RELATIVIZED CONTIGUITY

Part I: Contiguity and Syllabic Prosody*

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Often processes which truncate or augment a string are simply reflections of prosodic organization. Principles of syllabification, for example, are the major catalyst for the string modifications in (1): In (1a), a consonant deletes due to a prohibition on syllable Codas (see Steriade, 1982; Prince, 1984; Levin, 1985; Itô, 1986, '89; etc.); in (1b) a vowel deletes due to a prohibition on Onsetless syllables (see Prince & Smolensky, 1993; McCarthy & Prince, 1993; Rosenthall, 1994; Lamontagne and Rosenthall, 1996; etc.); in (1c), a vowel shortens due to a restriction on syllable size-- i.e., the two mora max. limit (see McCarthy & Prince ,1986; Myers ,1987; Broselow,1992; Tranel, 1992; Sherer, 199; etc.); and finally, in (1d), a vowel is inserted to provide a syllable for the stray consonant *C'* (see Broselow, 1980, '82, '92; Selkirk, 1981; Steriade, 1982; Itô, 1986, '89; Mester & Padgett, 1994; etc.)[1].

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*This is a first installment in a series of articles investigating the effects of contiguity restrictions in Optimality Theoretic grammars. The second part (Lamontagne, in progress) investigates the effects of contiguity restrictions on metrical prosody, while a third part (Lamontagne & Rosenthall, 1996) looks at various segmental fusion processes. I would like to thank audiences at Rutgers University and the University of Massachusetts at Amherst for insightful comments on various parts of this work. Thanks go to John Alderete, Eric Bakovic, John McCarthy, Alan Prince, Samuel Rosenthall, Lisa Selkirk, and Tom Wilson for discussions of the issues raised here. Of course I alone am responsible for any errors or omissions in this work. I am also grateful to John McCarthy for support under NSF grant SBR-9420424.

[1] Analogous processes at the Foot level include Iambic Lengthening, Trochaic Shortening and instances of Syncope (see Prince, 1990; and Hayes, 1995 for extensive discussion and examples). Further related processes with morphological influence include the augmentation of so-called "subminimal" lexical items in languages like Ponapean (McCarthy, 1983) and Lardil (Wilkinson, 1986, '88; Prince and Smolensky, 1993; McCarthy and Prince, 1993)-- for discussions of minimality phenomena see Prince (1980) and McCarthy and Prince (1986, 1991).

1. (a) Cluster Simplification: VCCV--> V.CV/*VC.CV
   (b) Hiatus Avoidance: CVV--> CV/*CV.V
   (c) Closed Syllable Shortening: CVVC --> CVC/*CVVC
   (d) Stray-C Syllabification: VC.C'.CV --> VC.C**v**.CV *or* V.C**v**C.CV

From (1) then, we may conclude that any general theory of string modification must appeal to some prosodic component and that such modifications can be understood as following from the *pressures* of prosodic well-formedness conditions-- where "pressures" maybe understood in terms of the formal apparatus of constraint interaction assumed by Optimality Theory (Prince and Smolensky, 1993).

More generally, however, prosody is only part of the explanation to the data in (1). At best principles of syllabification (and/or Foot assignment) tell us that a string must undergo some form of augmentation or truncation, the exact nature of which often eludes attempts to understand their essence in terms of prosodic effects. For example, consider the cluster simplification data in (1a). A Coda Condition motivates the deletion of one of two intervocalic consonants. But this condition is mute with respect to which of the two consonants must delete-- deleting either the first or second consonant will serve to satisfy the Coda Condition. Likewise, the deletion of either vowel in (1b) will adequately avoid the construction of an onsetless syllable. That each of these cases surfaces in language is illustrated by the data in (2) and (3). In (2a), we see Coda Condition driven cluster simplification where the first consonant of an intervocalic cluster deletes; while in (2b) we see a case where the second consonant of the cluster is lost.

2. (a) Diola Fogny[2] VC_1C_2V --> $V.C_2V$

/le**t**-ku-jaw/	lekujaw	'they won't go'
/ja**w**-bu-ŋar/	jabuŋar	'voyager'
/na-la**ñ**-lañ/	nalalañ	'he returned'

[2] Sapir (1965), examples from Itô (1986).

(b) Wiyot[3] VC_1C_2V --> $V.C_1V$ [Applicable to *illicit* clusters]

/pucarag-**l**olisw-/	pucaragorišw-	‘whistle a tune’
/kit-**h**us-/	kitus-	‘finish fishing’
/dot-**h**aphatk-/	dotaphatk-	‘make a large package’

Paralleling the above data are attested cases of hiatus avoidance where either the first (3a) or the second (3b) vowel of a VV sequence uniformly deletes:

3. (a) Iraqw[4] CV_1V_2C --> $CV_2.C$

/da:ng**i**-e:mo/	da:nge:mo	‘twins’
/lam**a**-e:mo/	lame:mo	‘lies’
/wan**e**-a/	wana	‘maybe it is’
/dir**i**-a ho:ta:n/	dira ho:ta:n	‘we live here’

(b) Kashaya[5] CV_1V_2C --> $CV_1.C$

/malucma-**î**m̓ic-ʔ/	malúc^{h}mabiʔ	‘start to bake (pl)’
/c^{h}i-ṅ̓e-**a**ṅ̓-I/	c^{h}ide:du	‘carry along’
/ca^{h}no-wă-**e** šoc-I/	cahnowá šoci	‘listen, he’s singing’

Any account then of this data in terms of the prosodic factors outlined above, and there are many such accounts in the literature, constitute only *half*-explanations of augmenting and truncating

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[3] Wiyot data taken from Teeter (1964).

[4] See Mous (1993).

[5] See Oswalt (1961); examples from Buckley (1994).

processes: such theories highlight the general cause of the phenomena but say little about the nature of the specific effect. Thus one major goal for prosodic theories of phonology is to provide a *predictive* account of the facts in (2) and (3), an account which ideally illuminates other issues and hence serves as more than just an appendage to current theories of prosodic phenomena. Addressing this goal is the central focus of the present paper.

I will propose here that an understanding of the facts in (2) and (3) follow from a deeper understanding of *contiguity* requirements in Optimality Theoretic grammars which demand that any sequence of segments contiguous in the input/output be contiguous in the output/input. I will show that once the constraints governing contiguous segments in a string are properly formalized, prosodically-driven processes like those above follow from the interaction of (minimally) violable constraints typical of Optimality Theoretic grammars. Crucial to this work is the role played by prosodic units in defining contiguity constraints. The theory of contiguity I will propose assumes that constraints regulating adjacent segments affect elements in distinct prosodic units, units such as the Syllable, Foot, Prosodic Word, etc. Here contiguity constraints are said to be *relativized* to specific prosodic domains. This yields a *family* of constraints which affect prosodicized output representations in a *vertical* fashion-- contiguity constraints at the syllabic level[6], contiguity constraints at the foot level, etc. I will refer to such a family of constraints as *Domain Contiguity-α* (where α = a prosodic unit).

In conjunction with this vertically defined family of contiguity constraints, will be another, more horizontally defined, family which governs adjacent segments across abutting units at some level of prosodic representation. Here contiguity relations will be evaluated at the junctures of adjacent prosodic units like Syllable, Foot, Prosodic Word, etc. Appropriately, I will refer to this family of constraints as *Juncture Contiguity-α* (where α = a prosodic unit).

Below we shall see that relativizing contiguity to prosodic domains not only provides an account of the data in (2) and (3), but also furthers our understanding of what I called "Stray-Consonant Syllabification" in (1d). Much literature on this subject has focused on the more general

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[6]For a similar (non-relativized) contiguity constraint at the level of the syllable see Duncan (1994) and Rosenthall (1994:62).

pattern of stem-medial epenthesis. In fact, there are cases where the general stem-medial patterns are *reversed* at the periphery of target stems. We shall see that the theory of contiguity proposed here predicts different patterns of cluster simplification for stem-medial and peripheral positions. Furthermore, the current theory predicts the possibility of what we may call *nonminimal* epenthesis as a cluster simplification strategy-- in other words, medial clusters with two stray consonants are predicted to surface with two epenthetic vowels: /...VCCCCV.../ --> [VC.C*v*.C*v*.CV]/*[VC.C*v*C.CV]. As we shall see this prediction is at odds with both pre-OT and OT accounts of epenthesis phenomena, yet it is empirically in agreement with the epenthesis processes attested in several languages.

Finally, relativizing contiguity relations to all prosodic levels allows for contiguity interactions within and between Feet as well as syllables. As discussed in Lamontagne (in progress), the sometimes inert behavior of epenthetic vowels with respect to processes of stress assignment can be understood in terms of Foot-level contiguity effects. Hence the theory of contiguity espoused in this paper is truly general, extending well beyond the data in (2) and (3).

The primary focus of the current paper will be on the effects of contiguity restrictions at the level of the syllable: *Domain Contiguity-σ* and *Juncture Contiguity-σ*. In Section 1, a formal definition of the relativized contiguity constraint is provide. Here I illustrate how defining contiguity in terms of prosody allows for the explanation of the (deletion) facts in (2) and (3). As we will see, epenthesis phenomena also result in violations of contiguity restrictions. Section 2 explores the predictions made by relativized contiguity constraints in determining the locus of epenthetic segments in word-medial and peripheral positions. This section also investigates the possibility of leaving output consonants unsyllabifed; in such cases, prosodically defined contiguity constraints will be violated. Here the factorial typology of the interaction between these constraints with Faithfulness and prosodic well-formedness constraints is explored and a general theory of phonotactic patterns emerges. Finally, in section 3, a case of epenthesis triggered surface contrast in the syllabic structure of Barra Gaelic is discussed and understood in terms of contiguity requirements.

1.0 THE CONTIGUITY CONSTRAINT

Contiguity requirements govern the sequencing of segments between two levels of representation. This constraint first received formal notice in morphological systems which exhibited shape-invariant affixation. In instances of reduplication, for example, it is often the case that the reduplicant is a proper substring of the base (4a):

4.	*Reduplicant*	+	*Base*	
	a. (ABC)	+	[ABCDE...]	Typical Reduplication Pattern
	b. (ACD)	+	[ABCDE...]	Atypical Reduplication Pattern

This fact is captured in the framework of Marantz (1982) by assuming that the base is first copied and then this copy is mapped to a shape-invariant affix in a *phoneme-driven* fashion. Since mapping to a template proceeds from the edge of the copy inwards, phoneme-by-phoneme, it follows that segments which were contiguous in the base will be contiguous in the reduplicant-- any deviation from strict contiguity will arise only at the expense of the mapping algorithm itself.

Within the *template satisfaction* framework of McCarthy and Prince (1986), contiguity requirements in shape-invariant morphological systems are recognized as a principle distinct from the principles of melodic association. In this framework, a copy of a base is mapped to a prosodically specified template in such a fashion as to maximally *satisfy* all prosodic requirements of the affix. Here contiguity, under the rubric “skipping phenomenon,” is explicitly assumed to constrain the mapping process. So we see cases like progressive formation in Ilokano, where contiguity requirements preempt the mapping to a syllable-affix thus yielding the nonmaximal association in (5f).

