable), but prevents assimilation of a coronal consonant in the initial syllable.

Although we have seen compelling evidence that positional IDENT constraints are active in Tamil featural phonology, there is a positional effect at the level of syllable structure which has yet to be addressed. As noted above, root-initial syllables in Tamil may be larger than non-initial syllables: complex codas are permitted in this position, though they are not tolerated elsewhere. Representative data are repeated in (51).

(51) Complex codas in initial syllables (Christdas 1988: 247)

/ayppaci/	[÷a <b>y</b> p.pé.sɪ]	a month
/payt5t5iyam/	[p <b>ay</b> t5.t5I.yã]	'madness'
/aykkiyam/	[÷a <b>y</b> k.kI.yã]	'unity'
/aa@ppaaʔam/	[÷aa@ <b>p</b> .paaʔ.ʔã]	'tumult'
/maa@t5t5aaʔam/	[maa@ <b>t</b> 5.t5aan=.d=ã]	place name
/a@t5t5am/	[÷a@ <b>t</b> 5.t5ã]	'meaning'
/äaaÄkkay/	[äaa <b>Ä</b> k.ké]	'life'

In each case in (51), the complex coda is composed of a coronal sonorant and the first half of a following geminate. These initial syllables incur both a violation of NOCODA and a violation of \*COMPLEX, the constraint which penalizes complex syllable margins (Prince & Smolensky 1993), but are admitted by the grammar as well-formed Tamil structures.

By contrast, there are no Tamil words with the shapes shown in (52).

(52) No complex codas in non-initial syllables

- \*CV.CVCC.CV
- \*CVC.CVCC.CV
- \*CV.CV.CVCC.CV
- etc.

The contrast between the data in (51) and the non-occurring shapes in (52) may suggest a simple prohibition on heavy or superheavy non-initial syllables, perhaps enforced by the constraints in (53).

(53) Prohibiting weight non-initially?

(53) is a positional markedness constraint which penalizes marked structures that occur outside of some prominent position. Elsewhere in this dissertation, I have argued against such constraints; they are at best redundant, and at worst, inadequate to account for positional asymmetries of distribution. However, even if such constraints are permitted, those in (53) cannot account for the contrast in well-formedness that holds between (51) and (52). Both open and closed syllables containing long vowels are permitted in non-initial position, as demonstrated in (54). The coda consonant in a closed syllable may be either the first half of a geminate, or a sonorant homorganic to the following onset.

(54)	Heavy non-initial syllables		
	÷aa@p.paa? ʔã	'tumult'	PC: 247
	maa@t̪.t̪aan=d=ã		place name "
	pa.laak.k}	a tree (dative)	PC: 281
	pu.r~aa	'pigeon'	PC: 174
	÷ak.kaa.n̪	'palm wine'	"
	tak.kaa.Æ̪	'tomato'	"
	kaak.kaa	'crow'	"
	ti.ŋ̪i@	'suddenly (onomat.)'	"
	ka.~iir	'clearly'	"
	ãay.suu.@̪	'smallpox'	"

These data, and other similar forms, show clearly that heavy and superheavy syllables are licit in non-initial position. Root-initial syllables are not unique in licensing heavy or super-heavy syllables, but rather in permitting complex codas, in violation of \*COMPLEX. Non-initial syllables respect \*COMPLEX; a single coda consonant is all that is permitted in such syllables.

The pattern outlined in (51)-(54) above is yet a further example of a positional phonological asymmetry in Tamil, indicative of a high-ranking positional faithfulness constraint. In schematic form, the operative constraint subhierarchy is that shown in (55).

- (55) Positional complex coda subhierarchy, schematic  
 FAITH-σ<sub>1</sub> » \*COMPLEX » FAITH

In contrast to the cases of positional faithfulness examined in Chapter 2, the dominant FAITH-σ<sub>1</sub> of (55) cannot be IDENT-σ<sub>1</sub>(Place). IDENT-σ<sub>1</sub>(Place) is irrelevant in selecting among the actual form, ÷ayp.pé.s̪I, and non-occurring ÷ap.pé.s̪I and ÷a.y̪p.pé.s̪I as the correct output for input

/ayppacy/. The contrast here is not between a form which satisfies  $\text{IDENT-}\sigma_1(\text{Place})$  and those which violate it; *none* of these candidates violates  $\text{IDENT-}\sigma_1(\text{Place})$ .

