



On the Status of CODACOND in Phonology

JILL N. BECKMAN¹
University of Iowa

ABSTRACT

Onset/coda feature licensing asymmetries have been extensively studied in the generative phonological literature. Pre-Optimality Theory analyses of such asymmetries rely on positional licensing or positional markedness statements, of which Itô's (1986, 1989) Coda Condition is the best-known. In OT, a different approach to onset/coda asymmetries has emerged: onset-specific faithfulness (Padgett 1995; Beckman 1999; Lombardi 1999, 2001). In a recent paper, Lombardi (2001) argues that both onset faithfulness and the Coda Condition are required to account for the range of repairs associated with coda/onset asymmetries in the licensing of place features, arguing that positional faithfulness alone cannot generate epenthesis as a repair strategy. In this paper, I show, through analyses of Tamil and Axininca Campa, that the Coda Condition is not required to generate place-driven epenthesis; rather, epenthesis emerges from the interaction of onset faithfulness with other, independently motivated faithfulness and syllable well-formedness constraints.

KEYWORDS: Positional Faithfulness, Coda Condition, Markedness, Licensing, Place Assimilation, Epenthesis, Tamil, Axininca Campa.

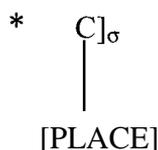
* *Address for correspondence:* Jill N. Beckman, University of Iowa, Department of Linguistics, 570 EPB, Iowa City, IA 52242, USA. E-mail: jill-beckman@uiowa.edu.

I. INTRODUCTION

1.1. Generative Approaches to Onset/Coda Asymmetries

Since the work of Steriade (1982) and Itô (1986, 1989), onset/coda feature licensing asymmetries have been extensively studied in the generative phonological literature. Pre-Optimality Theory analyses of such asymmetries take one of two forms, both of which militate against the occurrence of marked structure in coda position. The negative licensing approach is exemplified by Itô's (1986, 1989) Coda Condition, prohibiting a particular feature specification (typically Place) in the syllable coda:

(1) Coda Condition (Itô 1989:224)



An alternative, positive licensing approach to the same class of phenomena, Prosodic Licensing, was developed by Goldsmith (1989, 1990), Wiltshire (1992), and Bosch & Wiltshire (1992).² In Prosodic Licensing theory, onset/coda asymmetries in feature distribution are captured by syllable templates that incorporate positive licensing statements. Place features are licensed only by the onset position. In both the positive and negative licensing approaches, coda place of articulation is permitted in the event that the place features in question are also linked to a following onset.'

In Optimality Theory (Prince & Smolensky 1993/2002), there are also two dominant, and competing, strategies used to account for onset/coda asymmetries; these strategies may be characterized broadly as positional *markedness* and *positional faithfulness*. Itô's familiar Coda Condition exemplifies the positional markedness approach: marked features are prohibited in a specific position. In recent work (e.g., Itô & Mester 1997, 1998, 1999), this is formalized as the local conjunction (Smolensky 1995) of two or more markedness constraints:

(2) CODACOND
 [NOCODA & *PLACE]_{seg}

A segment which is both in coda position and a bearer of place features will incur a violation of (2).

The alternative to positional markedness, within OT, is positional faithfulness (Selkirk 1994; Padgett 1995; Urbanczyk 1996; Beckman 1997, 1999; Casali 1997; Walker 1997;

Lombardi 1999,2001; Alderete 1999,2001). According to proponents of positional faithfulness, onset-coda asymmetries exist not because place features are prohibited in codas, but rather that they are preferentially preserved in onsets, and less zealously guarded in other positions. The key idea in positional faithfulness theory is the notion that phonological and morphological domains which are perceptually prominent in some sense are loci of enhanced faithfulness. Onsets are perceptually privileged by virtue of their release features. (This point was originally made, with respect to laryngeal features, by Kingston 1985, 1990; see also Steriade 1993 for related discussion of segmental release and its relevance to positional neutralization. Early works recognizing the importance of release in phonological representation include McCawley 1967 and Selkirk 1982). Much of the acoustic information that signals the presence of contrastive consonantal features such as laryngeal state and place of articulation is carried in the segmental offset. In coda position, where release bursts are typically absent, reliable cues to phonological contrast are dramatically reduced. This disparity in prominence translates, in positional faithfulness terms, to preferential faithfulness requirements for segments in onset position, but not for those in coda position. High-ranking onset faithfulness constraints permit a broad range of phonological contrasts in onset position, and they render onsets resistant to many phonological processes. Codas, lacking release, are accorded no special faithfulness properties; consequently, codas often display a reduced segmental inventory, relative to onsets, and often undergo assimilation. Onsets will be afforded a full range of place contrasts, in the positional faithfulness analysis, by virtue of ranking IDENT-ONSET(Place) above a constraint or constraints that penalize marked structure; codas exhibit a severely impoverished range of place contrasts because the same markedness constraint or constraints dominate IDENT(Place), the only constraint which evaluates the faithfulness of coda segments."

1.2. Positional Faithfulness and Positional Markedness: A Necessary Redundancy?

While IDENT-ONSET and CODACOND may appear to provide largely overlapping empirical coverage of onset-coda asymmetries, Lombardi (2001) argues that *both* are required to account for the range of repairs associated with place features. In particular, she takes the existence of languages in which epenthesis and place assimilation coexist as strategies for avoiding coda place of articulation as crucial evidence that the grammar must include CODACOND, arguing that positional faithfulness constraints alone cannot generate epenthesis.

Positional faithfulness, interacting with place markedness constraints (Prince & Smolensky 1993, 2002, Lombardi 2002), can successfully account for patterns of coda place neutralization and place assimilation, by virtue of ranking the place markedness subhierarchy between onset-specific and context-free faithfulness:

(3) IDENT-ONSET(Place)

An output segment in the onset of a syllable and the segment's input correspondent must have identical Place specifications.

(4) Coda neutralization ranking

IDENT-ONSET(Place) » *DORSAL, *LABIAL » *CORONAL » IDENT(Place)

Because onset faithfulness is ranked above the place markedness constraints, place contrasts in the onset are maintained. But the ranking of the generic faithfulness constraint below place markedness entails that place specifications *outside* of the onset will be unfaithfully rendered in outputs, instead neutralizing to the least-marked place of articulation:

(5) Neutralization to least marked

/bim/	ID-ONSET(Place)	*DORSAL	*LABIAL	*CORONAL	IDENT(Place)
a. bim			**!		
b. bin			*	*	*
c. din	*!			**	**

In this hypothetical example, we see that onset neutralization, as in (5c), is rendered impossible by high-ranking IDENT-ONSET(Place). The fully faithful (5a) fails on markedness grounds, leaving (5b), with coda neutralization to coronal place, as the optimal output.

Given a coda-onset cluster, rather than an isolated coda, the same constraint ranking will generate regressive assimilation, as illustrated below:

(6) Coda assimilation

/bimki/	ID-ONSET(Place)	*DORSAL	*LABIAL	*CORONAL	IDENT(Place)
a. bim.ki		*	**!		
b. bin.ki		*	*	*!	*
c. biŋ.ki		*	*		*
d. bim.pi	*!		**		*

Here, when there is a following onset whose place features are protected, the result is assimilation to the following onset (6c), rather than neutralization to the least marked place (6b).⁵ Note that progressive assimilation, as in (6d), is prevented by high-ranking IDENT-ONSET(Place). The pervasive preference for regressive, rather than progressive, assimilation in coda-onset pairings such as this is one of the strongest arguments in favor of positional faithfulness.

The general pattern of constraint interaction outlined in (5) and (6) will account for a variety of cases of coda neutralization and/or assimilation, including Lardil (Hale 1973,

Wilkinson 1988), Japanese (Itô 1986), Acehnese (Al-Ahmadi Al-Harbi 2003), and a host of examples cited in Lombardi (2001), as well as cases of place-driven segmental deletion (Lombardi 2001). However, as Lombardi points out, these constraints alone apparently will not cover cases in which coda place of articulation is avoided by means of epenthesis. Axininca Campa (Payne 1981; Yip 1983; Itô 1986, 1989; Spring 1990, 1994; Black 1991; McCarthy & Prince 1993a,b) is one case in which epenthesis is apparently used to avoid coda place of articulation.⁶

(7) Epenthesis in Axininca Campa

- a. /no-N-tʃ^hik-wai-i/ → [noñtʃ^hikawaiti] 'I will continue to cut'
- b. /no-N-tasonk-wai-i/ → [nontasonkawaiti] 'I will continue to fan'
- c. /i-N-kim-piro-i/ → [igkimapiroti] 'he will really hear'

In an OT analysis, epenthesis results when the faithfulness constraint DEP is crucially dominated by some markedness constraint which would be satisfied by the presence of a vowel. In the context of the positional faithfulness analysis of coda neutralization, the relevant markedness constraints would seem to be the place markedness constraints. However, Lombardi (2001) observes that simply adding DEP to the constraint hierarchy in (5)-(6) above will never produce epenthesis as an optimal output. Consider the scenario below (where place assimilation and segmental deletion are not viable repairs).