5.	a. /basa/	ag+BAS+basa	‘be reading’
	b. /adal/	ag+AD+adal	‘be studying’
	c. /takder/	ag+TAK+takder	‘be standing’
	d. /trabaho/	ag+TRAB+trabaho	‘be working’

e. /dait/ *ag+DAT+dait 'be sewing'

f. /dait/ ag+DA+dait 'be sewing'

Although the need for principles of contiguity has been recognized as a necessity in theories of shape-invariant morphology for some time now, the formal articulation of such principles and any rigorous investigation of their empirical scope has until very recently been lacking. One reason being, given the formal rift between the mechanisms deriving the output of reduplicative processes and those deriving the phonetic representations of simplex or linearly concatenated complex stems, contiguity requirements have been afforded the status of nothing more than an idiosyncracy of prosodic morphology. Doomed to obscurity in a small corner of the grammar, within a domain so restricted to preclude any robust empirical testing, the contiguity constraint has been no more than a formal apparition. It is only recently, within the constraint interaction model of Optimality Theory (Prince and Smolensky, 1993), that prosodic morphology and linearly derived complex stems have received a great degree of formal equivalence through the role of minimally violable constraints evaluating output forms. Now the effects of the contiguity constraint can be investigated outside of the shape-invariant spectrum. For example, both Kenstowicz (1994) and Spencer (1993) implicate contiguity factors as the primary force behind the locus of epenthetic vowels in the Paleo-Siberian language Chukchee. Chukchee exhibits a familiar ban on consonant clusters at the periphery of words and allows no medial triconsonantal clusters. When medial triconsonantal clusters arise through the concatenation of morphemes, an epenthetic schwa in inserted. The locus of this vowel, however, varies:

6. a. qonaɣ-rat 'set of plants'

tumɣ[ə]-ret 'group of comrades'

b. umkuum 'brushwood'

nəm[ə]-tku-n 'group of villages'

c. miml[ə]-qaca-n ‘place near water’
wejem[ə]-lq-ən ‘teeming with rivers’

In the second example of (6a) we see that the vowel is inserted between the second and third consonants of the triconsonantal cluster-- the first example illustrates that the insertion of the vowel is not triggered by some stringwise cooccurrence restriction between the stem-final and suffix-initial segments. In the (6b) we see that the vowel is inserted between the first and second consonants of the triconsonantal cluster-- again the first example rules out cooccurrence restrictions as the catalyst for epenthesis. Finally, in (6c) we have what appears to be a minimal pair with respect to the insertion of schwa. Kenstowicz (1994) notes that the unifying generalization in these data is that the locus of the epenthetic vowel is pegged to gaps between morphemes. In other words, the ambiguity in the syllabification of the stray consonant (i.e., whether it is an onset or coda) depends on whether it is affiliated with the first or the second morpheme-- if the stray consonant belongs to the first morpheme (6a, and the first example in 6c), the schwa is inserted after this consonant into the gap between morphemes and this consonant becomes an onset; if the stray consonant belongs to the second morpheme (6b, and the second example in 6c), the schwa is inserted before this consonant (again in the gap between morphemes) forcing it into the coda. As the author notes, the notion of insertion into a “morpheme gap” can be understood as following from a constraint which demands that segments within a morpheme be contiguous in output representation. In other words, all segments which make up a morpheme in the output constitute proper substrings of the input. Thus treating the examples in (6c) in a unified fashion with respect to the position of the epenthetic vowel would always entail a violation of the contiguity constraint in one of the two cases. Here it is implicitly assumed that contiguity governs the sequencing of segments within all morphemes regardless of lexical specification. Contiguity restrictions are no longer seen as holding solely over base-reduplicant (B-R) mappings, rather they’ve been extended to affect the parings of all input underlying forms and their corresponding output surface form (i.e., all I(nput)-O(utput) mappings).

Another example of contiguity playing a role in I-O mappings has been noted by McCarthy and Prince (1993)[7]. In the Awarkan language Axininca Campa *subminimal* roots undergo various modes of augmentation depending on the shape of the base and/or the shape of a suffix. In some cases the language exhibits the epenthesis of an entire CV syllable:

7. /t^ho/ --> t^ho**ta** 'kiss, suck'

What McCarthy and Prince note is that cases of augmentation of this sort are always *root-external*. In other words, the root in (7) does not augment as *t^h* ***at****o* where an epenthetic VC sequence has been added internal to the root. Again we see the effects of the contiguity constraint discussed above for Chukchee: internal epenthesis is stymied by the fact that its result will create a representation where two segments of a morpheme would be noncontiguous in the output. We see, then, that an understanding of the lack of *root-internal* epenthesis in Axininca is achieved once we recognize the possibility that contiguity requirements extend past the domain of base-reduplicant relations to all mapping relations in grammar-- an extension which may be accomplished through Correspondence Theory (McCarthy and Prince, 1995).

Extending contiguity requirements to the I-O domain provides a rich empirical base to determine the exact formulation of the contiguity constraint and the scope of this constraint's effects. Many string-altering processes affect the mapping of a particular input to the set of candidate outputs: deletion, epenthesis, metathesis, reduction, etc. How does the contiguity constraint interact with these constraints that achieve such effects? How does contiguity play out over polysyllabic prosodized strings? Can this constraint provide a typology of the behavior of phonological processes affecting different positions within the word?... Such are a small sample of the issues which now arise.

Let us return to the cluster simplification data in (2) and investigate how contiguity requirements may affect potential output candidates in the I-O domain. A summary of these facts is as follows:

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[7]See also Prince and Smolensky (1993:118) for a similar example from Lardil.

8. a. /VC_1C_2V/ --> [$V.C_2V$] (Diola Fogny)

/le**t**-ku-jaw/ lekujaw 'they won't go'

b. /VC_1C_2V/ --> [$V.C_1V$] (Wiyot)

/pucarag-**l**olisw-/ pucaragorišw- 'whistle a tune'

For both cases, a prohibition on codas compels the deletion of a potentially offending consonant. Clearly each case exhibits a contiguity violation-- both output representations do not constitute a proper substring of the input string. For example, in (8a) the output realization of C_2 differs in segmental sequencing from its corresponding input form: in the input C_2 was contiguous with C_1, now it is contiguous with the first vowel. Likewise in (8b): here C_1 was contiguous with C_2 in the input; after deletion it is contiguous with the second vowel. It would appear at first blush that contiguity requirements cannot distinguish between the two types of data in (8) since both fare about the same along this dimension of evaluation. However, they can be distinguished by refining the notion "substring of" to which our, at this point informal, discussion of contiguity appeals.

For the Chukchee and Axininca examples discussed above, all instances of contiguity discussed involved matching the output (or reduplicant) with the input (or base) on a morpheme-by-morpheme basis. In other words, the "substring of" relation was morphologically delimited: each morpheme of the output was checked to see if the segments which defined it constituted a proper substring of its corresponding input morpheme. Although it is sufficient for the contiguity constraint to refer to a morphological domain when comparing output with input, several other modes of comparison can be envisioned. Instead of defining the "substring of" relation to hold over domains which are purely morphological in nature, one may calculate whether or not elements where contiguous *within phonological domains*. Assuming a fully prosodized output, contiguity relations would be determined within units like the syllable and the foot-- the intuition being that prosodic units within the output maintain a general degree of integrity with respect to the sequencing of input segments.[8] Here the segments which make up an output syllable could be checked to see if they constitute a proper substring of the input. Likewise for feet, prosodic words, etc., all the way up the metrical/prosodic hierarchy. Conceiving of contiguity in this fashion allows us to distinguish the two cases in (8)-- adding prosodic structure to these forms yields the following diagrams:[9]

9. a. $/VC_1C_2V/$ --> [$\boldsymbol{V.C_2}V$] (Diola Fogny)

```
Input:     l e t k u j a w          'they won't go'
           | |   | | | | |
Output:    l e   k u j a w
            \/    \/  \|/
Syllable:   σ     σ    σ
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b. $/VC_1C_2V/$ --> [$V.\boldsymbol{C_1V}$] (Wiyot)

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Input:     p u c a r a g l o l I s w-     'whistle a tune'
           | | | | | | |   | | | |  |
Output:    p u c a r a g   o r I š w-
            \/  \/  \/  \  /  \|/
Syllable:   σ   σ   σ    σ     σ
```

Although both examples in (9) exhibit general contiguity violations, the nature of these violations begin to diverge when we compare them at the level of the syllable. In cases where you delete the second consonant of a biconsonantal cluster (9b), contiguity is violated *within* an output syllable (relevant segments are bolded here). So, in the example *pu.ca.ra.**go**.rišw*, the two segments in the syllable [***go***] are not contiguous in the input-- i.e., they are not a proper substring of the input. On the other hand, in cases where the first consonant of the cluster is deleted (9a), contiguity is never violated within syllables-- here, all segments which make up a syllable in the output constitute proper

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[8]As John Alderete points out this intuition may be ultimately related to processes of lexical access. See Cutler and Norris (1988) for a discussion of the role of syllable types in segmentation for lexical access attempts.

[9] In the following type of diagram I have included vertical lines to indicate the correspondence relations holding between input and output segments. Such lines are not to be confused with "association lines" that coordinate relations between autonomous tiers in formal representations.

substrings of the input. In this case a contiguity violation holds only between two segments *across* syllables--i.e., at the juncture between two syllables. More specifically, all segments within each syllable of the form ***le.ku**.jaw* are contiguous in the input. A break in contiguity exists, however, between the last segment of the first syllable and the following onset consonant: [*l**e***][***k**u*].

Relativizing contiguity to prosodic units provides us with a means to distinguish the two modes of cluster simplification illustrated in (9): one type of language tolerates contiguity violations within the syllable domain (9b), while the other type prohibits such violations opting instead for contiguity violations at the junctures between syllables (9a). Here we have a typical constraint domination scenario: if contiguity relations were assessed separately for elements within prosodic domains and for those at the juncture between these domains, instances of C_1 deletion like (9a) follow from the prohibition on contiguity violations within syllables being *stronger* than the prohibition on contiguity violations at the juncture between syllables. The reverse prioritizing between these constraints holds in the C_2 deletion case (9b) where contiguity violations within the syllable are tolerated.

To pursue this account of the facts in (9) we must first provide a certain degree of concreteness to the notion *contiguity,* a notion which we have up to now discussed quite informally. Let us begin with defining what it means for two elements to be contiguous. Since contiguity is evaluated over both B-R and I-O mappings, it must appeal to an Optimality Theoretic account of *faithfulness* which assumes GEN relates input and output segments through the simplest of relations: *correspondence:*

10. **Correspondence** (McCarthy & Prince, 1995:262)

Given two strings S_1 and S_2, **correspondence** is a relation $\Re$ from the elements of S_1 to those of S_2. Elements $\alpha \in S_1$ and $\beta \in S_2$ are referred to as **correspondents** of one another when $\alpha \Re \beta$.

In this framework, constraints which monitor the addition or subtraction of elements from the input do this through evaluating the correspondence relation between input and output segments. Two relevant examples are given below:

11. (a) Faithfulness (No deletion): ***MAX-IO*** *(*M&P, 1995:264)

Every segment of the input has a correspondent in the output.

/ $p_1\ o_2\ k_3\ t_4\ u_5$ / --> [$p_1\ o_2\ \ t_4\ u_5$]   *k* deleted: MAX-IO violation

(b) Faithfulness (Epenthesis prohibition): ***DEP-IO*** *(*M&P, 1995:264)

Every segment of the output has a correspondent in the input.

/ $p_1\ o_2\ k_3\ t_4\ u_5$ / --> [$p_1\ o_2\ k_3$ **I** $t_4\ u_5$]   *I* inserted: DEP-IO violation

Contiguity is similar to these faithfulness constraints in that it too refers to the correspondence relations holding between input/base and output/reduplicant segments:

12. CONTIGUITY[10]

For $\alpha\gamma$ in S_1 and $\beta\delta$ in S_2, if $\alpha\ \Re\ \beta$ and $\gamma\ \Re\ \delta$, then α is contiguous to γ iff β is contiguous to δ.