(56)  $\text{IDENT-}\sigma_1(\text{Place})$  is irrelevant

	/ayppacy/	$\text{IDENT-}\sigma_1(\text{Place})$
a.	÷ayp.pé.sɪ	v
b.	÷ap.pé.sɪ	v
c.	÷a.y}p.pé.sɪ	v

Rather, there is a segment-level resistance to any deletion or epenthesis which would reduce the number of input segments which are dominated by the root-initial syllable. The constraint responsible for this pattern is the now-familiar  $\text{MAX-}\sigma_1$ , which favors maximal syllabification of input segments to the root-initial syllable, even at the expense of  $\text{NOCODA}$  and  $\text{*COMPLEX}$  violations. Complex codas in the initial syllable are the result. Outside of the initial syllable, there is no positional constraint to enforce complex coda syllabification; either epenthesis or deletion is chosen to avoid the  $\text{*COMPLEX}$  violation. In the remainder of this section, I will develop fully the analysis of Tamil complex codas.

### 5.5.2 Tamil onsets

Our primary concern in this section is the complex coda asymmetry exhibited by initial and non-initial syllables of Tamil. In order to correctly characterize the behavior of intervocalic consonants and consonant sequences, however, an understanding of the constraints which govern Tamil onsets will be required. Following the discussion of syllable onsets, I turn to the analysis of coda clusters.


All Tamil syllables are alike in requiring an onset consonant. Vowel-initial roots are augmented with an onset glide that varies according to the quality of the underlying vowel. Front vowels take an epenthetic *y*, round vowels take *w*, and the low vowels take ÷ (Wiltshire 1994, 1995, 1996).<sup>16</sup>

<sup>16</sup> The precise character of the inserted glide is determined by the place of the initial vowel, due to the influence of the place markedness subhierarchy (cf. chapter 2). The epenthetic glide takes on the place features of the following vowel in order to minimize  $\text{*PLACE}$  violations. Further discussion of CV place-

- (57) Initial glide insertion (Wiltshire 1994)
- |           |          |                |
|-----------|----------|----------------|
| /iruʔʔ/   | [yirʔʔ]  | ‘darkness’     |
| /ellaam/  | [yʔllāā] | ‘all’          |
| /aacc/    | [ʔaacc]  | ‘happened’     |
| /aasay/   | [ʔaasʔ]  | ‘desire, hope’ |
| /oʔʔakam/ | [wʔʔxō]  | ‘camel’        |
| /uusii/   | [wuusii] | ‘needle’       |

Non-initial syllables are also required to have an onset consonant; there are no examples of word-internal hiatus in the language. As Wiltshire (1995, 1996) argues, facts such as these indicate that the syllable structure constraint ONSET dominates the anti-epenthesis constraint DEP.<sup>17</sup> This is illustrated in (58).


- (58) ONSET » DEP

	/uusii/	ONSET	DEP
a.	uu.sii	*!	
b. 	wuu.sii		*

Glide epenthesis, as in (58b), is preferred to an onsetless syllable (58a).

That epenthesis, rather than deletion, is the preferred strategy for avoiding ONSET violations indicates that MAX » DEP.

- (59) MAX » DEP

	/uusii/	ONSET	MAX	DEP
a.	uu.sii	*!		
b. 	wuu.sii			*
c.	sii		*!	

Vowels are preserved, rather than deleted; candidate (59b) is optimal, although it incurs a violation of DEP. Each of the other candidates violates a higher-ranking constraint.

While Tamil syllables necessarily take an onset consonant, no further complexity at the onset level is permitted. There are no complex onsets in the language at all; syllables begin with exactly one consonant. This indicates that \*COMPLEX, the constraint prohibiting multiple segments in syllable margins, must dominate a faithfulness constraint such as DEP. Inputs which

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sharing which is motivated by the place markedness subhierarchy may be found in Alderete et al. (1996); see also Rosenthal (1994).