(8) Epenthesis fails

/...tʃ ^h ik-wai.../	ID-ONSET(Place)	*DORS	*LAB	*COR	ID(Place)	DEP
a. k.w		*	*			
b. ka.w		*	*			*!

We see in (8) that there is no ranking of DEP and the place markedness constraints that will ever result in (8b) being chosen over (8a). Because the violation marks incurred by (8a) are a subset of those incurred by (8b), (8a) will always be favored by a grammar consisting only of these constraints; no reranking of DEP with respect to these constraints can ever result in (8b) being optimal. Epenthesis does nothing to lessen place markedness, and it has the unhappy result of making the output form less faithful to its input correspondent.

The failure of epenthesis in this scenario leads Lombardi (2001) to assert that CODA_{COND} is a necessary supplement to positional faithfulness.' Because CODA_{COND} specifically targets place in coda position, this constraint can be satisfied by epenthesis:

(9) CODACOND can compel epenthesis

/kitik-men/	IDONS(Place)	*DORS	*LAB	*COR	ID(Place)	CODACOND	DEP
a. k.m		*	*			*!	
☞ b. ki.m		*	*				*

Provided that CODACOND outranks the anti-epenthesis constraint DEP, epenthesis is now a viable strategy for avoiding coda place of articulation.

The addition of CODACOND as a second means of addressing onset/coda asymmetries in the phonology of Place is troubling, however, as there are now two distinct devices that produce largely overlapping effects. Furthermore, each of these devices is apparently lacking in its ability to account for the phonology of Place. Positional faithfulness seemingly cannot generate epenthesis as a repair strategy. On the other hand, CODACOND alone cannot account for the regressive assimilation preference in cases where assimilation occurs, as shown in (10) below (repeating the hypothetical example from (6) above).⁸

(10) CODACOND does not distinguish direction of assimilation

lbimkil	CODACOND	IDENT(Place)
☞ a. biŋ.ki	✓	*
☞ b. bim.pi	✓	*

Given the standard assumption that linkage to the onset position is sufficient to achieve satisfaction of CODACOND, the candidates in (10) tie, making progressive assimilation appear to be a viable repair strategy. In order to make a decision here, we must appeal to some other constraint or constraints, but what will successfully militate in favor of (10a)? The place markedness constraints cannot be the decisive factor, as this would suggest that place assimilation should be driven by the least marked of the participating consonants, regardless of their positions. Manner-sensitive faithfulness (e.g., IDENT-OBSTRUENT(Place)) will not make the correct predictions, either, as it will predict different directions of assimilation, depending upon the relative positions of obstruent and sonorant consonants. (Furthermore, manner-sensitive faithfulness has nothing to contribute when the consonants in question are both obstruents, or both sonorants.) Positional faithfulness, as Padgett (1995) points out, provides a natural explanation for the directional bias of spreading in such instances.

Are we forced, then, to posit a grammar that contains both IDENTONSET(Place) and CODACOND, largely overlapping in their effects? In the remainder of this paper, I will argue, contra Lombardi (2001), that CODACOND is *not* a necessary part of the grammar of place-driven epenthesis. A careful examination of the coda neutralization and epenthesis facts of Tamil, in §II, shows that positional faithfulness constraints, interacting with independently motivated markedness (NOCODA, SYLLABLE CONTACT) and faithfulness (DEP, MAX) constraints, are fully

capable of generating epenthesis and coda place assimilation in the same grammar. The same result emerges in the analysis of Axininca Campa in §III. This is a classic TETU (McCarthy & Prince 1994) effect: when reduction of place markedness via assimilation would lead to the violation of higher-ranking constraints, these languages default to the unmarked open syllable structure, via epenthesis.

II. CASE STUDY: COLLOQUIAL TAMIL

11.1. Data and Generalizations

Before considering the details of the Tamil analysis, a few words regarding the language and the data sources are in order. The primary source of data and generalizations for recent work on Tamil phonology is Christdas (1988), who describes her own dialect, spoken in the Kanniyakumari district, at the southern edge of the Indian state of Tamilnadu. Christdas' data form the basis of the investigation of syllable structure conducted by Schafer (1993), and for a variety of studies conducted by Wiltshire (Bosch and Wiltshire, 1992; Wiltshire, 1992, 1995, 1998). Christdas' forms are supplemented in the latter cases by Wiltshire's field notes, in which data are drawn from Tamil speakers native to the central and northern regions of Tamilnadu.

Tamil, like many of the languages of India, has an elaborate consonant system in which many places of articulation are contrastive. The underlying consonant inventory, as described by Christdas (1988), is given in (11) below. Geminates (stops and non-rhotic sonorants) may also occur contrastively.

(11) Tamil consonant phonemes'

	<u>Labial</u>	<u>Dental</u>	<u>Alveolar</u>	<u>Retroflex</u>	<u>Palatal</u>	<u>Velar</u>
Stops	p	t̪	t	ʈ	tʃ dʒ	k
Fricatives			s	ʂ		
Nasals	m		n	ɳ	ɲ	ŋ
Laterals			l	ɭ		
Rhotics			r r̥	ɻ		
Approx.	u				j	

The surface inventory of segments in Tamil is somewhat more extensive. Although voicing is not contrastive in the language, voiced and partially voiced allophones of the obstruents do appear in surface representations. In general, the voiced continuant allophones of the stops appear intervocally, while the voiced stop allophones occur after a nasal. The surface inventory also includes palatalized velar sounds (represented here as post-palatal, in accord with Christdas' terminology), and dental nasals, which arise through place assimilation.

(12) Tamil surface consonants

	<u>Labial</u>	<u>Dental</u>	<u>Alveolar</u>	<u>Retroflex</u>	<u>Palatal</u>	<u>Post-Palatal</u>	<u>Velar</u>	<u>Glottal</u>
Stops	p b	t̪ d̪	t d	ʈ ɖ	tʃ dʒ	kʰ	k ɡ	ʔ
Fricatives	β	ð	s	ʂ		ç	x	
Nasals	m	ɳ	n	ɳ	ɲ		ŋ	
Laterals		l	ɭ	ɭ				
Rhotics			r r̥	ɻ				
Approx.	w u							ɻ

The vowel system of Tamil is relatively simple; there are five underlying vowel qualities, each of which may be long or short. The relative tenseness of the mid vowels varies with length.¹⁰

(13) Tamil vowels

	<u>Front</u>	<u>Back</u>
High:	i, ii	u, uu
Mid:	e, ee	o, oo
Low:		a, aa

In non-initial syllables, short /i/ and /u/ are pronounced as [i] and [u], respectively; short /a/ is realized as [ɛ], described by Christdas (1988:176) as fronted and non-low.

Tamil permits a wide range of possible syllable shapes, ranging from a simple CV to the superheavy CVVC, CVCC, and CVVCC. Onsets are required, and are never complex; outside of the root-initial syllable, codas, when they occur, are limited to a single segment." The identity of this single segment is extremely limited —Tamil employs various means of avoiding the syllabification of a coda consonant with an independent place of articulation. If C, in a C₁C₂ cluster is a sonorant, place assimilation is the favored strategy by which coda place is avoided. For example, if a nasal segment abuts a non-nasal by virtue of morpheme concatenation or compounding, the nasal assimilates in place of articulation; morpheme-internally, there are no heterorganic nasal + consonant sequences outside of the initial syllable.

(14) Nasal place assimilation

/maram + ka/	[marɛŋgɔ]	'trees'(PC:192)
/maram + taan/	[marɛŋd̪ā]	'tree (emphatic)'
/pasaŋ + ka/	[pasɛŋgɔ]	'children'(CW)
/maram # koʈti/	[marɛŋkoʈti]	'woodpecker'(PC:193)
/koʈam # toŋɳi/	[koʈɛŋtoŋɳi]	'tool for dredging ponds'(PC:192)

Laterals must undergo place assimilation when they precede a coronal obstruent (15). When the following segment is a non-coronal obstruent, epenthesis of [ʋ] occurs (16).¹²

- (15) Laterals undergo place assimilation when possible (Christdas, 1988: 319)
- | | | |
|-----------------|-------------|---------------------|
| /ʋajal + taan/ | [ʋajɜlɖãã] | 'field (emphatic)' |
| /kappal + taan/ | [kappɜlɖãã] | 'ship (emphatic)' |
| /paɪil + daan/ | [paɪɪlɖãã] | 'answer (emphatic)' |
- (16) No assimilation to non-coronal segments (Christdas, 1988: 319, 331)
- | | | |
|----------------|-------------|-------------------|
| /ʋajal + kal/ | [ʋajɜlʋkɜ] | 'fields' |
| /kappal + kal/ | [kappɜlʋkɜ] | 'ships' |
| /paɪil + kk/ | [paɪɪlʋkkɜ] | 'answer (dative)' |
| /pajir + kal/ | [pajɪrʋkɜ] | 'crops' |
| /poɖar + kal/ | [pɔɖɜrʋkɜ] | 'bushes' |
| /tamiɪ + kk/ | [tamiɪʋkkɜ] | 'Tamil (dative)' |

Epenthesis is also obligatory when rhotics concatenate with other consonants; they never assimilate, even to coronals, and generally cannot participate in linked structures (Christdas, 1988: 265).