Deletion and insertion phenomena interact with Contiguity as follows: In (13a) we see a case of deletion. Here despite stringwise adjacency between X and Y in the output, they are not contiguous because an additional segment (a_2) intervenes between them in the input. (13b) illustrates how the insertion of a segment serves disrupt contiguity. In this case despite the stringwise adjacency

[10] Contiguity might ultimately be evaluated along two dimensions: Input Contiguity and Output Contiguity. In this case deletion and epenthesis phenomena can be assessed individually (see McCarthy and Prince, 1995). For the duration of this paper, however, I will assume (12) which equally evaluates contiguity requirements over both the input and output.

between X and Y in the input, X and Y are not contiguous since they are separated by the segment ***a*** in the output. Finally, in (13c) we have a case where X and Y are contiguous.

13. (a) /...$X_1a_2Y_3$.../ --> [..X_1Y_3...] (**deletion**, X and Y *are not* contiguous)

(b) /...X_1Y_2.../ --> [...X_1**a**Y_2...] (**epenthesis**, X and Y *are not* contiguous)

(c) /...X_1Y_2.../ --> [...X_1Y_2...] (X and Y *are* contiguous)

Following the above discussion, the Contiguity Constraint is assumed to be relativized to various prosodic domains and it assesses whether elements are contiguous within and between such domains. In essence two general types of contiguity constraints emerge:[11]

14. Relativized Contiguity Constraints

(a) **D**(omain)-**CONTIG**(uity): *contiguity between correspondents within a domain D.*

For some domain D within S_2, all correspondents βδ in D must be contiguous. Where D = {Syllable, Foot, PrWd, etc.}

(b) **J**(uncture)-**CONTIG**(uity): *contiguity between correspondents across identical domains D.*

For two identical domains D and D_{+1} in S_2, where β is the final correspondent in D and δ is the first correspondent in D_{+1}, β and δ must be contiguous. Where D = {Syllable, Foot, PrWd, etc.}

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[11] My assumptions here concerning the evaluation of contiguity relations *within* and *between* domains has a clear antecedent in the literature investigating phrasal domains. See for example, the work in Selkirk (1980) where it is proposed that phonological rules may apply freely within *prosodic* domains (Selkirk's *domain span* rule) as well as apply to elements which must exist in distinct domains of the same type (Selkirk's *domain juncture rule).*

In (15) I provide some schematic examples of D-CONTIG interacting with deletion and insertion phenomena. In (15a) and (15b) Domain Contiguity is violated since two correspondents within domain “D” are not contiguous in both the input and the output.

15. D-CONTIG (Contiguity evaluated ***within*** some domain *D*)

(a) D-CONTIG violated within *D* [Deletion-*a*]

Input: ...X_1 $\mathbf{a_2}$ Y_3...
| |
Output: ...$\mathbf{X_1}$ $\mathbf{Y_3}$
\ /
Domain: D

(b) D-CONTIG violated within *D* [Epenthesis-*a*]

Input: ...X_1 Y_2...
| |
Output: ...$\mathbf{X_1}$ *a* $\mathbf{Y_2}$...
\ | /
Domain: D

(c) D-CONTIG **not** violated within *D* [Deletion-*Y*]

Input: ...X_1 a_2 $\mathbf{Y_3}$...
| |
Output: ...$\mathbf{X_1}$ $\mathbf{a_2}$
\ /
Domain: D

(d) D-CONTIG **not** violated within *D* [Epenthesis-*a*]

Input: ...X_1 Y_2...
| |
Output: ...$\mathbf{X_1}$ $\mathbf{Y_2}$ *a*...
\ | /
Domain: D

In (15c) and (15d) Domain Contiguity is not violated. In (15c) we see the deletion of the input segment Y. Even though this segment is deleted, there is no contiguity violation within "D" since the two segments composing "D" are also contiguous in the input. Here Y is deleted from either the periphery of "D" or the periphery of the domain immediately following it. In either case, since the deleted Y was at the periphery of some domain "D," no D-CONTIG violation will ensue within "D". Likewise for the epenthesis case in (15d): here the epenthetic *a* rests at the periphery of "D". Since *a* is epenthetic, a Dep-I/O violation, and therefore has no correspondent in the input, it itself is not subject to the contiguity constraints which govern only segments that stand in the correspondence relation. The elements which are subject to the constraint's effects are X and Y; and X and Y are both contiguous in the input and the output. Although (15c) and (15d) do not violate D-CONTIG, they most likely would violate Juncture Contiguity. To see this, let us turn our focus to the effects of Juncture Contiguity interacting with deletion and epenthesis phenomena:

16. J-CONTIG (Contiguity evaluated ***across*** two similar domains)

(a) J-CONTIG violated [Deletion-*a*]

Input: ...X_1 $\mathbf{a_2}$ Y_3...
| |
Output: ...$\mathbf{X_1}$ $\mathbf{Y_3}$...
| |
Domain: D D

(b) J-CONTIG violated [Epenthesis-*a*]

Input: ...X_1 Y_2...
| |
Output: ...$\mathbf{X_1}$ *a* $\mathbf{Y_2}$...
\ / |
Domain: D D

(c) J-CONTIG **not** violated [Deletion-*a*]

Input: ... a_1 X_2 Y_3...
| |
Output: ... $\mathbf{X_2}$ $\mathbf{Y_3}$...
| |
Domain: D D

(d) J-CONTIG **not** violated [Epenthesis-*a*]

Input: ... X_1 Y_2...
| |
Output: ...*a* $\mathbf{X_1}$ $\mathbf{Y_2}$...
\ / |
Domain: D D

Here Juncture Contiguity is violated in (16a) and (16b). In the first case, an element is deleted and the endmost correspondents of two adjacent domains "D" violate contiguity due to the fact they were not adjacent in the input. In the epenthesis case in (16b), the element *a* is positioned at the end of the first domain "D". Although *a* itself is not subject to the Contiguity Constraint (again due to its lack of having a correspondent in the input), it serves to render the two endmost correspondents of both domains noncontiguous in the output.

(16c) and (16d) both manifest an instance of a string modification process at the periphery of some domain "D". In both cases, J-CONTIG will not be violated for the domains shown since such processes do not have an effect on the juncture between these particular domains. In other words, at the particular junctures illustrated, the endmost correspondents of the two domains are contiguous in both the input and the output.

Now with a definition of contiguity in hand we may follow up on the constraint interaction aspect of the cluster simplification facts in (9). As noted above, these cases can be distinguished in terms of properly prioritizing the effects of the relativized contiguity constraints in (14). In instances where a Coda Condition forces the deletion of one member of a biconsonantal cluster C_1C_2, the actual locus of the deletion process, i.e., whether it is C_1 or C_2 that deletes, follows from the interaction between D-CONTIG and J-CONTIG. In cases where C_1 deletes, D-CONTIG is ranked higher than J-CONTIG:

17. VC_1C_2V --> $V.C_2V$ (Diola Fogny) [Assumed: NoCoda, DEP-IO >> MAX-IO]

/le**t**-ku-jaw/	lekujaw	'they won't go'
/ja**w**-bu-ŋar/	jabuŋar	'voyager'

D-CONTIG >> J-CONTIG [Domain = Syllable]

/l**et**-**ku**-jaw/	D-CONTIG	J-CONTIG
(i) le.**tu**.jaw	*!	
(ii) ☞ l**e**.**k**u.jaw		*

```
Cand.(i): I:     l e t k u j a w      Cand.(ii): I:  l e t k u  j  a w
                 | | |   | | |  |                    | |   | |  |  |  |
          O:    *l e t   u j a w                O:   l  e  k u  j  a w
                  \/   \  /  \ | /                    \/    \/   \ | /
          D:      σ     σ     σ                 D:    σ     σ     σ
```

In grammars where C_2 deletes, these contiguity constraints receive the opposite ranking: J-CONTIG is ranked higher than D-CONTIG:

18. VC_1C_2V --> $V.C_1V$ (Wiyot) [Assumed: NoCoda, DEP-IO >> MAX-IO]

/pucarag-**l**olisw-/	pucaragorišw-	'whistle a tune'
/kit-**h**us-/	kitus-	'finish fishing'

J-CONTIG >> D-CONTIG [Domain = Syllable]

/k**it-hu**s-/	J-CONTIG	D-CONTIG
(i) k**i.h**us	*!	
(ii) ☞ ki.**tus**		*

```
Cand.(i): I:    k  I  t  h  u  s        Cand.(ii): I:   k  I   t  h  u   s
                |  |     |  |  |                        |  |   |     |   |
          O:   *k  I     h  u  s                  O:    k  I   t     u   s
                 \/       \ | /                          \/     \   |   /
          D:     σ          σ                     D:     σ          σ
```

What we have here is a predictive account of Coda Condition-driven cluster simplification. As discussed at the outset of this paper, theories of prosody which assume coda conditions are able to assure that the strings in (17) and (18) must undergo some form of string modification. However these theories are unable to predict the specifics of the process-- in other words, they are unable to characterize the impetus behind a particular grammar favoring say C_1 deletion over C_2 deletion. Here it is proposed that the Contiguity Constraint, properly understood in terms of prosody, captures this distinction through constraint domination.

The hiatus resolution facts discussed above also submit to an analysis which assumes conflicting (relativized) contiguity constraints. Remember that in these cases a language may choose to consistently delete either the first or second member of a VV sequence:

19. (a) Iraqw CV_1V_2C --> $CV_2.C$

/da:ng**i**-e:mo/	da:nge:mo	'twins'
/lam**a**-e:mo/	lame:mo	'lies'
/wan**e**-a/	wana	'maybe it is'
/dir**i**-a ho:ta:n/	dira ho:ta:n	'we live here'

(b) Kashaya CV_1V_2C --> $CV_1.C$

/malucma-**î**m̓ic-ʔ/	malúc^{h}mabiʔ	‘start to bake (pl)’
/c^{h}i-n̓e-**a**n̓-I/	c^{h}ide:du	‘carry along’
/ca^{h}no-wǎ-**e** šoc-I/	cahnowá šoci	‘listen, he’s singing’

Clearly such cases of deletion involve a prosodic component: the need for a syllable to begin with an onset consonant drives the deletion process. But why delete V_1 and not V_2 in Iraqw; likewise, why does V_2 delete and not V_1 in Kashaya? Again these fine-tuned results of a prosodically-driven process may be understood as a particular grammar’s desire to maintain certain types of contiguity relations. For cases like Iraqw, the maintenance of contiguity relations at the junctures of syllables has a higher priority than the maintenance of such relations within syllables:

20. CV_1V_2C --> $CV_2.C$ (Iraqw) [Assumed: ONSET, DEP-IO >> MAX-IO]

/dir**i**-a ho:ta:n/ dira ho:ta:n ‘we live here’

J-CONTIG >> D-CONTIG [Domain = Syllable]

/di**ri-a h**o:ta:n/	J-CONTIG	D-CONTIG
(i) di.r**i**. **h**o:.ta:n	*!	
(ii) ☞ di.**ra**. ho:.ta:n		*

```
Cand.(i): I:   d I r I a h o: t a: n    (ii) I:   d I r I a h o: t a: n
               | | | |   | |  | |  |              | | |   | | |  | |  |
          O:  *d I r I   h o: t a: n         O:   d I r   a h o: t a: n
               \/  \/    \ /  \ | /               \/  \  /  \/   \ | /
          D:   σ   σ     σ    σ              D:    σ    σ    σ     σ
```

In Kashaya, on the other hand, contiguity relations within syllables hold at the expense of blurring such relations at the boundaries of syllables:

21. CV_1V_2C --> $CV_1.C$ (Kashaya) [Assumed: ONSET, DEP-IO >> MAX-IO]

/c^{h}i-n̓e-**a**n̓-I/ c^{h}ide:du 'carry along'

D-CONTIG >> J-CONTIG [Domain = Syllable]

/c^{h}i-**n̓e-an̓**-I/	D-CONTIG	J-CONTIG
(i) c$^{h.}$i.**da**:.du	*!	
(ii) ☞ c^{h}i.d**e**:.**d**u		*

```
Cand.(i): I:   ch I n̓ e  a n̓ I      Cand.(ii): I:   ch I  n̓ e a n̓ I
               |  | |    | |  |                     |  |  | |    | |
          O:  *ch I  d   a: d u               O:    ch I  d e:  d u
               \ /  \  /   \ /                       \ /  \ /    \ /
          D:    σ    σ      σ                 D:      σ    σ      σ
```

By extending contiguity effects to the I-O domain and allowing them to evaluate the prosodic units which make up morphemes, we have achieved a greater understanding of prosody-driven cluster simplification processes. Conflicting relativized contiguity constraints like Domain and Juncture Contiguity illustrate a factorial typology which accurately predicts the various modes of consonant and vowel deletion attested in language. Hence we have a more explanatory account of the string modification processes which result in cluster simplification.[12]

There are of course other string modification processes beside cluster simplification which disrupt contiguity relations between input and output segments. A prominent example being

---

[12]This is not to say that this account predicts that each mode of cluster simplification (C_1/V_1 deletion versus C_2/V_2 deletion) is equally distributed across language. Such a prediction would in fact be inaccurate. The patterns of cluster simplification discussed here may be broken down into those which are *unmarked* and those which are *marked*--for example, considering frequency, V_1 and C_1 deletion are more widely attested than V_2 and C_2 deletion; hence the former being the unmarked case while the latter takes the status of the marked case. Although the relative ranking of juncture and domain contiguity constraints symmetrically predicts the occurrence of each type of cluster simplification, this prediction should not be confused with a statement of markedness. The relative rankings between constraints yield a typology of phonological processes allowed by language. How such a typology relates to markedness issues is a distinct question, a question which has received some discussion in the OT literature (cf. Prince and Smolensky, 1993; Smolensky, 1993; and McCarthy and Prince, 1994, for some examples). In fact most of these works have focused on questions of segmental markedness, McCarthy and Prince (1994) being the exception. Here the issue concerns the prominence of one particular ranking of two constraints in grammar. Issues like these may indeed be beyond the level of the substantive universals assumed by the theory and ultimately rest in a certain articulation of the framework's formal universals.

epenthesis. Clearly the facts surrounding such processes bear on the proper formalization of the relativized contiguity constraints.

2.0 CONTIGUITY AND THE LOCUS OF EPENTHESIS

Let us begin with a case of epenthesis which has commanded the attention of phonological research for the last fifteen years: the two types of epenthesis exhibited by Arabic dialects.[13] Arabic dialects can be broken into two sets with respect to the locus of epenthetic vowels within triconsonantal clusters. In one set of dialects, which I will refer to as the Cairene group, an epenthetic vowel is inserted between the second and third consonant of a medial triconsonantal cluster: /...$VC_1C_2C_3V$.../ --> [...$VC_1.C_2$**v**$.C_3V$...]. Another set of dialects, which I will refer to as the Iraqi group, exhibits an epenthetic vowel between the first and second consonant of a medial CCC cluster: /...$VC_1C_2C_3V$.../ --> [...$V.C_1$**v**$C_2.C_3V$...]. Interestingly, the locus of epenthesis in these dialects converges for instances of medial quadriconsonantal clusters. In this environment both dialects minimize the epenthesis process and insert only one vowel between the second and third consonant: /...$VC_1C_2C_3C_4V$.../ --> [...$VC_1.C_2$**v**$C_3.C_4V$...]. This convergence between the two dialect sets is what makes this case challenging for any theory of epenthesis with claims on universality: such a theory must at the same time predict both the differences between the dialect sets (which in fact exhibit general epenthesis strategies used by languages other than Arabic) and their similarities in quadriconsonantal environments. So the grammars of these dialects must include mechanisms which allow them to diverge and converge on very similar sets of data-- to this end the general strategy has been to allow each grammar to treat the *stray* consonant of the cluster differently and rely on some means of minimizing the structure derived from the presence of epenthetic segments.

[13] See Broselow (1980, ‘82, ‘92), Selkirk (1981), Itô (1986, ‘89), Lamontagne (1993), Mester & Padgett (1994), and more recently Farwaneh (1995).

Looking at the output representations of these cases with an eye towards contiguity, we see that the presence of the epenthetic vowel generally serves to disrupt the sequencing of the underlying segments:

22. (a) Cairene Arabic: /...VCCCV.../

VC#	ka.tab	'he wrote'
VC**C**+**C**	ka.tab**.t**_i_**.l**u	'I wrote to him'
VC**C**#**C**	ka.tab.**t**_i_. **g**a.waab	'I wrote a letter'

(b) Iraqi Arabic: /...VCCCV.../

VC#	ki.tab	'he wrote'
VC**C**+**C**	ki.ta.**b**_i_**t**.la	'I wrote to her'
VC**C**#**C**	ki.ta.**b**_i_**t**. mak.tuub	'I wrote a letter'

(c) Cairene & Iraqi: /...VCCCCV.../

/katab**tl**ha/--> ka.tab.**t**_i_**l**.ha 'I wrote to her'

In all of the above cases there is a contiguity violation. However when we look at contiguity in terms of prosodic domains, we immediately see a difference between the two sets of dialects. For the Cairene group in (22a) we see that contiguity is violated between syllables; whereas in the Iraqi group (22b), contiguity relations are maintained between syllables but violated within syllables. These two patterns can be achieved through the interaction between the relativized contiguity constraints D-CONTIG and J-CONTIG. When domain contiguity effects take priority over juncture contiguity, the epenthetic vowel is predicted to occur between the second and third consonants of the cluster, yielding a case where the stray consonant serves as the onset of the syllable supported by the epenthetic vowel:[14]

23. Cairene: D-CONTIG >> J-CONTIG [Assumed: *Stray-C, Max-I/O >> Dep-I/O]

/...$VC_1C_2C_3V$.../	D-CONTIG	J-CONTIG
(i) V.$\mathbf{C_1}v\mathbf{C_2}$.$C_3$V	*!	
(ii) ☞ VC_1.$\boldsymbol{C_2}v$.$\mathbf{C_3}$V		*

```
Cand.(i): I:    V  C1    C2  C3  V          Cand.(ii): I:  V  C1  C2     C3  V
                |  |     |   |   |                         |  |   |      |   |
          O:   *V  C1  v C2  C3  V                     O:  V  C1  C2  v  C3  V
                |    \ | /    \ /                           \ /    \ /    \ /
          D:    σ      σ       σ                       D:   σ       σ      σ
```

Reversing the ranking between these two constraints predicts the Iraqi case: here juncture contiguity is maintained at all costs, so the epenthetic vowel is situated in a context where it is flanked by two consonants within the same syllable and hence incurs a violation of domain contiguity. Here the stray consonant serves as the coda of the syllable supported by the epenthetic vowel.

[14]A comment on *Stray-C: this constraint essentially requires that all segments be parsed into a syllable and may be interpreted as a post-correspondence version of Parse which bears no relation to faithfulness. Since in correspondence-based theories faithfulness is determined independent of over- and under-parsing, it is possible to have an unsyllabified consonant surface in the output without violating faithfulness constraints like Max-I/O-- here the segment would be in violation of *Stray-C. In other words, the lack of surface syllabification does not entail the lack of phonetic realization as was the case in containment-based theories. A consonant which violates *Stray-C in the output will be phonetically realized. As pointed out in Section 2.2.1, the phonological gain here will be an account of consonant extraprosodicity and quantity insensitivity.

24. Iraqi: J-CONTIG >> D-CONTIG [Assumed: *Stray-C, Max-I/O >> Dep-I/O]

$/VC_1C_2C_3V/$	J-CONTIG	D-CONTIG
(i) ☞ $V.\mathbf{C_1}v\mathbf{C_2}.C_3V$		*
(ii) $VC_1\,.\boldsymbol{C_2}v.\mathbf{C_3}V$	*!	

It would appear then that the relativized contiguity constraint is able to characterize the difference in the locus of epenthesis in the two sets of Arabic dialects. Depending on the relative ranking of domain and juncture contiguity, the stray consonant of the triconsonantal cluster will be assigned either to the onset or the coda of a syllable supported by an epenthetic vowel. The convergence of the two dialects in the treatment of quadriconsonantal clusters also follows straightforwardly here. Minimal epenthesis arises from either one of the two general rankings in (25).

25. Minimal Epenthesis

(a) Dep-I/O >> J-CONTIG,D-CONTIG
(b) J-CONTIG >> D-CONTIG,Dep-I/O

Both rankings have the effect of minimizing epenthetic vowels in the output. In (25a), a high ranking of Dep-I/O predicts, by virtue of minimal violation, that only one vowel will be inserted into a quadriconsonantal cluster:

26. Dep-I/O >> J-CONTIG,D-CONTIG [*Stray-C, Max-I/O >> Dep-I/O]

$/...VC_1C_2C_3C_4V.../$	Dep-I/O	J-CONTIG	D-CONTIG
(i) ☞ $...VC_1.\mathbf{C_2}v\mathbf{C_3}.C_4V...$	*		*
(ii) $...VC_1.\mathbf{C_2}v\mathbf{.C_3}v.\mathbf{C_4}V...$	**!	**	

The ranking in (25b) makes a similar prediction. Here juncture contiguity is ranked higher than domain contiguity. Since nonminimal epenthesis creates two open syllables, juncture contiguity will be violated twice (between C_2 and C_3; and between C_3 and C_4). Minimal epenthesis on the other hand satisfies juncture contiguity:

27. J-CONTIG >> D-CONTIG,Dep-I/O [*Stray-C, Max-I/O >> Dep-I/O]

/...$VC_1C_2C_3C_4V$.../	J-CONTIG	D-CONTIG	Dep-I/O
(i) ☞ ...$VC_1.\mathbf{C_2}v\mathbf{C_3}.C_4V$...		*	*
(ii) ...$VC_1.\mathbf{C_2}v.\mathbf{C_3}v.\mathbf{C_4}V$...	*!*		**

In summary, the patterns of epenthesis exhibited in Arabic may be explained as following from the effects of contiguity requirements imposed on the I/O-domain. But this analysis is much more than just an analysis of Arabic data. The patterns displayed by the Arabic dialects reflect the general options available to languages which resort to epenthesis to break up sequences of consonants. For example, the Cairene pattern illustrates an option where the stray consonant surfaces as the onset of a syllable, an option employed by other languages as well-- to name two, Kashaya (Oswalt, 1961; Buckley, 1994) and Central Siberian Yupik (St. Lawrence Island) (Krauss, 1975). The Iraqi pattern involves associating the stray consonant with the coda of a syllable. This pattern, the more frequent of the two, is found in Mohawk (Michelson, 1988, ‘89), Bulgarian (Aronson, 1968; Scatton, 1975; Zec, 1988), and Yawelmani (Newman, 1944) to name but a few languages. The relativized Contiguity Constraint is then a truly general theory of string modification processes-- not only does it predict certain modes of prosody-driven cluster simplification effects via deletion, its predictions also encapsulate such cluster simplification process which appeal to various modes of epenthesis.