<sup>17</sup> Wiltshire, working in a pre-Correspondence Theoretic framework, adopts the constraint FILL, from Prince & Smolensky (1993). I have updated the analysis in accordance with Correspondence Theory.

contain consonant sequences that might be syllabified in an onset position do not surface faithfully. This is shown in (60), where the input is a hypothetical Tamil word.

(60) \*COMPLEX » DEP

	/kruul/	*COMPLEX	DEP
a.	kruul	*!	
b. <del>ku</del>	ku.ruul		*

The candidate with epenthesis, (60b), is optimal. Candidate (60a) incurs a fatal violation of \*COMPLEX.<sup>18</sup> Similar clusters, occurring word-internally, will be syllabified heterosyllabically, as we saw in Chapter 2.

The rankings which account for the behavior of syllable onsets in Tamil are summarized in the diagram in (61) below.

(61) Onset ranking summary

Lowest-ranking DEP permits glide epenthesis with vowel-initial roots, in order to satisfy high-ranking ONSET. The ranking of ONSET » DEP also prohibits internal hiatus. Finally, the domination of DEP by \*COMPLEX rules out complex onsets in any position; epenthesis is preferable to an illicit onset cluster. No ranking of \*COMPLEX, MAX and ONSET can be established at this point.

### 5.5.3 Codas in Non-initial Syllables

In the preceding section, I established the basic ranking which will derive the obligatorily simplex onsets of Tamil syllables. Now we turn our attention to the opposite end of the syllable, the coda. As we saw in Chapter 2, the inventory of permissible codas is tightly constrained in non-initial syllables. Coda consonants in this position must share place of articulation with the following onset. This is due to the ranking of \*PLACE » IDENT(Place). The coda must also be of greater sonority than the following onset, due to the high-ranking SYLLABLE CONTACT LAW ((96) in Chapter 2). Consonants which cannot satisfy these high-ranking constraints may not be

<sup>18</sup> An additional candidate with deletion, as in *kuul*, is not considered. Such an outcome is possible if \*COMPLEX » MAX. However, because (as established in Chapter 2) MAX » DEP, candidate (60b) will win over any candidate which satisfies \*COMPLEX by means of segmental deletion.

syllabified as codas in non-initial syllables; an epenthetic vowel will render them onsets, where their features are protected via IDENT-ONSET(Place). Examples which demonstrate the behavior of potential coda consonants in non-initial syllables are repeated in (62)-(63) below; for full discussion, see Chapter 2. The place markedness subhierarchy is abbreviated here as \*PLACE.

(62) Nasal assimilation in coda position

/pasan $\delta$ + ka $\text{Æ}$ /	MAX	ID-ONSET	*PLACE	NOCODA	ID(Place)	DEP
a. $\text{pa.s}\tilde{\text{e}}.\text{g}\acute{\text{e}}$			p, s, $\tilde{\text{g}}$	*	*	
b. $\text{pa.s}\acute{\text{e}}\text{n}\delta.\text{g}\acute{\text{e}}$			p, s, n $\delta$ , g!	*		
c. $\text{pa.s}\acute{\text{e}}\text{n}\delta\text{ }.\text{g}\acute{\text{e}}$			p, s, n $\delta$ , g!			*
d. $\text{pa.s}\acute{\text{e}}.\text{x}\acute{\text{e}}$	*!		<b>p, s, x</b>			

Nasals (and laterals) assimilate wherever possible, due to high-ranking MAX and low-ranking IDENT(Place). In the event that assimilation is not possible, epenthesis results.

(63) Epenthesis in obstruent+obstruent sequences

/kat $\text{5ap}$ +ka $\text{Æ}$ /	MAX	SCL	ID-ONSET	*PLACE	ID(Place)	DEP
a. $\text{ka.d}\delta\acute{\text{e}}.\text{ä}\text{ }.\text{x}\acute{\text{e}}$				<b>k, d<math>\delta</math>, ä,</b> <b>x</b>		*
b. $\text{ka.d}\delta\acute{\text{e}}\text{p}.\text{k}\acute{\text{e}}$		*!		<b>k, d<math>\delta</math>, p,</b> <b>k</b>		
c. $\text{ka.d}\delta\acute{\text{e}}.\text{x}\acute{\text{e}}$	*!			<b>k, d<math>\delta</math>, x</b>		

As we have seen elsewhere, the constraint hierarchy employed in (62) and (63) will account for the behavior of simplex codas in these cases, and others as well.