Finally, underlying obstruent+obstruent clusters are resolved via epenthesis; assimilation or segmental deletion are not possible repairs. Some examples are given in (17).

- (17) Epenthesis in obstruent + obstruent clusters (Christdas, 1988: 289,302,306)
- | | | |
|---------------|--------------|------------------|
| /kaaɖ + kal/ | [kaaɖʋkɜ] | 'ears' |
| /kaaɖ + kk/ | [kaaɖʋkkɜ] | 'ear (dative)' |
| /kamp + kal/ | [kambiʋkɜ] | 'sticks' |
| /kamp + kk/ | [kambʋkkɜ] | 'stick (dative)' |
| /paɪɪ + kal/ | [paɪɪʋkɜ] | 'balls' |
| /paɪɪ + kkl/ | [paɪɪʋkkɜ] | 'ball (dative)' |
| /kajat + kal/ | [kajɜrʋkɜ] | 'ropes' |
| /kajat + kk/ | [kajɜttʋkkɜ] | 'rope (dative)' |
| /kaɖap + kal/ | [kaɖɜʋkɜ] | 'doors' |
| /kaɖap + kk/ | [kaɖɜʋkkɜ] | 'door (dative)' |

There are no morpheme-internal clusters of obstruents that are not geminates.

For convenience, the strategies employed in resolving illicit C₁C₂ sequences are summarized in (18) below. With this outline of the relevant generalizations in hand, we can now turn to the positional faithfulness analysis of the onset/coda asymmetry in Tamil.

(18) Summary: Syllabifying illicit consonant clusters.

C ₁	C ₂	Result	Example
Nasal	Obstr.	Place assimilation	/maram + ka/ → marəŋgə
Lateral	Coronal obstr.	Place assimilation	/vajal + taan/ → vajəɽdāā
Lateral	Non-coronal obstr.	Epenthesis	/vajal + ka/ → vajəɽlukə
Rhotic	Any consonant	Epenthesis	/pajir + taan/ → pajirudāā
Any obstruent	Any consonant	Epenthesis	/kaaɽ + ka/ → kaaɽuxə

11.2. Analysis

As the data above demonstrate, Tamil syllables display a seemingly classic "Coda Condition" pattern of behavior. When possible, coda place of articulation is parasitic on a following onset, and, when impossible, coda syllabification is avoided altogether. In positional faithfulness terms, however, this pattern reflects not an overt prohibition on coda Place, but rather the low priority given to place faithfulness outside of the onset position. When a markedness constraint (or constraints) intervenes between the positional and context-free faithfulness constraints, as in (19), neutralization outside of the privileged context is the result.

(19) Positional neutralization of Place in Tamil codas, non-initial
 IDENT-ONSET(Place) » *LABIAL, *DORSAL » *CORONAL » IDENT(Place)¹³

This ranking will account for the assimilatory behavior of nasals and laterals in non-initial codas. Coda consonants assimilate to the place of articulation of a following onset consonant because *LABIAL, *DORSAL » *CORONAL » IDENT(Place); reduction of output place specifications (and thus, place markedness) is more harmonic than complete faithfulness to input values. By contrast, onsets trigger spreading (rather than undergoing it) because of the ranking IDENT-ONSET(Place) » *LABIAL, *DORSAL » *CORONAL. Faithfulness to onset place specifications is paramount, and takes precedence over the imperative to minimize place specifications in the output.

Through ranking, the constraint subhierarchy in (19) will interact with the other faithfulness and markedness constraints responsible for syllable wellformedness in Tamil: MAX, DEP, NOCODA and the Syllable Contact Law. Crucially, though NOCODA is dominated by place markedness in the grammar of Tamil, its effects emerge, in the form of epenthesis, just when place assimilation is rendered impossible by higher-ranking constraints.

To illustrate this result, we must first develop the basic analysis of coda place assimilation ((14)-(16) above). Nasal + obstruent clusters which span non-initial syllables are always homorganic, whether hetero- or tautomorphic. One point is obvious from the Tamil data above: NOCODA, which favors open CV syllables, must be dominated by MAX, the anti-deletion constraint. Segments are not simply deleted in order to avoid a NOCODA violation; closed syllables occur quite regularly in the language. This is illustrated in (20).

(20) MAX » NoCODA

/pasəŋ + ka/	MAX	NoCODA
☞ a. pa.səŋ.gə		
b. pa.sə.xə	*!	

The actually occurring (20a) incurs a violation of NoCODA, but this violation is rendered irrelevant by the dominant MAX. The opposite ranking would favor **uniformly** open syllables, incorrectly ruling out **all** coda consonants.

The pair of candidates in (20) provides evidence for an additional ranking: MAX » IDENT(Place). Place assimilation is preferred to segmental deletion.

(21) MAX » IDENT(Place)

/pasəŋ + ka/	MAX	IDENT(Place)
☞ a. pa.səŋ.gə		*
b. pa.sə.xə	*!	

The actual surface form violates IDENT(Place), a constraint which is satisfied by candidate (21b). The IDENT(Place) violation does not matter, however, due to high-ranking MAX; (21a) is optimal. (Having established that MAX is high-ranking, I will henceforth, in the interest of simplicity, restrict the candidates under consideration to those which satisfy the constraint).

An important question has yet to be answered: Why is (21a), *pa.səŋ.gə*, preferred to a candidate *pa.səŋ.gə* which satisfies both MAX and IDENT(Place)? The answer actually lies in the constraint subhierarchy given in (19) above; the place markedness constraints, which **dominate** IDENT(Place), are sufficient to enforce minimization of place features, via place assimilation.

Proceeding in step-wise fashion, let us begin at the bottom of the Tamil constraint subhierarchy. The **dominance** of the place markedness constraints over IDENT(Place) will favor place-sharing between coda and onset. Consider the candidates in tableau (22) below. (Hereafter, violations of the place markedness constraints will be indicated by the segment whose feature(s) violate the constraints, to aid in reading the tableaux.)

(22) *LABIAL, *DORSAL » *CORONAL » IDENT(Place)

/pasəŋ + ka/	*LAB	*DORS	*COR	IDENT(Place)
☞ a. pa.səŋ.gə	p	ŋg	s	*
b. pa.səŋ.gə	p	g	s, ŋ!	

Each independent place specification receives one violation mark for the relevant *PLACE constraint. Therefore, the independent coronal place of articulation of the coda consonant in the fully faithful (22b) incurs a fatal violation of *CORONAL. The place assimilation in (22a) avoids this violation, by reducing the Coronal, Dorsal sequence of input /ŋk/ to a single output Dorsal

specification. The IDENT(Place) violation which results from place assimilation is irrelevant, due to the subordination of this constraint to the place markedness subhierarchy.

As (22) shows, the ranking of *DORSAL, *LABIAL » *CORONAL » IDENT(Place) favors assimilation, rather than a faithful output rendering of all input places. However, the ranking in (22) does not successfully select between the actual surface form (25a) and another possible alternative, *pa.sɔŋ.ɖɔ*. In this candidate, place assimilation results in removal of an offending *DORSAL violation, in favor of a less-marked Coronal cluster. Such a candidate would be favored by the ranking in (22), but it is not the actually occurring form.

The forms in question, *pa.sɔŋ.gɔ* (22a) and *pa.sɔŋ.ɖɔ*, both exhibit nasal place assimilation, but they differ in the direction of assimilation. In the actual Tamil form, *pa.sɔŋ.gɔ*, a coda consonant assimilates to the following onset; in the unattested *pa.sɔŋ.ɖɔ*, the onset assimilates to the preceding coda. It is the subordination of the onset's place features to those of the preceding coda in *pa.sɔŋ.ɖɔ* which is fatal to such a candidate. Padgett (1995) reminds us that place assimilations typically proceed from onset to coda; the features of the released segment are preferentially maintained in output forms. In the theory of positional faithfulness, this finding is incorporated naturally: onset features are preserved, by virtue of high-ranking IDENT-ONSET(Place). As Padgett (1995) observes, the direction of spreading, from onset to coda, is a natural consequence of the faithfulness asymmetry between onsets and codas, and need not be stipulated independently.

IDENT-ONSET(Place), ranked above the place markedness subhierarchy, accounts for the optimality of (22a) (as well as the non-optimality of a maximally unmarked candidate such as *ta.sɔŋ.ɖɔ*, which contains only coronal consonants).

(23) IDENT-ONSET(Place) » *LABIAL, *DORSAL » *CORONAL » IDENT(Place)

/pasaŋ + ka/	ID-ONSET(Place)	*LAB	*DORS	*COR	IDENT(Place)
a. pa.sɔŋ.gɔ		p	ŋg	s	*
b. pa.sɔŋ.ɖɔ	*!	p		s, ŋɖ	*
c. ta.sɔŋ.ɖɔ	**!			t, s, ŋɖ	**

High-ranking IDENT-ONSET prevents wholesale changes in onset place of articulation, initiated in the interest of minimizing markedness, as in (23c). More to the point, it also prevents the coda-to-onset assimilation of (23b). The ranking in (23) has the result that only coda segments may undergo assimilation, as in (23a). It should be clear from the preceding discussion that the ranking in (23) will compel place-sharing for any nasal+obstruent cluster, regardless of the nasal's input place specification. Thus, we see that nasal place assimilation can easily be generated in Tamil without any reference to CODA COND.