This account of epenthesis also makes several predictions which as far as I know no prior theory of similar phenomenon makes. For example, there is another *general* ranking which must be added to those in (25) to complete the *factorial typology*: namely where D-CONTIG is dominant.

This ranking predicts the possibility of nonminimal epenthesis. Although such cases have not received much attention in the literature, we will see below that they do occur, hence providing strong support for the present theory. Likewise, the present account of epenthesis predicts the possibility of suspending certain types of epenthesis patterns at the periphery of stems, where contiguity requirements are not in effect. This subsumes facts that have sometimes come under the rubric of extrametricality. Again, as we shall see below, these predictions are borne out.

2.1 Prediction: Nonminimal Epenthesis

As we saw in (25), the relative rankings between D-CONTIG, J-CONTIG, and Dep-I/O yield two general cases which both predict that epenthesis be minimal when two stray consonants exist. There is however, one final general ranking between these constraints which predicts that epenthesis be nonminimal in this context. This ranking holds domain contiguity as the dominant constraint:

28. D-CONTIG >> J-CONTIG,Dep-I/O

The ranking of constraints in (28) requires the maintenance of all contiguity relations within syllables at the expense of violating contiguity at the junctures between syllables. Thus, when there are two stray consonants, multiple Dep-I/O violations creating two open syllables will be the only way to satisfy D-CONTIG. This is illustrated below by the tableau in (29).

29. D-CONTIG >> J-CONTIG,Dep-I/O [*Stray-C, Max-I/O >> Dep-I/O]

/...V$C_1C_2C_3C_4$V.../	D-CONTIG	J-CONTIG	Dep-I/O
(i) ...VC_1.$\mathbf{C_2}v\mathbf{C_3}$.$C_4$V...	*!		*
(ii) ☞ ...VC_1.$\mathbf{C_2}v$.$\mathbf{C_3}v$.$\mathbf{C_4}$V...		**	**

```
Cand.(i): I:     V  C1  C2    C3  C4 V     (ii)  I:      V  C1  C2     C3     C4 V
                 |  |   |     |   |  |               |  |   |      |      |  |
          O:    *V  C1  C2 v  C3  C4 V           O:  V  C1  C2  v  C3  v  C4 V
                  \ /    \ | /     \ /                \ /    \ /    \ /    \ /
          D:       σ       σ        σ            D:    σ      σ      σ      σ
```

Systems which exhibit nonminimal epenthesis have received little discussion in the current phonological literature. In fact they are predicted not to exist by several theories of such phenomenon. For example, the directional syllabification account of epenthesis in Itô (1986, ‘89) always predicts minimal epenthesis in cases of two stray consonants regardless of whether the setting of the *directionality parameter* is fixed for *right-association* to syllabic templates or *left-association*-- this is due to the assumption that association to a syllabic template be *maximal* and therefore fill as many templatic slots as possible given the segmental composition of a string.[15] Likewise the OT-based *alignment* approach to epenthesis in Mester and Padgett (1993:83) “derives the Maximality effect [i.e., the maximization of a syllabic template exhibited by minimal epenthesis. GL] as a theorem: the more syllables, the more Fill violations, and the more alignment violations. Hence Itô’s directionality-driven convergence effect between L[eft]-R[ight] and R-L systems in *cccc* clusters follows directly, without additional legislation”.

We have here then a divergence between the present contiguity-based theory and prior theories of epenthesis-- the former predicting systems of nonminimal epenthesis as a possibility in grammar and the latter theories principally ruling out such systems. The morphology of languages is generally uncooperative in assisting in any evaluation of these conflicting predictions-- this being so due to the fact that intricacies of morphological concatenation do not always allow for long contiguous strings of monoconsonantal affixes. In reality there are only a handful of cases with a richness that allows for two (or more) contiguous stray consonants while at the same time simplifying illicit clusters through epenthesis. Two such systems, however, do exhibit nonminimal epenthesis-- the Yuman language Diegueno (Langdon, 1970) and the Hokan language Souheastern Pomo (Moshinsky, 1974).

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[15]Maximality in this case is only sacrificed when the avoidance of onsetless syllables is at issue.

2.1.1 Diegueno

In Diegueno, when a monoconsonantal prefix precedes a root an epenthetic vowel appears between the affix and the root:

30.	(a)	/t-luk/	[tə.luk]	'to bend'
	(b)	/m-was/	[mə.was]	'to be soft, tender'

In this language several monoconsonantal prefixes may precede the root. In these cases, nonminimal epenthesis is attested:

31.	(a)	/s-k-wank/	[sə.kə.wank]/*[sək.wank]	'to turn wrong side out'
	(b)	/t-p-kʷir/	[tə.pə.kʷir]/*[təp.kʷir]	'to wind'

An extreme case of nonminimal epenthesis is seen in (32) where three epenthetic vowels surface.

32. /t-x-m-kʷan/ [tə.xə.mə.kʷan]/*[təx.mə.kʷan]/ *[tə.xəm.kʷan] 'to wrap a ball'

That these are genuine instances of quality-insensitive, nonminimal epenthesis and not just cases of epenthesis triggered by stringwise, quality sensitive constraints on adjacent consonants becomes apparent when we compare the nonattested patterns in (31) and (32) with the following examples.

33.	(a)	[ʔə**p**.**kʷ**aɬ]	'yellow jacket'	[compare (31b)]
	(b)	[ka**m**.**k**ac]]	'California'	[compare (32)]

The nonattested pattern in (31b), **tə**p.kʷ**ir*, cannot be ruled out due to some prohibition on adjacent consonants since the CC cluster in this case, *pkʷ*, is in general tolerated in the language as illustrated in (33a). Likewise the CC cluster in (33b) serves to deflate any account of the (second) nonattested example in (32) which is based on consonantal cooccurrence conditions.

This data from Diegueno, then, supports a prediction of the contiguity theory of epenthesis--namely, that nonminimal epenthesis is indeed an option for languages whose morphology tolerates multiple affixation of monoconsonantal affixes. In (34), I present a summary tableau of the Diegueno case.

34. D-CONTIG >> J-CONTIG,DEP-IO [Assumed: *Stray-C,MAX-IO >> DEP-IO]

/t-p-k^wir/	D-CONTIG	J-CONTIG	DEP-IO
(i) **tәp**.k^wir	*!		*
(ii) ☞ **t**ә.**p**ә.**k^w**ir		**	**

```
Cand.(i): I:     t   p  kʷ I  r        Cand.(ii): I:   t     p     kʷ I  r
                 |   |  |  |  |                        |     |     |  |  |
          O:   * t ə p  kʷ I  r                   O:   t  ə  p  ə  kʷ I  r
                  \|/    \ | /                          \ /   \ /    \ | /
          D:       σ       σ                      D:     σ     σ       σ
```

As well as exhibiting the effects of contiguity requirements relativized to prosodic domains, Dieguено also exhibits phenomena which are best analyzed in terms of contiguity defined along morphological dimensions. Consider again the monomorphemic form in (33a). This word begins with a glottal stop followed by a schwa. Langdon notes that a lot of monomorphemic forms begin precisely with this sequence of segments and that they are most probably prothetic to the root. Once the initial syllable of such forms is stripped off we are left with a root that begins in a CC cluster, a cluster type not tolerated at the beginning of syllables. Here it would appear that this root-initial cluster is split between two syllables, the first of which is epenthetic:

35. /pkʷaɬ/ [ʔəp.kʷaɬ] 'yellow jacket'
/xpuq/ [ʔəx.pu:q] 'clover'
/psi/ [ʔəp.si:] 'bush'

This mode of augmentation differs from that displayed by the monoconsonantal prefixes in (30). The question here is why do roots invoke prothetic augmentation (36a) while prefixes require the opposite pattern (36b)?

36. (a) Roots: /CCVC/ --> [ʔəC.CVC]
(b) Prefixes: /C-CVC/ --> [Cə.CVC]

The answer to this question involves recognizing an interaction between contiguity within the *root-domain* and a constraint which requires that words begin with lexically specified elements (i.e., Left-Anchor(S_1,S_2)-- cf. McCarthy and Prince, 1995:371). With root contiguity ranked higher than Left-Anchor, the mode of augmentation in (36a) is predicted for roots. In the first candidate of the following tableau, the segments making up the root in the input are all contiguous. The second candidate, although properly anchored, violates Root-CONTIG with an epenthetic schwa nestled between the first two consonants of the root.

(37) Root Augmentation: Root-CONTIG >> Left-Anchor

/**CC**VC/	Root-CONTIG	Left-Anchor
(i) ☞ *ʔə***C.C**VC		*
(ii) **C***ə***.C**VC	*!	

To yield the mode of augmentation characteristic of prefixes, Left-Anchor must be ranked higher than the phonologically defined D-CONTIG and J-CONTIG. A matter to which we will turn in detail below concerns the evaluation of contiguity requirements at the periphery of a stem. The prothetic mode of augmentation is precisely this environment. Saving more in depth discussion of contiguity assessment at domain peripheries for later, it is sufficient here to simply note that D-CONTIG (as well as J-CONTIG) is not violated in cases of prothesis. The following tableau completes our distinguishing the two modes of string augmentation exhibited in Diegueno.

(39) Prefix Augmentation: Left-Anchor >> D-CONTIG >> J-CONTIG

/**C**-**C**VC/	Left-Anchor	D-CONTIG	J-CONTIG
(i) *ʔə***C**.**C**VC	*!		
(ii) ☞ **C***ə*.**C**VC			*

The Diegueno data then support a major prediction made by the factorial typology of contiguity constraints with Faithfulness: when D-CONTIG is ranked higher than both J-CONTIG and DEP-I/O, candidates exhibiting nonminimal epenthesis are most harmonic and thus are predicted to occur in languages. With these facts we have a fully instantiated factorial typology in hand-- all possible rankings of contiguity constraints and DEP-I/O converge on two basic attested patterns of epenthesis: minimal epenthesis as in Arabic, and nonminimal epenthesis as in Diegueno and, as we shall see below, Southeastern Pomo.

2.1.2 Southeastern Pomo

In her detailed study of the phonotactics of Southeastern Pomo (Moshinsky, 1974), Goodman (1990) notes a significant degree of nonminimal epenthesis in the verbal suffix system which consists solely of monoconsonantal affixes. A summary of the relevant data is given in (40).

40. Epenthesis in Southeastern Pomo Suffixes[16]

(a)	/(C)CV+C/ --->	[(C)CVC]	
	/ʔ-ke-t/	[ʔket]	'grab something'
(b)	/(C)CVC+C/		
	/(C)CV+C+C/ --->	[(C)CV.C**v**C]	
	/ʔ-sat-t/	[ʔsa.t**i**t]	'feel something with hands'
	/ci-q-t/	[ci.q**a**t]	'carry a lot of things away'
(c)	/(C)CVC+C+C/		
	/(C)CV+C+C+C/ --->	[(C)CVC.C**v**C]	
	/s-kʻot-l-t/	[skʻot.l**i**t]	'he shovelled all day'
	/b-kʻo-w-l-t/	[bkʻow.l**i**t]	'tell something to a lot of people'
(d)	/(C)CVC+C+C+C/		
	/(C)CV+C+C+C+C/--->	[(C)CVC.C**v**.C**v**C]	
	/b-lit-k-q-t/	[blit.k**i**.q**a**t]	'stick out the tongue'
	/s-wo-t-k-q-t/	[swot.k**i**.q**a**t]	'dissolve'
(e)	/(C)CVC+C+C+C+C/		
	/(C)CV+C+C+C+C+C/ --->	[(C)VC.C**v**.C**v**.C**v**C][17]	
	/ʔyotʻ-q-m-q-t/	[yotʻ.q**a**.m**a**.q**a**t]	'three refuse'
	/ca-l-q-m-q-t/	[cal.q**a**.m**a**.q**a**t]	'many are rolling it along'

[16] This data is taken (in an abridged form) from Goodman (1990:146-147).