However, the codas of non-initial syllables are further restricted, in a way which is not predicted by the constraint rankings above: only a single consonant may appear in the coda of a non-initial syllable. \*COMPLEX, the constraint which penalizes the occurrence of multiple segments in a syllable margin, may not be violated in non-initial syllables. Input forms which contain sequences of three or more consonants cannot be fully syllabified without epenthesis, should the consonants in question fall outside of the initial syllable. This is illustrated with a hypothetical form in (64) below; as demonstrated in the discussion of onsets, \*COMPLEX » DEP. (The featural IDENT constraints have been omitted for the sake of simplicity.)

## (64) Epenthesis in triconsonantal clusters

/kat5a@mpa/	MAX	*COMPLEX	*PLACE	NOCODA	DEP
a. ka.t5é@m.pé		*!	k, t5, @, mp	*	
b. ka.t5é@.mpé		*!	k, t5, @, mp	*	
c. ka.t5ém.pé	*!		<b>k, t5, mp</b>	*	
d. ☞ ka.t5é.@}m.pé			k, t5, @, mp	*	*

As (64) clearly shows, the ranking of \*COMPLEX » DEP is crucial in ruling out non-initial complex codas. In the first two candidates, no segments have been added or deleted, resulting in a necessarily complex syllable margin in coda (64a) or onset (64b). The concomitant violations of \*COMPLEX are fatal. Were DEP ranked above \*COMPLEX, either (64a) or (64b) would be optimal, rather than (64d). Yet forms like (64a,b) never occur in Tamil.

Triconsonantal clusters which fall outside of the initial syllable cannot ever be syllabified without epenthesis. This will be true if the consonants in question all belong to a single morpheme, as in (64), and also if the triconsonantal string arises through morpheme concatenation, as in (65).

Hypothetical examples such as these show that \*COMPLEX » \*PLACE » DEP; better satisfaction of \*PLACE is sacrificed in order to avoid a \*COMPLEX violation.

## (65) Epenthesis in derived triconsonantal clusters

/kat5a~k-kaÆ/	MAX	*COMPLEX	*PLACE	NOCODA	DEP
a. ka.t5é~g.gé		*!	<b>k, t5, ~gg</b>	*	
b. ka.t5é~.ggé		*!	<b>k, t5, ~gg</b>	*	
c. ka.t5ék.ké	*!		<b>k, t5, kk</b>	*	
d. ☞ ka.t5é.~}k.ké			<b>k, t5, ~, kk</b>	*	*

Just as in (64), epenthesis is favored by high-ranking \*COMPLEX and MAX. Candidate (65d) is optimal, even though it incurs more \*PLACE violations than any other candidate. Polysyllabic roots which end in consonant clusters cannot be faithfully syllabified when concatenated with a consonant-initial suffix. Epenthesis will always result from this grammar.

The preceding discussion demonstrates the constraint interaction which is required to account for the absence of complex codas in non-initial syllables. Complex codas and onsets



are avoided by means of epenthesis, due to low-ranking DEP. The results of this section are integrated with those of the preceding discussion of onsets in (66).

(66) Interim ranking summary

#### 5.5.4 Codas in Initial Syllables

The subgrammar of Tamil outlined in (66) above will correctly account for the absence of complex syllable onsets, and for the nonexistence of complex codas in non-initial syllables. However, it cannot generate complex codas in initial syllables; the positional faithfulness constraint  $M_{AX}-\sigma_1$  will be necessary to admit the data in (67).

(67) Complex codas in initial syllables (Christdas 1988: 247)

/ayppacy/	[÷ayp.pé.sɿ]	a month
/payt5t5iyam/	[payt5.t5ɿ.yã]	'madness'
/aykkiyam/	[÷ayk.kɿ.yã]	'unity'
/aa@ppaaʔam/	[÷aa@p.paa.ʔã]	'tumult'
/maa@t5t5aaʔam/	[maa@t5.t5aan=.d=ã]	place name
/a@t5t5am/	[÷a@t5.t5ã]	'meaning'
/äaaÄkkay/	[äaaÄk.ké]	'life'

In order to demonstrate that  $M_{AX}-\sigma_1$  is crucially high-ranking in Tamil, I provide the tableau in (68), where only the constraints of (66) are arrayed. (I assume that degemination is not a possible strategy; geminate/singleton contrasts are robustly maintained in Tamil.)