However, thus far, we have not addressed an important question: What is the relative ranking of the anti-epenthesis constraint DEP and the constraint subhierarchy illustrated in (23)? The answer cannot be determined by examining nasal codas. Comparing a hypothetical candidate such as *pa.sɔ.ŋu.xɔ*, where epenthesis occurs, with the actual output form (23a), there is no valid ranking argument to be drawn. The epenthesis candidate incurs two constraint violations that the real output form does not. This is shown in (24), where DEP is arbitrarily displayed in the ranking.

(24) No ranking of DEP and *LABIAL, *DORSAL » *CORONAL possible

/pasan + ka/	DEP	*LAB	*DORS	*COR	IDENT(Place)
a. pa.sɔŋ.gɔ		p	ŋg	s	*
b. pa.sɔ.ŋu.xɔ	*	p	x	s, ŋ	

Even if DEP were dominated by the place markedness subhierarchy, the additional *CORONAL violation incurred by (24b) would be fatal. In order to determine the ranking of DEP, we must turn our attention to the behavior of lateral and obstruent segments.

Recall that the laterals assimilate to following coronal obstruents, but not to other places of articulation. This selective assimilation can be attributed to high-ranking feature cooccurrence constraints. In Tamil, as in most languages of the world, non-coronal laterals are not permitted.¹⁴ This restriction on the inventory of segments can be enforced by the constraints LATCOR and IDENT(lateral) in (25) below.

- (25) LATCOR
 [lateral] → [Coronal]
 Lateral segments must be Coronal.¹⁵

IDENT(lateral)

An input segment and its output correspondent must agree in their specification of the feature [lateral].

LATCOR and IDENT(lateral) must dominate all of the place faithfulness constraints, including IDENT-ONSET(Place), in order to ensure that an input velar lateral is mapped on to an output coronal lateral, regardless of the underlying place of articulation. By transitivity of ranking, LATCOR also dominates the place markedness subhierarchy. This will prevent place assimilation to a non-coronal obstruent, as shown in (26) below for the input /vajal + ka/, 'fields' (here "L" represents a velar lateral).

(26) Assimilation to a non-coronal is prohibited

/vajal + ka/	LATCOR	IDENT (lat)	ID-ONS (Place)	*LAB, *DORS	*COR	IDENT (Place)
● a. va.jɔl.gɔ				v, g	j, l	
b. va.jɔL.gɔ	*!			v, Lg	j	*
c. va.jɔl.dɔ			*!	v	j, ld	*
d. va.jɔŋ.gɔ		*!		v, ŋg	j	*

Each of candidates (26b-d) is ruled out by a high-ranking constraint, predicting that (26a) should be the optimal form. However, (26a) is not the actually occurring surface form in this case. Rather, epenthesis occurs, yielding *v.jɔ.lu.xɔ*. This candidate and (26a) fare equally well with respect to the place markedness subhierarchy, but differ with respect to two other constraints:

NOCODA and DEP. The relevant violations are shown in the chart in (27) below.

(27) NOCODA is relevant in selecting the optimal candidate

Candidate	*DORS	*LAB	*COR	NOCODA	DEP
va.jɜ.l.gɜ	g	ʋ	j, l	*	
va.jɜ.luɪ.xɜ	x	ʋ	j, l		*

The two candidates tie on each of the *PLACE constraints, making these constraints irrelevant to the choice of the optimal candidate. This leaves NOCODA and DEP, and here there is a clear ranking argument to be made: NOCODA » DEP. When high-ranking LATCOR and IDENT-ONSET(Place) conspire to prevent place assimilation, as in the case at hand, epenthesis is the result —though CODACOND has not been recruited to achieve this effect. Insertion of non-underlying material is tolerated in order to achieve less marked syllable structure. (Note that the relative ranking of NOCODA and DEP with respect to the place markedness subhierarchy cannot, as yet, be determined.)

The preceding discussion has demonstrated that epenthesis is preferred when place assimilation cannot occur. However, the constraint hierarchy in (26) does correctly allow for place assimilation when a sequence of lateral+coronal obstruent occurs in the input. This case will also provide an argument for the ranking of NOCODA with respect to the place markedness subhierarchy: NOCODA must be dominated by *CORONAL, and by transitivity of ranking, by *LABIAL and *DORSAL. The reduction of place markedness via multiple linking takes precedence over the achievement of open syllables. Because epenthesis does not reduce place markedness, it is dispreferred when place assimilation is possible, *even though the anti-epenthesis constraint DEP is ranked below NOCODA*. This is shown in (28) below.

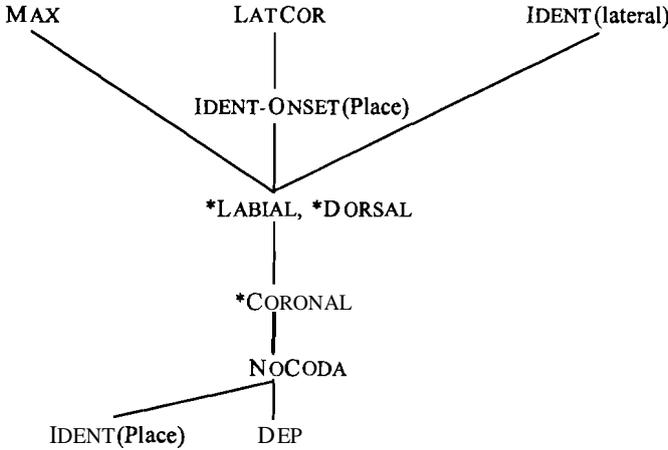
(28) Assimilation to a coronal obstruent is required

/vajaɪ + ʈaan/	LAT COR	IDENT- ONSET	*LABIAL, *DORSAL	*CORONAL	NO CODA	DEP	IDENT (Place)
a. va.jɜ.l.ɖãã			ʋ	j, l, ɖ	*		
b. va.jɜ.luɪ.ɖãã			ʋ	j, l, ɖ!		*	

Candidate (28b) fares better on NOCODA than (28a), but worse on *CORONAL. The optimality of (28a) indicates that *CORONAL » NOCODA.

Thus far, the analysis has accounted for the behavior of nasals and laterals which are followed by obstruents in the input. (The rhotics and the sonorants and *j* never assimilate to a following obstruent, probably due to a combination of restrictions on place/stricture, multiple linking and syllable contact interactions. See Padgett (1991) for relevant discussion). The following ranking relationships have been established:

(29) Interim ranking summary



Now we turn our attention to C_1C_2 sequences in which the segments are of equal or rising sonority; that is, sequences of two obstruents, two sonorants, or an obstruent followed by a sonorant. Such sequences can never be syllabified as coda and onset, regardless of their place of articulation; even homorganic clusters such as *nl*, *ŋl*, etc. cannot be successfully syllabified. Christdas (1988: 225-229) reasonably attributes this gap in the inventory of coda-onset sequences to the Syllable Contact Law (Hooper, 1976; Murray & Vennemann, 1983; Clements, 1990). A formulation is provided in (30) below.¹⁶

(30) SYLLABLE CONTACT LAW (SCL)

In a sequence $VC_1.C_2V$, the sonority value of $C_1 >$ the sonority value of C_2 .

I will adopt (30), with the additional provision that sequences of consonantal root nodes are the relevant units over which SCL is evaluated. Geminate, which I assume are underlyingly moraic consonants with a single root node, vacuously satisfy SCL.¹⁷

In Tamil, SCL is never violated; the constraint must enter the realm of the high-ranking, along with MAX, LATCOR and IDENT(lateral). Crucially, SCL dominates both the *PLACE subhierarchy and DEP, and is dominated by MAX. Such a ranking will force epenthesis, rather than deletion, as a means of satisfying SCL, even at the expense of the *PLACE constraints. This will account for data such as those in (17) above, in which underlying obstruent sequences are split by an epenthetic vowel in surface forms. This is illustrated in tableau (31) below.

(31) Epenthesis in obstruent+obstruent sequences

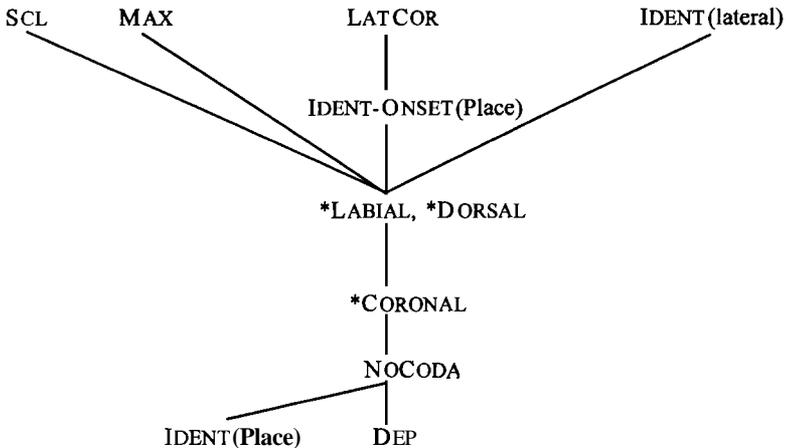
/kaʃap+ka/	MAX	SCL	ID-ONS	*LAB, *DORS	*COR	NO CODA	DEP	ID(Place)
☞ a.ka.ʃa.ʋʋ.xʒ				k, ʋ, x	d		*	
b.ka.ʃap.kʒ		*!		k, p, k	d	*		
c.ka.ʃa.xʒ	*!			k, x	d			

SCL and MAX correctly favor (31a) over the candidates in (31b,c).¹⁸ Here, again, we see that epenthesis is a legitimate outcome of consonant contact in Tamil, though CODACOND is nowhere in evidence.