[17] These forms have been reported to vary with [(C)CVC.CC**v**.C**v**C] forms. So, [yotʻ.qm**a**.q**a**t] and [cal.qm**a**.q**a**t] are possible alternate forms.

The pattern in (40e) is the real challenge for theories which allow only for minimal epenthesis.[18] Such theories predict the following incorrect pattern:[19]

41. /(C)CVC+C+C+C+C/
/(C)CV+C+C+C+C+C/ ---> *[(C)VC.C**v**C.C**v**C]
/ʔyotʿ-q-m-q-t/ *[yotʿ.q**a**m.q**a**t] 'three refuse'
/ca-l-q-m-q-t/ *[cal.q**a**m.q**a**t] 'many are rolling it along'

As pointed out by Goodman, the relevant generalization in the data of (40) is that all stems must end in a final consonant.[20] Following McCarthy (1993), we may assume that this fact reflects the effects of the constraint Final-C:

---

[18] This is not to say that the other cases are not relevant to the evaluation of adequate theories of epenthesis. In fact the data in (40c) and (40d) are also in direct conflict with the predictions of the pre-OT *Directionality-approach* (Itô 1986, '89) to epenthesis-- this approach predicts unattested patterns for these cases. Now the OT-based *Alignment-approach* (Mester and Padgett, 1993) can indeed account for this data with Align-R(ight) and a high ranking of the constraint Final-C (cf. McCarthy, 1993). This approach, however, is unable to account for all of the data in (40e).

[19] It should be pointed out that these theories differ on how they characterize the alternate patterns for these forms: [yotʿ.qm**a**.q**a**t] and [cal.qm**a**.q**a**t]. Here one might assume that non-initial onsets can be (idiosyncratically) complex and that the mapping process in the directional approach can appeal at times to complex onsets for help in organizing a string. Even with this assumption, mapping either form L-R or R-L will yield an incorrect result:

L-R: *cal.qmaq.t**a** R-L: *cal.q**a**m.q**a**t

Assuming the creation of syllables by GEN can appeal to the notion *idiosyncratic complex onset* (or that other constraints define the locus of word-internal complex onsets, constraints like those responsible for syncope perhaps), will allow the alignment approach to characterize this pattern. In fact the alignment approach will favor any candidate which has a CCV syllable where other candidates have CVC-- such a syllable, being one less mora than CVC, will serve to create a more harmonic alignment of adjacent syllables with an edge. So, although the alignment approach cannot characterize the nonminimal alternate, it can indeed (with Align-R & Final-C) account for the complex-onset variant provided some constraints define under what conditions such an onset is tolerated.

As we will see below, the *contiguity-approach* proposed here can account (separately) for both variants of the data in (40e). Assuming the norm is the variant with the non-complex onset, this approach will yield nonminimal epenthesis. However, if the generation of an idiosyncratic word-internal complex onset is at times allowed, this approach will still provide the correct output.

[20] In fact Goodman does not say this in as many words: her mode of attack is to characterize the final suffix in all these forms as *extrametrical* then sift any generalizations from the residue. Implicit in this analysis, however, is that all forms end in a final consonant and that once this element is formally licensed a pattern emerges. In an OT-based analysis, Final-C will serve to grant the final consonant of the stem special status.

42. FINAL-C: $*V]_{PrWd}$

Once the final consonant is extracted from the data, the following general pattern emerges for the forms in (40c)-(40e):

43. All suffixes which are not preceded by a vowel serve as the onset of open syllables headed by epenthetic vowels.

What is not attested, again except word-finally where the effects of Final-C are active requiring stems to terminate in a consonant, are CVC syllables which are headed by epenthetic vowels. Thus Pomo distinguishes between open and closed syllables with epenthetic nuclei, where the former appear robustly while the later are for the most part prohibited. This distinction may be formally characterized in terms of relativized contiguity constraints: syllable-domain contiguity is more highly valued by the grammar than syllable-juncture contiguity, and therefore when it comes down to choosing candidates exhibiting epenthesis contiguity violations of the latter type are more readily tolerated. The only instance of a domain contiguity violation seen is in stem-final position. Here the requirement that stems end in a consonant (42), takes priority over contiguity requirements within the syllable, yielding the only case of a CVC syllable with an epenthetic nuclei.

We can begin a formal characterization of the data in (40) by first focusing on the data in (40b). Here we see through conflict between Final-C and D-CONTIG, that the former is ranked higher than the latter:

44. /(C)CVC+C/; /(C)CV+C+C/ ---> [(C)CV.C**v**C]

FINAL-C >> D-CONTIG [Assumed: *Stray-C,Max-I/O >> Dep-I/O]

/ci-**q**-**t**/	FINAL-C	D-CONTIG
(i) ☞ [ci.**q***a***t**]		*
(ii) [ci**q**.**t***a*]	*!	

Moving to the more complex case in (40d) will provide us with the ranking between D-CONTIG and J-CONTIG:

45. /(C)CVC+C+C+C/
/(C)CV+C+C+C+C/ ---> [(C)CVC.C**v**.C**v**C]

D-CONTIG >> J-CONTIG

/s-wo-**t**-**k**-**q**-**t**/	D-CONTIG	J-CONTIG
(i) ☞ [swo**t**.**k***i*.**q***a***t**]	*	*
(ii) [swo.**t***i***k**.**q***a***t**]	**!	
(iii) [swo.**t***i*.**k***i*.**q***a***t**]	*	**!

All candidates in this tableau violate D-CONTIG once due to the effects of Final-C. The first two candidates differ along the shape of the syllable supported by the epenthetic vowel: in the first candidate the syllable is open (CV) while in the second it is closed (CVC). The open syllable will incur a violation of juncture contiguity while the closed one violates domain contiguity. Since CVC syllables with epenthetic nuclei are avoided in this language, D-CONTIG must be ranked higher than J-CONTIG and therefore the first candidate will be more harmonic. The third candidate exemplifies a case of nonminimal epenthesis. Although it too only violates D-CONTIG once, it exhibits multiple

J-CONTIG violations and is thus less harmonic than the (optimal) first candidate. Hence in this configuration epenthesis can be said to be minimal.

Finally, the nonminimal epenthesis case in (40e) establishes the ranking between D-CONTIG and Dep-I/O: since two CV syllables occur in the output instead of one CVC, Dep-I/O, like J-CONTIG, is violated several times in order to preserve contiguity relations within syllables:

46. /(C)CVC+C+C+C+C/
/(C)CV+C+C+C+C+C/ ---> [(C)VC.C**v**.C**v**.C**v**C]

D-CONTIG >> J-CONTIG,DEP-IO

/ca-**l**-**q**-**m**-**q**-**t**/	D-CONTIG	J-CONTIG	Dep-I/O
(i) ☞ [ca**l**.**q***a*.**m***a*.**q***a***t**]	*	**	***
(ii) [ca**l**.**q***a***m**.**q***a***t**]	**!		**
(iii) [ca.**l***a***q**.**m***a*.**q***a***t**]	**!	*	***
(iv) [ca.**l***a*.**q***a***m**.**q***a***t**]	**!	*	***

All relevant candidates are given in the above tableau. The first two candidates illustrate the crucial ranking D-CONTIG >> Dep-I/O, hence sealing the fate of any candidate exhibiting minimal epenthesis. Of the various nonminimal epenthesis cases illustrated, i.e., (i), (iii) and (iv), this ranking correctly predicts the first candidate as optimal, a candidate which in itself reflects a tendency for Southeastern Pomo to avoid (non-final) CVC syllables with epenthetic nuclei.

This completes our discussion of epenthesis in Southeastern Pomo, or more generally our discussion of nonminimal epenthesis.[21] With Pomo and Diegueno in hand, all possible rankings of the relativized contiguity constraint and the faithfulness constraint Dep-I/O yield attested surface

[21]One final point: I have not provided a formal account of the data in (40c) but this now follows straight forwardly from the ranked constraints above: a (C)CV(+)C+C+C pattern can only be syllabified as [(C)CVC.C**v**C]. The only other relevant alternative candidate, [(C)CV.C**v**.C**v**C], incurs multiple Dep-I/O violations and a violation of J-CONTIG-- constraint violations above and beyond the actual surface form.

patterns. Although the current account of epenthesis is weaker than the other accounts referred to in this section, since it does not rule out in principle nonminimal epenthesis, we see here that it is more in tune with the actual facts of language.

2.2 Prediction: Epenthesis at the Periphery of Stems

Accounting for the placement of epenthetic material as an effect of contiguity requirements makes an interesting prediction when the *stray* consonant(s) is in either stem-initial or final position. In such cases we'd expect to see the epenthetic vowel occupy the absolute stem-initial/final position since in such a position none of the relativized contiguity constraints would be violated-- i.e., with respect to contiguity, peripheral epenthesis will always be more harmonic than non-peripheral epenthesis because in the former case input segments remain stringwise adjacent in the output:

47. Peripheral Epenthesis Harmony Status

(a) /#C_1C_2V.../ --> [#**v**C_1.C_2V...] $\succ$ [#C_1**v.**C_2V...]

(b) /...VC_1C_2#/ --> [VC_1.C_2**v**#] $\succ$ [...V.C_1**v**C_2#]

In both cases, peripheral epenthesis does not disrupt any contiguity relations between correspondents. This contrasts with non-peripheral epenthesis which triggers a juncture contiguity violation in (47a) and a domain contiguity violation in (47b).

Given the harmonic status of peripheral epenthesis, we'd expect to see this pattern surface when the constraint hierarchy leaves it solely up to the contiguity constraint to decide the locus of epenthetic material. What is of interest here is that the more harmonic nature of peripheral epenthesis can serve to skew what appears to be a regular pattern of epenthesis in word-medial contexts. For example, in cases where D-CONTIG is dominant, a word-medial stray consonant will regularly syllabify as an onset (48a). Potentially this pattern may shift word-initially to a contiguity respecting pattern where the initial stray consonant surfaces as a coda in the output (48b).

48. (a) Word-medial stray consonant ($\boldsymbol{C_2}$): onset-pattern

$/VC_1\boldsymbol{C_2}C_3V/$	D-CONTIG	J-CONTIG
(i) $V.\mathbf{C_1}v\mathbf{C_2}.C_3V$	*!	
(ii) ☞ $VC_1.\boldsymbol{C_2}v.\mathbf{C_3}V$		*

(b) Word-initial stray consonant ($\boldsymbol{C_1}$): coda-pattern

$/\#\boldsymbol{C_1}C_2V.../$	D-CONTIG	J-CONTIG
(i) $\#\mathbf{C_1}\,v.\mathbf{C_2}V$		*!
(ii) ☞ $\#vC_1.C_2V$		

```
Cand.(i): I:   # C1    C2   V...          Cand.(ii): I:   #    C1  C2  V...
                 |       |    |                                 |    |    |
          O:   *#C1  v  C2   V...                    O:   #  v  C1  C2  V...
                   \ /     \  /                                \  /    \  /
          D:        σ        σ                           D:       σ       σ
```

Likewise, such epenthesis-reversals potentially exist when J-CONTIG is dominant: here a stray consonant will be syllabified as a coda word-medially (49a), but in word-final position this consonant may surface in the onset of a syllable (49b).