(68) Complex codas in initial syllables?

	/äaaÄkkay/	$M_{AX}$	*COMPLEX	*PLACE	NOCODA	DEP
a.	äaaÄk.ké		*!	ä, A, kk	*	
b.	●* äaa.A}k.ké			ä, A, kk	*	*

The candidate exhibiting epenthesis, (68b), is clearly optimal under this grammar. Yet, forms such as (68a) exist in the language and must be generated. \*COMPLEX is dominated by a constraint which favors maximal syllabification of the root-initial syllable; that constraint is  $M_{AX}-\sigma_1$ .

The effects of high-ranking  $M_{AX}-\sigma_1$  are shown in (69) below. The constraint must crucially dominate \*COMPLEX:

(69)  $M_{AX-\sigma_1} \gg *C_{OMPLEX}$

	/ääÄkkay/	$M_{AX-\sigma_1}$	$M_{AX}$	* $C_{OMPLEX}$	* $P_{LACE}$	$NOC_{ODA}$	$DEP$
a. ☞	ääÄk.ké	a, y	y	*	ä, Ä, kk	*	
b.	ää.Ä}k.ké	a, y, Ä!, kk	y		ä, Ä, kk	*	*

Candidate (69a), in which the initial syllable is maximally filled by input segments, is optimal; this is true even though \* $C_{OMPLEX}$  is violated. By contrast, (69b) satisfies \* $C_{OMPLEX}$ , but at the expense of  $M_{AX-\sigma_1}$ . Maximization of the prominent root-initial syllable is paramount, although a marked complex coda must be admitted as a result.

High-ranking  $M_{AX-\sigma_1}$  will not influence the syllabification of consonant clusters which fall outside the purview of the root-initial syllable. This is shown in (70), where the hypothetical root of (64) is repeated.

(70) Non-initial clusters are not affected by  $M_{AX-\sigma_1}$

	/kat5a@mpa/	$M_{AX-\sigma_1}$	$M_{AX}$	* $C_{OMPLEX}$	* $P_{LACE}$	$NOC_{ODA}$	$DEP$
a.	ka.t5é@m.pé	t5, a, @, m, p, a		*!	<b>k, t5, @, mp</b>	*	
b.	ka.t5é@.mpé	t5, a, @, m, p, a		*!	<b>k, t5, @, mp</b>	*	
c.	ka.t5ém.pé	t5, a, @, m, p, a	*!		<b>k, t5, mp</b>	*	
d. ☞	ka.t5é.@}m.pé	t5, a, @, m, p, a			<b>k, t5, @, mp</b>	*	*

Each of the candidates ties with respect to  $M_{AX-\sigma_1}$ ; exactly the same segments are omitted from the initial syllable of the root, and packing more segments into the coda of the second syllable will not achieve better satisfaction of  $M_{AX-\sigma_1}$ . Candidate (70d) is therefore optimal, by virtue of satisfying  $M_{AX}$  and \* $C_{OMPLEX}$ , just as we saw in (64) above.

One additional remark is in order at this point. There is another relevant candidate which was not considered in (70) above: *kat5.é.@}m.pé*. This form fares better on  $M_{AX-\sigma_1}$  than any of the candidates considered above, yet it is not optimal. This shows that  $ONSET \gg M_{AX-\sigma_1}$ .  $ONSET$  is an undominated constraint of the language, and cannot be sacrificed, even to  $M_{AX-\sigma_1}$ .

We have now seen that  $M_{AX-\sigma_1}$  plays a central role in determining the possible syllable shapes of initial and non-initial syllables in Tamil. The constraint rankings which are relevant to the syllabification of the language are summarized in (71).<sup>19</sup>

(71)

The positional  $M_{AX}$  constraint  $M_{AX-\sigma_1}$  will help to solve a mystery which was left outstanding at the close of Chapter 2: how can freestanding coronal codas be syllabified in the root-initial syllable? Consider the forms in (72).