11.3. Conclusion

To sum up the results of this section, I have shown that the prohibition on independent place specifications in coda position results from the asymmetry between onset and coda faithfulness, which are separately assessed via IDENT-ONSET(Place) and IDENT(Place). Place assimilation derives from the ranking of the place markedness subhierarchy above IDENT(Place). *PLACE » IDENT(Place) yields place assimilation whenever possible; that is, when neither LATCOR nor SCL is violated. The high-ranking positional faithfulness constraint IDENT-ONSET(Place) favors maintenance of contrastive information in onset position, meaning that codas are the targets (rather than the triggers) of place assimilation in such circumstances. Finally, under domination of MAX and SCL, the ranking *LABIAL, *DORSAL » *CORONAL » DEP will result in epenthesis when assimilation is blocked. The final ranking summary is shown in (32) below.

(32) Final ranking summary



This set of constraints, crucially incorporating the positional faithfulness constraint, IDENT-ONSET(Place), is responsible for the patterns of coda assimilation and epenthesis which characterize non-initial syllables in Tamil. The place markedness constraints all dominate generic IDENT(Place), meaning that minimization of place markedness is paramount —wherever possible, place assimilation occurs. When place assimilation is impossible as a means of better satisfying the place markedness constraints, epenthesis is the chosen repair strategy, leading to an emergence of the unmarked CV syllable structure. In the next section, I will show that a parallel result obtains in Axininca Campa, where open syllables again emergence under duress from undominated constraints that block place assimilation as a possible repair strategy.

III. CASE STUDY: AXININCA CAMPA

That epenthesis and coda place assimilation peacefully coexist in Tamil, and can both be generated without reference to the Coda Condition, casts doubt on Lombardi's (2001) claim that CODA COND, along with IDENT-ONSET(Place), is an essential part of the grammar of place neutralization. The Tamil evidence shows us that a variety of constraints in the grammar may conspire to achieve effects that have been attributed to CODA COND. Specifically, although the place markedness constraints alone favor coda place assimilation, rather than coda-avoiding epenthesis, the effects of these constraints can be overridden by higher-ranking constraints. In Tamil, those overriding constraints take the form of segmental (LATCOR) and syllabic (SCL) well-formedness constraints. In other languages, the constraints that lead to epenthesis may be different —but the ultimate effect will be the same.

Consider the well-known example of Axininca Campa (Payne 1981; Yip 1983; Itô 1986, 1989; Spring 1990, 1994; Black 1991; McCarthy & Prince 1993a,b). Morpheme-internally, and between prefix and root, nasals agree in place of articulation with a following stop or affricate.¹⁹

- (33) Agreement in NC clusters
- | | | | |
|----|--------------------------|------------------|-----------------|
| a. | [igkomati] | 'he will paddle' | /i-N-koma-i/ |
| b. | [iŋtʰiki] | 'he will cut' | /i-N-tʰik-i/ |
| c. | [impisiti] | 'he will sweep' | /i-N-pisi-i/ |
| d. | [nontasogki] | 'I will fan' | /no-N-tasɔŋk-i/ |
| e. | [igki] | 'peanut' | |
| f. | [-aantsh ^h i] | 'INF' | |
| g. | [sampaa] | 'balsa' | |

Between a root and a following suffix, however, nasal place assimilation does not occur. Rather, there is epenthesis of [a] to break up the consonant cluster:

- (34) Epenthesis between root and suffix
- | | | | |
|----|--------------------------|--------------------------|--------------------------|
| a. | [noŋtʰikawaiti] | 'I will continue to cut' | /no-N-tʰik-wai-i/ |
| b. | [nontasogkawaiti] | 'I will continue to fan' | /no-N-tasɔŋk-wai-i/ |
| c. | [igkimapiroti] | 'he will really hear' | /i-N-kim-piro-i/ |
| d. | [manapit ^h a] | 'hide (referential)' | /man-pit ^h a/ |

The key question, for any analysis of Axininca Campa onset/coda asymmetries, is why is place assimilation ruled out at a root-suffix juncture, but permitted elsewhere? That is, why do (34c,d) differ from the data in (33)?²⁰ The answer can be found in the prosodic morphology system of the language: suffixes must attach, whenever possible, to a Prosodic Word (McCarthy & Prince 1993a,b), and Prosodic Words must be crisp (in the sense of Itô & Mester 1994). CODACOND plays no role in the analysis.²¹

Consider first the analysis of nasal place assimilation in Axininca Campa. As we have seen, coda place assimilation will result from the constraint ranking in (35):

(35) IDENT-ONSET(Place) » *DORSAL, *LABIAL » *CORONAL » IDENT(Place), NOCODA » DEP

As in Tamil, NOCODA must be ranked below the *PLACE constraints, in order to ensure that codas are permitted, just in case they succeed in reducing place markedness. As in Tamil, MAX » NOCODA » DEP, ensuring that epenthesis will result when place markedness cannot, for some reason, be reduced. This ranking, with one important amendment, will account for the morpheme-internal and prefix-root phenomena in Axininca. In order to guarantee that the nasals will actually surface with place specifications, HAVEPLACE (Itô & Mester 1993, Padgett 1995, Walker 1998, Lombardi 1999; c.f. Parker 2001) must also be high-ranking:²²

(36) HAVEPLACE

$\forall x$, where x is an output segment, $\exists y$ such that $y \in \text{Place}$ and x dominates y .

“An output segment must have a Place specification.”

HAVEPLACE interacts with the ranking in (35) to generate nasal place assimilation between prefix and root, as shown in (37).

(37) Prefix-root juncture

/no+N+kim+i/	HAVEPLACE	*LAB, *DORS	*COR	IDENT(Place)	NOCODA	DEP
a. noN.kimi	*!	k, m	n		*	
b. noŋ.kimi		ŋk, m	n	*	*	
c. non.kimi		k, m	n, n!	*	*	
d. nonakimi		k, m	n, n!	*		*

Given the ranking of HAVEPLACE and the place markedness constraints above IDENT(Place), and the low rank of NOCODA, assimilation of the nasal (37b) is the favored outcome —this is true even if the insertion of place features on an underlyingly placeless segment does not incur faithfulness violations, contra the violation marks in (37). Note that epenthesis, as in (37d), is

ruled out here by the place markedness constraints, no matter where DEP is ranked. Just as Lombardi (2001) asserts, epenthesis is not a possible repair strategy if NOCODA violations are tolerated in the language *and only the place markedness and faithfulness constraints are considered*. This result will hold, even morpheme-internally (38), and even if the input nasal in question is place-ful, rather than placeless (39).

(38) Place assimilation occurs morpheme-internally

/iit ^h oNki/ 'climb'	HAVEPLACE	*LAB, *DORS	*COR	IDENT(Place)	NOCODA	DEP
a. iit ^h oN.ki	*!	k	t ^h	*	*	*
b. iit ^h oŋ.ki		ŋk	t ^h	*	*	*
c. iit ^h oN.ki		k	t ^h , n!	*	*	*
d. iit ^h oNaki		k	t ^h , n!	*	*	*

(39) Assimilation occurs with fully specified input place

/iit ^h oNki/ 'climb'	ID-ONS(Place)	*LAB, *DORS	*COR	IDENT(Place)	NOCODA	DEP
a. iit ^h oN.ki		k	t ^h , n!	*	*	*
b. iit ^h oŋ.ki		ŋk	t ^h	*	*	*
c. iit ^h oN.ti	*!		t ^h , nt	*	*	*
d. iit ^h oNaki		k	t ^h , n!	*	*	*

In both instances, the place of the nasal coda consonant is parasitic on that of the following onset, achieving the best possible satisfaction of the place markedness constraints, HAVEPLACE, and IDENT-ONSET(Place), at the expense of NOCODA.

The apparent problem that arises, in light of this preference for multiple linking, is the failure of multiple linking in the context of a root-suffix boundary. The rankings above predict that place assimilation should occur here, as well.

(40) No epenthesis

/...kim+piro.../	ID-ONS(Place)	*LAB, *DORS	*COR	IDENT(Place)	NOCODA	DEP
a. kim.piro		k, mp	r	*	*	*
b. kimapiro		k, m, p!	r	*	*	*

We know, given the occurrence of nasal codas in other contexts, that NOCODA must be ranked below place markedness. With this ranking, however, there is no possible ranking of DEP with respect to the other constraints that will succeed in selecting (40b) as the optimal candidate — yet (40b) is the correct surface form.