49. (a) Word-medial stray consonant ($\boldsymbol{C_2}$): coda-pattern

$/VC_1\boldsymbol{C_2}C_3V/$	J-CONTIG	D-CONTIG
(i) ☞ $V.\mathbf{C_1}v\mathbf{C_2}.C_3V$		*
(ii) $VC_1.\boldsymbol{C_2}v.\mathbf{C_3}V$	*!	

(b) Word-final stray consonant (***C***$_2$): onset-pattern

/...$VC_1\mathbf{C_2}$#/	J-CONTIG	D-CONTIG
(i) ...V.$\mathbf{C_1}\,v\mathbf{C_2}$#		*!
(ii) ☞ ...V$\mathbf{C_1}$.$\mathbf{C_2}v$#		

Although peripheral epenthesis in the above examples is more harmonic than the non-peripheral cases, this is not to say that the current theory predicts that reversals in patterns of epenthesis *must always* be attested in the syllabification of word-medial versus word-initial/final stray consonants. Cases of epenthesis-reversal are predicted to occur only when it is solely up to the relativized contiguity constraint to decide the locus of epenthesis. Other more highly ranked constraints may serve to mark any such reversals as non-harmonic. An example of this was seen in the analysis of the Diegueno data above. When ranked higher than the contiguity constraints, a constraint like Left-Anchor (39), which requires prosodic words to begin with lexical material, can serve to choose the non-peripheral epenthesis pattern (48b.i) over the contiguity-satisfying, peripheral pattern (48b.ii). Likewise, a constraint like Final-C, when ranked higher than the contiguity constraints, will force a stem to always end in a consonant regardless of any contiguity violations-- hence, (49b.i) will be chosen as optimal over the peripheral epenthetic pattern in (49b.ii).

So peripheral epenthesis, although more harmonic than non-peripheral epenthesis, can be blocked by the effects of independently motivated constraints like Left-Anchor and Final-C. Nevertheless it is a prediction of the current theory that epenthesis-reversals can indeed occur given a ranking of constraints whereby contiguity alone characterizes the locus of epenthetic vowels. In other words, part of the factorial typology of the constraints assumed here predicts the possibility of epenthesis-reversals and accordingly, if the present account is on the right track, such patterns should be attested to some extent in language. Epenthesis-reversals receive no coherent analysis independent of contiguity constraints-- dubious nongeneralizing constraints like Final-V, Initial-V, Anti-Anchor, etc., would have to be invoked to explain this phenomena. In the present framework, they follow simply from one particular ranking of independently motivated constraints. I am aware of two cases of epenthesis-reversal: one involves the form of some verbal stems in Arabic, while the other involves the distribution of schwa in Central Siberian Yupik (St. Lawrence Island). In both cases, a word-medial pattern of epenthesis where the stray consonant serves as an onset is reversed in word-initial position to a pattern where the stray consonant surfaces as a coda by virtue of peripheral epenthesis. More specifically:

In all Arabic dialects verbal stems exhibit a phenomenon know as *hamazatu l-waSli* (the "elideable" glottal stop). McCarthy & Prince, (1990:146) summarize this phenomenon as follows:

> Although medial syllables begin with exactly one consonant, initial sequences of two consonants occur. These appear in verb forms and their derivatives that have what is traditionally called hamzatu l-waSli, the "elideable" glottal stop. Examples include Form 7 ʔinfaʕal, Form 8 ʔiftaʕal, and Form 10 ʔistafʕal. The distribution of this property forces any generative phonological analysis to say that the initial glottal stop and the vowel following it are not in fact elided, but rather inserted in the course of syllabification. For example, the underlying representation of the Form 8 stem is ftaʕal, although on the surface this word in isolation is pronounced as ʔiftaʕal.

That this phenomenon takes place in dialects like Cairene Arabic (50a), where in medial contexts a stray consonant is syllabified as an onset (50b), provides support for a contiguity-based theory of epenthesis. In fact no other general theory of epenthesis, either *directionally-based* (Itô, 1986. '89) or *Alignment-based* (Mester and Padgett, 1993), can account for this data. Tableaux characterizing the following patterns were given above in (48)[22].

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[22] As noted in Broselow (1983), word-initial CC clusters in the loan word vocabulary of Cairene Arabic receive a different analysis:

"floor" --> f[i]loor
"plastic" --> b[i]lastic

My assumptions concerning these forms follow current OT conceptualizations of lexical stratification as constraint reranking (see Itô and Mester, 1995, for insightful discussion of these issues). For this part of the Cairene vocabulary, Left-Anchor must be ranked higher than the contiguity constraints. As John McCarthy points out, this results in a form which is, phonetically speaking, more similar to its realization in the source-model.

50. (a) Cairene Arabic (Peripheral epenthesis; stray-C = coda):

/**g**tamaʕ/ --> [*ʔi***g**.ta.maʕ] / *[**g***i*.ta.maʕ]

(b) Cairene Arabic (Medial epenthesis; stray-C = Onset):

/...VC**C**+C.../ --> [ka.tab**.t***i***.**lu]

/...VC**C**#C.../ --> [ka.tab.**t***i*. ga.waab]

A similar pattern of augmentation is exhibited in the St. Lawrence Island dialect of Central Siberian Yupik (Krauss, 1975).[23] In this language, with the exception of the homorganic cluster *ŋqx*^{w}, clusters are limited to two consonants and may only surface word-medially. With respect to consonant quality, "Clusters consist of two stops, or two voiceless continuants, or two voiced continuants, or of voiceless continuants and stops, or of voiced nasal or *y* plus stop or voiceless continuant." (Krauss, 1975:52). From the data Krauss provides, it appears that illicit triconsonantal clusters are broken up with an epenthetic schwa heading an open syllable-- i.e., like Cairene, the stray consonant here is syllabified as an onset:

51. /...x**q**f../ ---> [ax.**q***ə*.fik] / *[a.x*ə***q**.fik] "altar"[24]

Turning to word-initial position, we see that stems which appear to begin in CC clusters undergo prothetic augmentation with schwa. In fact initial [ə] in St. Lawrence Island CSY is attested only when followed by a CC-Cluster. Here the distribution of this vowel is predictable: underlying #CC-clusters are broken up by epenthesis of [ə]. In this case, the [ə] is prothetic and hence will not violate Contiguity constraints as illustrated in the Tableaux of (48). Data which illustrate this epenthesis-reversal are given below.

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[23] I thank Eric Baković for bringing this Yupik data to my attention.

[24] Note the form [a:**tx**ani] 'in his name', where a sequence of a voiceless stop followed by a voiceless fricative is tolerated. The presence of this cluster type argues against any account that tries to rule out the ungrammatical option in (51) as following from some type of quality specific cluster condition.

52. Prothetic vowel in #CC-Clusters:

(a) [əf.tuq] / *[f**ə**.tuq] "noise of gunshot"

(b) [əx.kuq] / *[x**ə**.kuq] "tip, end"

(c) [əv.luk] / *[v**ə**.luk] "wave"

It appears then that the epenthesis-reversals predicted by the contiguity-based theory of epenthesis are borne out. Of interest here is that the two cases known to me both involve epenthesis at the initial periphery of words. I have yet to find a clear case of epenthesis-reversal involving the Iraqi pattern-- i.e., with medial /...VC_1**C_2**C_3V.../ --> [...V.C_1*v*$\mathbf{C_2}$.C_3V...] but final /...VC_1**C_2**# / --> [VC_1.$\mathbf{C_2}$*v*#] (J-CONTIG >> D-CONTIG). It remains to be seen whether this gap is systematic or accidental.

2.2.1. Contiguity and Consonant Extraprosodicity

Before closing out this section, one further result of relativizing contiguity and its predictions for stem-peripheral contexts can be briefly investigated. Up to this point we have looked at cases where the contiguity constraint has governed the result of a string modification process such as epenthesis and deletion. However, under certain conditions this constraint can be invoked independent of the effects of faithfulness conditions. For example, the contiguity constraint affects correspondents within and between specified prosodic domains. It follows from this conception of the constraint that the elements which are subject to its effects be included within some prosodic domain. So, for the array of data discussed above, the segments subject to the contiguity constraint all belong to a syllable in the output; or more specifically, these segments satisfy the constraint which I have been referring to as *Stray-C. This need not always be the case-- in other words, differing from the faithfulness scenario depicted in Prince and Smolensky (1993), where insertion and deletion are grounded literally in prosodic over- and under- parsing, a correspondence-based theory of faithfulness does not view the nonsyllabification of segments as a breech of faithfulness. In this theory, a syllabically unaffiliated segment may arise in the output (and therefore be pronounced) by virtue of violating a constraint like *Stray-C which requires of a segment that it be associated with some species of syllabic material.[25] Such a state of affairs may result in a violation of the relativized contiguity constraint: more to the point, when a word-medial consonant remains unsyllabified by virtue of violating *Stray-C, a juncture contiguity violation will be exhibited by the output:

53. Medial *Stray-C Violation: J-CONTIG violated[26]

$$/...C_1V_2C_3C_4V_5C_6.../ \ \text{-->} \ [C_1\mathbf{V_2}.(c_3).\mathbf{C_4}V_5C_6]$$

$$\begin{array}{lcccccc} \text{I:} & C_1 & V_2 & C_3 & C_4 & V_5 & C_6 \\ & | & | & | & | & | & | \\ \text{O:} & C_1 & \mathbf{V_2} & c_3 & \mathbf{C_4} & V_5 & C_6 \\ & \backslash & / & & \backslash & | & / \\ \text{D:} & & \sigma & & & \sigma & \end{array}$$

In the above example, V_2 and C_4 are two correspondents at the edges of adjacent syllables and are therefore required to be contiguous by the effects of Juncture Contiguity (14b). These two segments, however, do not meet the definition of Contiguity in (12) and are therefore noncontiguous and in violation of J-CONTIG.

Following the results of the prior section, we know that juncture contiguity will be satisfied at the periphery of a word. So, in word-final position for example, the effects of *Stray-C and J-CONTIG diverge: the former may under certain conditions be violated while the latter will always be satisfied:

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[25]Here *Stray-C is simply one of several violable constraints which in conjunction result in the Prosodic Hierarchy.

[26] A lower case character within parenthesis will be used to symbolize that a segment is syllabically unaffiliated. Again it should be stressed that this output segment will be phonetically realized.

54. Final *Stray-C Violation: J-CONTIG satisfied

$/...C_1V_2C_3\#/$ --> $[...C_1V_2.(c_3)\#]$

Given the differences in the satisfaction of *Stray-C and J-CONTIG in (53) and (54), an interesting prediction arises: if J-CONTIG is ranked higher than the constraint which forces a violation of *Stray-C, a potential coda consonant will surface unsyllabified word-finally but not word-medially where the effects J-CONTIG are active. Assuming that NoCoda (or in some cases a more specific coda condition, CodaCond) is the driving constraint which compels a violation of *Stray-C (thus, NoCoda >> *Stray-C), ranking J-CONTIG above NoCoda will suffice to ensure that all (word-medial) potential coda consonants are associated with the final position of a syllable. If, under these conditions, a segment was not to be associated with a coda, J-CONTIG would be violated (55i). In such cases, the optimal candidate will exhibit a NoCoda violation (55ii).