(72) Independent POA

/t5eyääm/	[t5ey.ää]	‘god’	PC: 230
/aa@ äam/	[÷aa@.ää]	‘eagerness’	PC: 231
/maa@kaÄiy/	[maa@.xé.ÄI]	a month	PC: 231
/munĪiy/	[mun.ĪI]	‘teacher’	PC: 234
/tunpam/	[tun.bã]	‘sorrow’	PC: 234
/na <sup>-</sup> pan/	[n8 a <sup>-</sup> .bã]	‘friend’	PC: 234
/anp/	[÷an.b }	‘love’	PC: 157

In each case, the initial syllable coda contains a coronal consonant which is not homorganic to the following syllable onset. Neither dorsal nor labial codas are permitted to occur freely in initial syllable codas.

In Chapter 2, I showed that the freestanding coronal place specification of the codas in these data derives from the ranking given in (73) below. The rankings established in Chapter II are repeated, and the portion of the constraint hierarchy which permits initial syllable codas to be coronal, though not labial or dorsal, is enclosed in the dark box.

(73)

Crucially,  $IDENT-\sigma_1(Place) \gg *CORONAL$ , rendering faithfulness to the input coronal place of the coda consonant of paramount importance.

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<sup>19</sup> The ranking of  $MAX-\sigma_1 \gg *COMPLEX$ , as shown in (71), predicts that complex onsets should be permitted in root-initial syllables. Input /CCV.../ should be syllabified as CCV, rather than CV.CV or VC.CV, in order to better satisfy  $MAX-\sigma_1$ . That such syllabifications do not occur indicates that  $*COMPLEX$  must be further dispersed into  $*COMPLEX-ONSET$  and  $*COMPLEX-CODA$ , not a surprising result.

In order to integrate  $M_{AX-\sigma_1}$  into the constraint hierarchy shown in (73), we must examine anew the forms in (72), as well as parallel inputs in which labial or dorsal segments are predicted to close the initial syllable. Consider first the tableau in (74). The comparison of interest is that of the actually occurring form (74a), and a candidate with epenthesis, as in (74b).

(74) Coronal codas?

	/tunpam/	IDENT- $\sigma_1$ (Place)	*COR	NOCODA	IDENT(Place)	DEP
a.	tun.bã		t, n	*!		
b.	• <sup>*</sup> tu.n}.ää		t, n			*

Epenthesis is actually favored by this grammar, incorrectly predicting that forms such as (74a) are ill-formed.

Though candidate (74b) appears to be problematic, the difficulty it poses is more apparent than real. The preceding discussion of complex codas has established that  $M_{AX-\sigma_1} \gg *COMPLEX$ , and that  $*COMPLEX \gg *PLACE$ . By transitivity of ranking, this entails that  $M_{AX-\sigma_1} \gg *PLACE$ , as shown in (71). Crucially,  $M_{AX-\sigma_1}$  also dominates NOCODA, by transitivity of ranking. The coronal coda of (74a) is therefore favored, even at the expense of NOCODA. This is demonstrated in (75).

(75)  $M_{AX-\sigma_1} \gg NOCODA$

	/tunpam/	MAX- $\sigma_1$	*DORS	*LAB	ID- $\sigma_1$ (Place)	*COR	NOCODA	ID(Place)	DEP
a.	☞ tun.bã	p, a, m		b		t, n	*		
b.	tu.n}.ää	n!, p, a, m		ä		t, n			*
c.	tum.bã	p, a, m		mb	*!	t	*	*	

The correct candidate, (75a), is selected as the optimal form. (75b) better satisfies NOCODA, but the ranking of  $M_{AX-\sigma_1} \gg NOCODA$  renders this satisfaction irrelevant. Candidate (75c), in which the coda consonant assimilates to the following onset, is ruled out by high-ranking IDENT- $\sigma_1$ (Place).