The success of epenthesis here, and the failure of nasal place assimilation, arises from the prosodic morphological requirements of Axininca Campa. As McCarthy & Prince (1993a,b) demonstrate at length, suffixes in Axininca Campa subcategorize for a PrWd base." This requirement is implemented in McCarthy & Prince (1993a) with the following Alignment constraint:

- (41) ALIGN-SFX
 ALIGN(Suffix, L, PrWd, R)
 "The left edge of every suffix coincides with the right edge of some PrWd."

ALIGN-SFX dominates DEP, resulting in augmentative epenthesis when a subminimal root is combined with a consonant-initial suffix. This is shown in (42), where the PrWd boundary is marked with "j".

(42) ALIGN-SFX drives augmentation

/na-piro/	FTBIN	ALIGN-SFX	DEP
a. na]piro	*!		
b. nata]piro			**
c. napiro		*!	

Only (42b) can satisfy both requirements on prosodic word wellformedness (FTBIN) and affixal subcategorization requirements (ALIGN-SFX).²⁴

Suffixation in Axininca Campa is subject to an additional requirement: the Prosodic Word to which a suffix attaches must be crisp, in the sense of Itô & Mester's revision of Generalized Alignment (Itô & Mester 1994). Itô & Mester identify several formal problems with a formalization of Alignment that penalizes cases of multiple linking across a category boundary as instances of misalignment. They suggest that Alignment be defined in terms of a "relation which traces downwards from a category to the terminal string and finds the category's contents. This relation will take the place of the 'is u' relation which traces upwards from a terminal substring towards a category and requires uniqueness of the higher category" (Itô & Mester 1994: 37). The upshot is that Alignment may be satisfied by the presence of the specified entity standing at the specified edge of a category, even if the entity in question is not uniquely linked to the dominant category.

Itô & Mester (1994) propose that the unique linkage aspect of the problem be parceled out to a different constraint, CRISPEGE.

- (43) CRISPEGE[PCat]
 Let A be a terminal (sub)string in a phonological representation, C a category of type PCat, and A *be-the-content-of* C. Then C is crisp (or: *has crisp edges*) if and only if A *is-a* PCat.

Here the upwards-tracing *is-u* relation *does* come into play; CRISPEDGE will be violated whenever segments or features are linked across a PCat boundary, such that they are not uniquely identified with a single PCat. Itô & Mester suggest that every prosodic category is governed by a CRISPEDGE constraint. CRISPEDGE[σ], for example, is violated by geminates and other structures linked across a syllable boundary; CRISPEDGE[Ft] can be seen as limiting ambisyllabicity in English to foot-internal positions (Itô & Mester 1994:38).

In Axininca Campa, CRISPEDGE[PrWd] acts to rule out any multiple linking across the PrWd boundary.

- (44) CRISPEDGE[PrWd]
A PrWd must be crisp.

High-ranking ALIGN-SFX requires that the suffix attach to a PrWd base whenever possible, and CRISPEDGE[PrWd] prevents that PrWd from being non-crisp. The only way to satisfy both requirements, while minimizing place markedness, is via epenthesis. This is shown in (45) below.

(45) CRISPEDGE forces epenthesis

/i-N-kim-piro-i/	CRISP [PRWD]	ALIGN- SFX	*LAB, *DORS	*COR	IDENT (Place)	NOCODA	DEP
a. kim].piro ∨ Lab	*!		k, mp	r		*	
b. kim].piro			k, m, p	r		*!	
c. kima].piro			k, m, p	r			*
d. kim.piro		*!	k, mp	r		*	

Here we need to compare the victorious, epenthizing candidate (45c) with two ALIGN-SFX satisfying competitors. (45d), which violates ALIGN-SFX by failing to parse the base as a PrWd, is provided for illustrative purposes, but cannot win, given that an Aligning alternative is available.) In (45a), we see multiple linking of place features across the PrWd boundary; this minimizes place markedness, but runs afoul of CRISPEDGE. More interesting is (45b), in which no multiple linking takes place. CRISPEDGE is satisfied by this candidate, which ties with (45c) in terms of place markedness—but (45b) ultimately fails on syllable structure grounds.

Just as in Tamil, when multiple linking of place features is not available as a means of minimizing place markedness, open syllable structure, satisfying NOCODA, is the optimal choice. In Tamil, the constraints that prevent multiple linking are LATCOR, IDENT(lateral) and the Syllable Contact Law; in Axininca Campa, it is CRISPEDGE[PrWd] and ALIGN-SFX that lead to this result. The effects in both languages are the same: epenthesis and coda place assimilation coexist as optimal outcomes, though CODA_{COND} is nowhere in sight.

IV. CONCLUSION

In Optimality Theory, two competing, but largely overlapping, approaches have been posited to account for onset/coda asymmetries in the distribution of place features. Both IDENTONSET(Place) and CODACOND can produce a limited occurrence of place features in syllable coda position, favoring parasitic linking to an onset position when assimilation is possible. Padgett (1995), Beckman (1999), and Lombardi (1999, 2001) argue that positional faithfulness is necessary to account for the pervasive preference for regressive assimilation in such coda-onset clusters. CODACOND alone does not distinguish between progressive and regressive assimilation as possible repair strategies, predicting that both should be possible ((46), repeated from (10) above), yet progressive assimilation is rarely, if ever, attested.²⁵

(46) CODACOND predicts progressive assimilation

/bimki/	CODACOND	IDENT(Place)
மீர் a. biŋ.ki	✓	*
மீர் b. bim.pi	✓	*

Without IDENT-ONSET(Place) in the grammar, there is no explanation for the fact that the configuration in (46a) is the universally preferred outcome.

Conversely, Lombardi (2001) has argued that CODACOND is necessarily included in the repertoire of constraints provided by the grammar, because IDENT-ONSET(Place) alone cannot generate place-driven epenthesis processes. As we have seen, however, this assertion is not correct. Both Tamil and Axininca Campa demonstrate that epenthesis can emerge as a repair strategy—even with the complete absence of CODACOND—due to the influence of low-ranking NOCODA, a constraint for which there is abundant independent motivation (c.f. Prince & Smolensky 1993:2002).

The data from onset/coda asymmetries, therefore, provide no motivation for the inclusion of CODACOND in the inventory of OT constraints; positional faithfulness yields the same empirical coverage, with the added advantage of accounting for the directional bias in assimilation. Occam's Razor favors the simplest possible grammar consistent with range of data attested in natural language. In this case, the grammar which contains IDENT-ONSET, but not CODACOND. The extent to which this positional faithfulness/positional markedness redundancy can be eliminated in the treatment of other positional phonological asymmetries remains an important question for future research.

Acknowledgements

My thanks to Karen Baertsch, Stuart Davis, John McCarthy, Jaye Padgett, Cathie Ringen, two anonymous reviewers, and audiences at MCWOP 9, the 2004 meeting of the Linguistic Society of America, and the 12th Manchester Phonology Meeting for helpful discussion of the material.

NOTES

1. See also Yip (1991), where the negative licensing formulation of the Coda Condition is supplemented with a constraint against multiple place specifications in consonant clusters. Related OT proposals may be found in Stenade (1997) and Zoll (1998).

2. See also the positive licensing formulation of laryngeal constraints in Lombardi (1991).

3. Here I ignore the question of how exactly this result is achieved by different implementations of coda licensing. Though interesting, these issues are tangential to the point at hand.

4. See Jun (1995), Padgett (1995), Lombardi (1999) and Petrova, Plapp, Ringen & Szentgyörgyi (2000) for representative Optimality Theoretic applications of positional faithfulness to coda assimilation and neutralization. The issue of onset resistance to neutralization is a complex one; much evidence suggests that at least some "coda" neutralization phenomena are sensitive to phonetic cues, rather than syllable position (Steriade 1997). Two alternative positional faithfulness proposals which make use of cues, rather than syllabification, are Padgett's (1995) FAITH_{RELEASE} and the IDENT-PRESONORANT constraints of Petrova *et al.* As Petrova *et al.*, note, however, there are some cases (Dutch being one example) in which presonorant or release position alone is not a sufficient predictor of resistance to neutralization: onset syllabification is also required. I retain IDENT-ONSET here largely for simplicity's sake, and because, in the cases that I consider, onsets are simple, meaning that all onset segments are also presonorant, and therefore, released.

5. See also Padgett (1995), who provides evidence for a separate constraint, SPREAD(Place), that is active in at least some cases of nasal place assimilation, particularly those in which complex segments are participating in the assimilation process. While SPREAD(Place) does appear to be necessary in some cases of place assimilation, there are many circumstances (such as the Tamil example in section 2) in which place markedness alone is sufficient to generate assimilation.

6. With nasals, coda place is avoided by means of epenthesis only at root+suffix junctures. Root-internally, and at prefix + root junctures, place assimilation occurs (as seen in these examples). These differences in repair strategy will be addressed in section 3 below.

7. See Smolensky (1995) and Itô & Mester (1994, 1997) for representative discussion and formalization of CODA COND within Optimality Theory.

8. See Mohanan (1993), Jun (1995) and Padgett (1995) for additional discussion of, and motivation for, the regressive assimilation imperative.

9. I have slightly modified the transcription system employed by Christdas, replacing certain of her symbols with the relevant IPA characters. Retroflex segments are represented with single characters, rather than with the subdot diacritic. Also, the use of underlining to indicate alveolar place of articulation has been abandoned. Dentals are transcribed with the bridge diacritic, [j] is used for the palatal approximant, and [tʃ] and [dʒ] are used, as in Wiltshire (1998), to represent the palatal obstruents.

10. There is a tense/lax distinction correlated with length in each of the long/short vowel pairs. Wiltshire (1995, 1998) consistently transcribes /a/ as [ʌ], /u/ as [u] and /i/ as [i] in initial syllables, and as [a], [ʊ] and [ɪ] elsewhere. Underlying long vowels are transcribed by Wiltshire as short, but tense: /oo/ = [o], /ii/ = [i], etc. However, increased

duration is definitely a property of the phonologically long vowels. Balasubramanian (1980: 463) measured vowel duration for phonologically short and long vowels in a variety of syllable structures. For all of the vowels measured, the long vowel had a duration approximately twice that of the corresponding short vowel.

11. Root-initial syllables are somewhat more permissive, allowing both complex codas and free-standing Coronal place. I will focus on the behavior of non-initial syllables here. See Wiltshire (1992) for a Prosodic Licensing account of the initial/non-initial asymmetry, and Beckman (1999) for an Optimality Theory analysis in positional faithfulness terms.

12. Here I ignore the question of how exactly this result is achieved by different implementations of coda licensing. Though interesting, these issues are tangential to the point at hand.

13. See Lombardi (2002) for extensive recent discussion of place markedness. She argues that *PHARYNGEAL should be ranked below *CORONAL in Prince and Smolensky's (1993) place markedness subhierarchy, but notes that the relative rarity of pharyngeals and laryngeals in inventories may reasonably be attributed to other factors, such as lack of perceptual salience. Glottal stop does occur in Tamil, but only as a word-initial epenthetic segment before the low vowel *a* (Christdas 1988:164), meaning that the segment must be prevented from occurring elsewhere in the inventory by high-ranking constraints that take precedence over place markedness. I will not address the nature of those constraints here, but simply employ Prince and Smolensky's original place markedness subhierarchy.

14. Contrastive velar laterals have been reported for a handful of languages in New Guinea (Melpa, Mid-Waghi, Kanite and Yagara), Africa (Kotoko) and North America (Comox) (Ladefoged and Maddieson 1996).

15. Walsh Dickey (1996) argues that laterals are complex [Coronal, Dorsal] sounds, rather than [lateral] segments. It is unclear how the effects of the implicational constraint in (26) can be captured in such a theory.

16. A full formulation of SCL within Optimality Theory would take us far beyond the scope of this paper. The interested reader is referred to the pre-Optimality Theory work of Clements (1990), and to Prince & Smolensky (1993) and Baertsch (2002), for related proposals and discussion.

17. The single-root theory of geminates accounts for their unexceptional behavior with respect to SCL. But see Selkirk (1990) for an alternative view of geminate structure which assumes two root nodes, and Ringen and Vago (2002a,b) for recent arguments in favor of a two-root representation.

18. I have omitted one set of interesting candidates from (31), namely those of the form *ka.ɟɟk.kɟ*. There are two discrete representations to consider here: one in which the underlying /p/ has assimilated in place of articulation to the following /k/, and one in which the /p/ has deleted, with gemination of the input /k/. Both candidates may be ruled out straightforwardly. Oral stops never undergo place assimilation in Tamil, possibly reflecting a priority on faithfulness in obstruents (see Jun 1995 for extensive development of such a proposal), or a prohibition on multiple linking between obstruents (NO-CC-LINK; Itô, Mester & Padgett 1995). In any case, even if such assimilations were possible, such a candidate would violate SCL, just as (31b) does. The alternative structure, in which /p/ deletes and /k/ geminates, necessarily incurs a violation of MAX, parallel to that in (31c), and additionally violates WEIGHT-IDENT (Urbanczyk 1996). Given the ranking of MAX in the grammar, epenthesis is the preferred repair strategy.

19. There are no clusters of nasal + continuant consonant in Axininca Campa, and no obstruent codas at all. I assume, with McCarthy and Prince (1993a,b) that the former generalization reflects a prohibition on place-sliding, along the lines of Padgett (1991). The latter prohibition reflects a very common sonority-based restriction on possible syllable

margins. See Prince & Smolensky (1993:2002, chapter 8) for extensive discussion of such facts, and Baertsch (2002) for refinements of Prince & Smolensky's *MARGIN constraints.

20. The necessity of epenthesis in (34a,b) is due to the aforementioned absolute ban on obstruent codas.

21. See Spring (1994) for a very different analysis of this asymmetry

22. This constraint is obviously relevant to the analysis of Tamil (and other languages), as well, but the necessity for the constraint is clearest in Axininca, where the standard analysis in the literature assumes an underlyingly placeless archiphoneme /N/. Without a constraint forcing output specification, any constraint penalizing place feature specifications will rule in favor of a surface placeless nasal n o t the correct outcome in Axininca (or Tamil).

23. This point was first made, though only for reduplicative suffixes, in Spring (1990)

24. A fourth candidate, naa].piro, is ruled out because it violates an additional Alignment constraint, ALIGN(Stem, R, o. R).

25. Coda-to-onset progressive assimilation does occasionally occur, as in *Ibibio* (Akinlabi & Urua 1993, Beckman 1999), where there is a pattern of progressive assimilation spreading both place and manner from the coda to the following onset. In this case, and all other cases that I know of, the onset consonant undergoing the assimilation is in a suffix, while the triggering coda is a member of the root. Such examples are generated by the ranking IDENT-ROOT(F) » *F » IDENT-AFFIX(F) (c.f. McCarthy & Prince 1995, Beckman 1999).

REFERENCES

- Akinlabi, Akiibiyi & Urua, Eno (1993). Foot structure in the Ibibio verb. Ms., Rutgers University and University of Uyo, Nigeria.
- Al-Ahmadi Al-Harbi, Awwad (2003). Acehese coda-condition: An Optimality-Theoretic account. *Umm Al-Qura University Journal Of Educational and Social Sciences and Humanities*, 15, 9–28.
- Alderete, John (1999). Head-dependence in stress-epenthesis interaction. In: Hermans, B. & van Oostendorp, M. (Eds.), *The Derivational Residue in Phonological Optimality Theory*. Amsterdam: John Benjamins, 29–50.
- Alderete, John (2001). Root-controlled accent in Cupeño. *Natural Language and Linguistic Theory*, 19, 455–502.
- Baertschi, Karen (2002). *An Optimality Theoretic Approach to Syllable Structure: The Split Margin Hierarchy*. Ph.D. dissertation, Indiana University.
- Balasubramanian, T. (1980). Timing in Tamil. *Journal of Phonetics*, 8, 449–467.
- Beckman, Jill N. (1997). Positional faithfulness, positional neutralization and Shona height harmony. *Phonology*, 14.1, 1–46.
- Beckman, Jill N. (1999). *Positional Faithfulness: An Optimality Theoretic Treatment of Phonological Asymmetries*. New York: Taylor and Francis.
- Black, H. Andrew (1991). The phonology of the velar glide in Axininca Campa. *Phonology*, 8, 183–217.
- Bosch, Anna & Wiltshire, Caroline (1992). The licensing of prosodic prominence in Tamil. In: Stvan, L.S. (Ed.), *Papers from the Third Annual Meeting of the Formal Linguistics Society of Midamerica*. Bloomington: Indiana University Linguistics Club, 1–15.
- Casali, Koderic (1997). Vowel elision in hiatus contexts: Which vowel goes? *Language*, 73:3, 493–533.
- Christdas, Prathima (1988). *The Phonology and Morphology of Tamil*. Ph.D. dissertation, Cornell University.
- Clements, G.N. (1990). The role of the sonority cycle in core syllabification. In: J. Kingston & M. Beckman (Eds.), *Papers in Laboratory Phonology I: Between the Grammar and Physics of Speech*. Cambridge: Cambridge University Press, 283–333.
- Goldsmith, John (1989). Licensing, inalterability, and harmonic rule application. In: C. Wiltshire, R. Graczyk & B. Music (Eds.), *Papers from the 25th Annual Regional Meeting of the Chicago Linguistic Society*. Chicago: Chicago Linguistic Society. 145–156.
- Goldsmith, John (1990). *Autosegmental and Metrical Phonology*. Oxford: Blackwell