Not any coronal consonant may serve as the coda of a root-initial syllable, as we saw in Chapter 2. Only a sonorant coronal may appear in this position. Non-geminate obstruent codas are generally prohibited by the SYLLABLE CONTACT LAW (SCL), which rules out coda-onset sequences of equal or rising sonority. The absence of freestanding coronal obstruents in root-

initial syllables shows that  $S_{CL}$  dominates  $M_{AX-\sigma_1}$ ; coronal obstruent codas are illicit in any position. This is demonstrated in (76) below, where the input is a hypothetical root. (For discussion of the failure of place assimilation in such clusters, see Chapter 2.)

(76)  $S_{CL} \gg M_{AX-\sigma_1}$

	/tutpam/	SCL	MAX- $\sigma_1$	*DORS, *LAB	ID- $\sigma_1$ (Place)	*COR	NOCODA	ID(Place)	DEP
a.	tut.pã	*!	p, a, m	p		t, t	*		
b.	tu.?.}ãã		t, p, a, m	ä		t, ?			*

Candidate (76a) fares better on  $M_{AX-\sigma_1}$  than does (76b), but it is not optimal, due to higher-ranking  $S_{CL}$ . Epenthesis is favored; (76b) is optimal.

To complete the discussion of Tamil positional faithfulness, we must examine the outcome of the full constraint hierarchy when applied to inputs containing dorsal or labial consonants in the orbit of the root-initial syllable. Though the grammar will permit freestanding coronal codas in initial syllables, it will not allow other places of articulation to surface unscathed.  $M_{AX-\sigma_1}$  favors maximization of the root-initial syllable, but it does not require featural identity of the segments in the initial syllable. Featural faithfulness is assessed by the separately ranked constraint  $ID_{ENT-\sigma_1}(\text{Place})$ , which is dominated by the place markedness constraints \*LABIAL and \*DORSAL. This will force place assimilation of an input labial or dorsal consonant, even if it is parsed by the root-initial syllable. Consider the hypothetical input in (77).

(77) No free labial or dorsal codas

	/tũpam/	MAX- $\sigma_1$	*DORS	*LAB	ID- $\sigma_1$ (Place)	*COR	NOCODA	ID(Place)	DEP
a.	tũ.bã	p, a, m	~!	b		t	*		
b.	tu.~}.ãã	~!, p, a, m	~	ä		t			*
c.	tũm.bã	p, a, m		mb		t	*	*	

Candidate (77b), in which there is epenthesis, is ruled out summarily by  $M_{AX-\sigma_1}$ . This leaves (77a) and (77c). Of these, (77c) is optimal because it avoids the \*DORSAL violation incurred by (77a). The ranking of \*DORSAL \*LABIAL  $\gg$   $ID_{ENT-\sigma_1}(\text{Place})$  favors place assimilation of non-coronal codas, just as in Chapter 2; high-ranking  $M_{AX-\sigma_1}$  has no effect on this result.

#### 5.5.5. Conclusions

To summarize, we have seen in this section that the positional  $M_{AX}$  constraint  $M_{AX}-\sigma_1$  accounts for the distribution of complex codas in Tamil. Because  $M_{AX}-\sigma_1$  dominates  $*C_{COMPLEX}$ , complex codas are possible in initial syllables. The ranking of  $*C_{COMPLEX} \gg DEP$  forces epenthesis for any case in which satisfaction of  $M_{AX}-\sigma_1$  is not at issue; namely, when the complex clusters in question fall entirely outside of the root-initial syllable. I have also shown that, through interaction with the positional Identity constraints and the place markedness subhierarchy, high-ranking  $M_{AX}-\sigma_1$  accounts for the occurrence of freestanding coronal codas in initial syllables. Epenthesis, which would draw a coronal segment out of the root-initial syllable (in violation of  $M_{AX}-\sigma_1$ ), is optimal only under duress from a constraint which dominates  $M_{AX}-\sigma_1$ ;  $SCL$  and  $LATCOR$  are two such constraints. The final ranking summary for Tamil is given in (78) below.

(78) Final ranking summary, Tamil

The interaction of both positional  $IDENT$  and positional  $M_{AX}$  constraints with the syllable and place markedness constraints correctly derives a complex pattern of initial-syllable privilege in this language. The extent to which these, and other positional faithfulness constraints, interact in the grammars of the world's languages, is an important avenue for future research.

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