- Hale, Kenneth (1973). Deep-surface canonical disparities in relation to analysis and change: An Australian example. *Current Trends in Linguistics*, 11, 401–458.
- Hooper, Joani B. (1976). *An Introduction to Natural Generative Phonology*. New York: Academic Press.
- Itô, Junko (1986). *Syllable Theory in Prosodic Phonology*. Ph.D. dissertation, University of Massachusetts, Amherst.
- Itô, Junko (1989). A prosodic theory of epenthesis. *Natural Language and Linguistic Theory*, 7, 217–259.
- Itô, Junko & Mester, Armin (1993). Licensed segments and safe paths. *Canadian Journal of Linguistics*, 38, 197–213.
- Itô, Junko & Mester, Armin (1994). Reflections on Coda Cond and Alignment. In Jason Merchant, Jaye Padgett & Rachel Walker, (Eds.), *Phonology at Santa Cruz*, 3, 27–46.
- Itô, Junko & Mester, Armin (1997). Sympathy theory and German truncation. In V. Miglio & B. Moreau (Eds.), *University of Maryland Working Papers in Linguistics 5. Selected Phonology Papers from Hopkins Optimality Theory Workshop 1997 / University of Maryland Mayfest 1997*, 117–139. [ROA-211-0897].
- Itô, Junko & Mester, Armin (1998). Markedness and word structure: OCP effects in Japanese. Ms. University of California at Santa Cruz [ROA-255-0498].
- Itô, Junko & Mester, Armin (1999). On the sources of opacity in Optimality Theory: Coda processes in German. Ms. University of California at Santa Cruz [ROA-347-0999].
- Itô, Junko, Mester, Armin & Padgett, Jaye (1995). Licensing and underspecification in Optimality Theory. *Linguistic Inquiry*, 26, 517–613.
- Jun, Jongho (1995). *Perceptual and Articulatory Factors in Place Assimilation: An Optimality Theoretic Approach*. Ph.D. dissertation, UCLA.
- Kingston, John (1985). *The Phonetics and Phonology of the Timing of Oral and Glottal Events*. Ph.D. dissertation, University of California, Berkeley.
- Kingston, John (1990). Articulatory binding. In: J. Kingston & M. Beckman (Eds.), *Papers in Laboratory Phonology I: Between the Grammar and Physics of Speech*. Cambridge: Cambridge University Press, 406–434.
- Ladefoged, P. & Maddieson, I. (1996). *The Sounds of the World's Languages*. Oxford: Blackwell.
- Loinbardi, Linda (1991). *Laryngeal Features and Laryngeal Neutralization*. Ph.D. dissertation, University of Massachusetts, Amherst.

- Lombardi, Linda (1999). Positional faithfulness and voicing assimilation in Optimality Theory. *Natural Language and Linguistic Theory*, 17, 267–302.
- Lombardi, Linda (2001). Why Place and Voice are different: Constraint-specific alternations in Optimality Theory. In: L. Lombardi (Ed.), *Segmental Phonology in Optimality Theory: Constraints and Representations*. Cambridge: Cambridge University Press, 13–45.
- Lombardi, Linda (2002). Coronal epenthesis and inarkedness. *Phonology*, 19, 219–251
- McCarthy, John J. & Prince, Alan (1993a). Generalized alignment. In Geert Booij & Jaap van Marle (Eds.), *Yearbook of Morphology*. Dordrecht: Kluwer, 79–153.
- McCarthy, John J. & Prince, Alan (1993b). Prosodic morphology I: Constraint interaction and satisfaction. Ms., University of Massachusetts, Amherst and Rutgers University.
- McCarthy, John J. & Prince, Alan (1994). The emergence of the unmarked: Optimality in prosodic morphology. In Mercedes González (Ed.), *Proceedings of NELS 24*. Amherst, MA: GLSA, 333–379.
- McCarthy, John J. & Prince, Alan (1995). Faithfulness and reduplicative identity. In Jill N. Beckman, Laura Walsh Dickey & Suzanne Urbanczyk (Eds.), *University of Massachusetts Occasional Papers in Linguistics 18: Papers in Optimality Theory*. Amherst, MA: GLSA, 249–384.
- McCawley, James (1967). The role of a phonological feature system in a theory of language. *Languages*, 8, 112–123.
- Mohanan, K.P. (1993). Fields of Attraction in Phonology. In John Goldsmith (Ed.), *The Last Phonological Rule: Reflections on Constraints and Derivations*. Chicago: University of Chicago Press, 61–116.
- Murray, R.W. & Vennemann, Theo (1983). Sound change and syllable structure in Germanic phonology. *Language*, 59, 514–528.
- Padgett, Jaye (1991). *Structure in Feature Geometry*. Ph.D. dissertation, University of Massachusetts, Amherst.
- Padgett, Jaye (1995). Partial class behavior and nasal place assimilation. In: Proceedings of the South Western Optimality Theory Workshop 1995. The University of Arizona Coyote Papers, Tucson, 145–183.
- Parker, Steve (2001). Non-optimal onsets in Chamicuro: an inventory initialised in coda position. *Phonology*, 18, 361–386.
- Payne, David L (1981). *The Phonology and Morphology of Axininca Campa*. Arlington, TX: Summer Institute of Linguistics.

- Petrova, Olga, Plapp, Rosemary, Ringen, Cathieriie & Szentgyörgyi, Szilard (2000). *Constraints on voice: An OT typology*. Paper presented at the Annual Meeting of the Linguistic Society of America.
- Priice, Alan & Sinolensky, Paul (1993/2002). *Optimality Theory: Constraint Interaction in Generative Grammar*. Ms., Rutgers University and University of Colorado, Boulder.
- Riiigen, Cathieriie & Vago, Robert (2002a). *Geminates: Heavy or long?* Paper presented at the Annual Meeting of the Linguistic Society of America, Atlanta, GA.
- Ringen, Catheriie & Vago, Robert (2002b). *The weight vs. length analysis of geminates*. Paper presented at the Ninth International Phonology Meeting, Vienna, Austria.
- Schafer, Ainy (1993). The syllable structure of Tamil nouns. In: T. Sherer (Ed.), *University of Massachusetts Occasional Papers in Linguistics 16: Phonological Representations*. Amherst, MA: GLSA, 247–274.
- Selkirk, Elisabetli (1982). The syllable. In: H. van der Hulst & N. Smith (Eds.), *The Structure of Phonological Representations, Part II*. Dordrecht: Foris, 337–383.
- Selkirk, Elisabetli (1990). The two-root theory of length. In: E. Dunlap & J. Padgett (Eds.), *University of Massachusetts Occasional Papers in Linguistics 14: Papers in Phonology*. Amherst, MA: GLSA, 123–171.
- Selkirk, Elisabetli (1994). *Optimality Theory and featural phenomena*. Lecture notes, LING 730, University of Massachusetts, Amherst.
- Smolensky, Paul (1995). On the internal structure of the constraint component *Con* of UG. Handout from a talk presented at the University of California, Los Angeles.
- Spruiig, Cari (1990). *Implications of Axininca Campa for Prosodic Morphology and Reduplication*. Ph.D. dissertation, University of Arizona.
- Spring, Cari (1994). Combinatorial specification of a consonant system. In Erii Duncan, Donka Farkas & Philip Spaelti (Eds.), *Proceedings of WC'CFL 12*. Stanford: CSLI, 133–155.
- Steriade, Doiica (1982). *Greek Prosodies and the Nature of Syllabification*. Ph.D. dissertation, Massachusetts Institute of Technology.
- Steriade, Doiica (1993). *Positional neutralization*. Talk presented at NELS 24, University of Massachusetts. Amherst.
- Steriade, Donca (1995). Underspecification and markedness. In John Goldsmith (Ed.), *The Handbook of Phonological Theory*. Oxford: Blackwell, 114–174.

- Steriade, D. (1997). *Phonetics and phonology: The case of laryngeal neutralization*. Ms., University of California, Los Angeles.
- Urbaiiczky, Suzanne (1996). *Patterns of Reduplication in Lushootseed*. Ph.D. dissertation, University of Massachusetts, Amherst.
- Walker, Rachel (1997). *Faith and markedness in Esiinbi feature transfer*. In Rachel Walker, Matoko Katayama & Dan Karvonen (Eds.), *Phonology at Santa Cruz*, 5, 103–115.
- Walker, Rachel (1998). *Nasalization, Neutral Segments, and Opacity Effects*. Ph.D. dissertation, University of California, Santa Cruz.
- Walsh Dickey, Laura (1996). *The Phonology of Liquids*. Ph.D. dissertation, University of Massachusetts, Amherst.
- Wilkinson, Karina (1988). Prosodic structure and Lardil phonology. *Linguistic Inquiry*, 19, 325–334.
- Wiltshire, Caroline (1992). *Syllabification and Rule Application in Harmonic Phonology*. Ph.D. dissertation, University of Chicago.
- Wiltshire, Caroline (1995). Abandoning the lexical/post-lexical derivation: An argument from syllabification. Handout from a talk presented at the Tilburg Conference on the Derivational Residue in Phonology.
- Wiltshire, Caroline (1998). Extending Align constraints to new domains. *Linguistics*, 36, 423–467.
- Yip, Moira (1983). Some problems of syllable structure in Axininca Campa. In Peter Sells & Charles Jones (Eds.), *Proceedings of NELS 13*. Amherst, MA: GLSA, 243–251.
- Yip, Moira (1991). Coronals, consonant clusters and the Coda Condition. In Carole Paradis & Jean-François Prunet (Eds.), *The Special Status of Coronals: Internal and External Evidence (Phonetics and Phonology 2)*. San Diego: Academic Press, 61–78.
- Zoll, Cheryl (1998). *Conflicting directionality*. Ms., Massachusetts Institute of Technology. (<http://roa.rutgers.edu/files/151-10961151-1096-ZOLL-0-0.PDF>)