55. J-CONTIG >> NoCoda >> *Stray-C (Word-medial context)

$/...CV_1C_2C_3V.../$	J-CONTIG	NoCoda	*Stray-C
(i) $[...C\mathbf{V_1}.(c_2).\mathbf{C_3}V...]$	*!		*
(ii) ☞ $[...CV_1\mathbf{C_2}.\mathbf{C_3}V...]$		*	

```
Cand. (i) I:    C  V1  C2  C3  V        (ii)   I:    C  V1  C2  C3  V
                |  |   |   |   |                     |  |   |   |   |
          O:   *C  V1  c2  C3  V               O:    C  V1  C2  C3  V
                 \ /        \ /                       \ |  /     \ /
          D:      σ          σ                 D:     σ           σ
```

Things are radically different for word-final consonants, however. In this context, contiguity constraints are always satisfied. So under this constraint ranking a word-final consonant will avoid a NoCoda violation by remaining unsyllabified (56i).

56. J-CONTIG >> NoCoda >> *Stray-C (Word-final context)

$/...CV_1C_2\#/$	J-CONTIG	NoCoda	*Stray-C
(i) ☞ $[...CV_1.(c_2)\#]$			*
(ii) $[...CV_1C_2\#]$		*	

```
Cand. (i)  I:   ...C V1 C2#        (ii)  I:   ...C V1 C2#
                   |  |  |                       |  |  |
           O:   ...C V1 c2#              O:   ...C V1 C2#
                    \ /                           \ |  /
           D:        σ                   D:        σ
```

The tableaux in (55) and (56) illustrate an important prediction of the interaction between contiguity constraints and other constraints on syllabic structure. Namely the ranking J-CONTIG >> NoCoda[27] >> *Stray-C will allow an extrasyllabic consonant at the end of a word. This ranking in fact serves to characterize a phenomenon which has been referred to in the literature as *Consonant Extraprosodicity*-- i.e., the syllabically inert behavior of word-final consonants. Here Consonant Extraprosodicity is depicted as nonsyllabification-- i.e., that a consonant behaves as if it is immune to the results of syllabification resides in the fact that it is literally not syllabified.

This account both characterizes and explains the phenomenon of Consonant Extraprosodicity. All prior accounts of this phenomenon must assume some *peripherality condition* on extrasyllabic behavior-- in other words, the grammar must contain a separate statement which restricts extrasyllabic behavior to the periphery of a word (Hayes, 1981, '82; Harris, 1983). Here the *peripherality condition* follows trivially from the fact that contiguity effects have no relevance on a peripheral segment. No reranking of the above constraints will yield a case where a potential coda consonant is extrasyllabic medially but syllabically affiliated finally; thus such an option is correctly predicted to not occur in language. The existence of consonant extraprosodicity as an option in language follows here from the factorial typology of the three constraints discussed above. The

[27]Or any similar constraint.

peripherality condition governing this phenomenon follows from the involvement of contiguity constraints in the I/O-mapping.

With factorial typology in mind, we may ask ourselves what patterns do the other rankings of the above three constraints predict. Any ranking with *Stray-C dominating NoCoda (i.e., *Stray-C >> NoCoda) will predict both medial and final syllabification of potential coda consonants regardless of the ranking of J-CONTIG-- that this is so is due to the fact that violating J-CONTIG will entail a violation of *Stray-C in these cases. Here it is simply more desirable to tolerate NoCoda violations and syllabify all relevant consonants as codas. Such instances of non-Consonant Extraprosodicity are well attested in Language.

A third (and final) pattern follows from the factorial typology of these constraints: namely, a pattern where potential coda consonants in both medial and final positions are not syllabified. This pattern follows from the ranking NoCoda >> *Stray-C,J-CONTIG. Here it is most desirable to never violate NoCoda, hence leaving consonants which would trip this constraint syllabically unaffiliated.[28] This pattern is also robustly attested and is exhibited by languages where CVC syllables pattern with CV syllables with respect to stress assignment, word minima phenomena, and phonotactic regularities.[29] Typically CVC syllables in these languages have been regarded as nonmoraic. Here their nonmoraic nature follows from the fact that they are not syllabified: the mora, being a constituent of the syllable, will not be licensed by a syllabically unaffiliated segment. The following tableaux illustrate the optimality of what we may call the *Light-CVC* pattern.

[28] Other (syllable-independent) constraints will rule out surface forms with long strings of unsyllabified consonants. In fact, as noted in Lamontagne (1993), any truly general theory of phonotactics must appeal to such syllable-independent constraints to account for clustering possibilities in language. On the nature of such constraints see, Prince (1984), Yip (1991), Lamontagne (1993), and Hamilton (1995).

[29] See Hayes (1995:88-89, 303) for a list of languages which illustrate some of these properties.

57. (a) NoCoda >> *Stray-C,J-CONTIG (Word-medial context)

$/...CV_1C_2C_3V.../$	NoCoda	*Stray-C	J-CONTIG
(i) ☞ [...C**V**$_1$.(c$_2$).**C**$_3$V...]		*	*
(ii) [...CV$_1$**C**$_2$.**C**$_3$V...]	*!		

(b) NoCoda >> *Stray-C,J-CONTIG (Word-final context)

$/...CV_1C_2\#/$	NoCoda	*Stray-C	J-CONTIG
(i) ☞ [...CV$_1$.(c$_2$)#]			
(ii) [...CV$_1$C$_2$#]	*!		

To summarize: the relative rankings of the three constraints J-CONTIG, NoCoda, and *Stray-C yield three general patterns: non-Consonant Extraprosodicity (word-medial/final *CVC* is heavy), Consonant Extraprosodicity (word-medial *CVC* is heavy, word-final *CVc* is light), and Light-CVC (word-medial/final *CVc* is light). The unattested pattern where word-medial *CVc* is light and word-final *CVC* is heavy does not follow from any of the possible rankings of these constraints-- thus the current theory correctly characterizes the implication: if *CVc* is light word-medially, then it is light word-finally. The following table illustrates the factorial typology of these constraints and the patterns which arise.

58. Juncture Contiguity Interactions: Input: /...CVC.../
c = unsyllabified consonant

	Factorial Typology: NoCoda; J-Contig; *Stray-C	Medial σ	Final σ
a.	*Stray-C >> NoCoda		

J-Contig

b.	J-Contig >> NoCoda >> *Stray-C	CVC	CVc
c.	NoCoda >> J-Contig,*Stray-C	CVc	CVc

With regards to the ranking in (58c), we see that a prohibition against codas forces the nonsyllabification of certain consonants in the optimal output. This of course is only one of several ways to avoid a NoCoda violation-- much literature in optimality theory has illustrated how faithfulness to the input can be circumvented by the effects of a dominant NoCoda constraint. Given the role of faithfulness constraints in accounting for a large number of phonological processes, we may ask ourselves how such constraints like Max-I/O and Dep-I/O fit into the above typology and what, if any, new patterns are predicted?

Let us consider a conveniently labeled faithfulness constraint, $\mathscr{F}$, which may be interpreted as either Max-I/O or Dep-I/O. Adding this to the set of constraints in (58) will yield eighteen more possible rankings. Most of these rankings, however, converge to yield the three patterns in (58). Besides the three patterns, *non-Consonant Extraprosodicity* (58a), *Consonant Extraprosodicity* (58b), and *Light-CVC* (58c), two more patterns emerge: one which will require a strict CV surface pattern (*Strict-CV)*; and one which will tolerate CVC medially but allow only CV finally (*Final-V*). As is the case with the three patterns in (58), both the *Strict-CV* and *Final-V* pattern are attested. Thus, increasing the factorial typology in (58) by adding faithfulness constraints has no adverse effects-- in fact we account for a wider range of phonotactic patterns and therefore move closer towards a general theory of phonotactics.

Both of the additional patterns arise from a ranking of faithfulness below prohibitions on unsyllabified segments-- i.e., *Stray-C >> $\mathscr{F}$. In such cases, if all other constraints conspire towards the lack of codas, deletion of a potential coda segment (or V-epenthesis immediately following this segment) will be favored over leaving it unsyllabified in the output. As was the case in (58), the positional difference between *Final-V* and *Strict-CV*, i.e., the latter prohibiting codas medially and finally while the former allowing them medially, follows from the ranking between juncture contiguity and NoCoda: When J-CONTIG >> NoCoda, medial deletion/epenthesis will violate J-CONTIG. It is best then to retain codas word-medially under this ranking. Word-finally, however, neither C-deletion nor V-epenthesis will violate J-CONTIG so all words are predicted to end in a vowel. When NoCoda >> J-CONTIG (the *Strict-CV* pattern), potential coda consonants will be removed as faithfulness sees fit from all positions of the word. The results of this expanded factorial typology are summarized in the following table.[30]

59. Juncture Contiguity Interactions: Input: /...CVC.../

$\mathscr{F}$ = Faithfulness constraints (Max-I/O, Dep-I/O)

c = unsyllabified consonant

<table>
<tr><th colspan="2">Factorial Typology: $\mathscr{F}$; NoCoda; J-Contig; *Stray-C</th><th>Medial σ</th><th>Final σ</th><th>Lang. Type</th></tr>
<tr><td colspan="2">$\mathscr{F}$, *Stray-C >> NoCoda
J-Contig</td><td>CVC</td><td>CVC</td><td>No Extraprosod</td></tr>
<tr><td rowspan="2">J-Contig >> NoCoda</td><td>$\mathscr{F}$ >> *Stray-C</td><td>CVC</td><td>CVc</td><td>C Extraprosod</td></tr>
<tr><td>*Stray-C >> $\mathscr{F}$</td><td>CVC</td><td>CV</td><td>Final-V</td></tr>
</table>

[30] Another phonotactic pattern which has received much attention in the literature is one which requires CV medially and CVC finally. Examples of this are Diola Fogny (Sapir, 1965), Ponapean (Reg and Sohl, 1981), Yapese (Jensen, 1977), etc. These patterns follow simply from the inclusion of the constraint Final-C in the following set of constraints. The addition of this constraint will yield only one additional pattern despite the large number of particular rankings which result. Since this constraint is satisfied regardless of the syllabic affiliation of a final consonant, it is only insightful to investigate its implications for rankings which produce a final CV pattern-- i.e., *Final-V* and *Strict-CV*. The superimposition of the constraint Final-C onto the *Final-V* ranking can result in nothing more than a pattern which requires CVC medially and finally (i.e., the *Non-Extraprosodicity* pattern). In the case of the *Strict-CV* ranking, an additional pattern will result where CV is required medially but CVC must surface finally-- precisely, the Diola, Ponapean, Yapese pattern.

Note that I assume Diola and Ponapean are CV medially. This assumption is an idealization of the surface facts-- both language tolerate doubly-linked clusters medially. Here constraints governing the nature of potential codas (i.e., Coda Conditions, see Itô and Mester, 1993, 1994a, 1994b, for discussion) must be added to the following set of constraints. With a proper formulation of Coda Conditions plus the constraints in (59), a general theory of possible phonotactic patterns in language will emerge.

NoCoda >> J-Contig	$\mathcal{F}$ >> *Stray-C	CVc	CVc	*Light-CVC*
	*Stray-C >> $\mathcal{F}$	CV	CV	*Strict-CV*

3.0 PROSODIC CONTRAST IN BARRA GAELIC

Relativizing the contiguity constraint for prosodic domains also allows us to analyze an interesting case of a prosodic surface contrast in Barra Gaelic.[31] It has been reported (Borgstrøm, 1937, 1940) that in Barra Gaelic surface VC.V sequences contrast with V.CV sequences:[32]

60. (a) ***VC**.V* (b) ***V.C**V*

b**ɔd**.əx	‘old man’	m**a.r**av	‘dead’
ar.an	‘bread’	**a.r**am	‘army’
ʃ**æʀ**.ak	‘a glass of whiskey’	ʃ**æ.r**ak	‘to fade’
f**aL**.u	‘empty’	t^{h}’**i.m**iç.aL	‘round about’

Clearly, the cases in (60a) are severely marked-- an intervocalic consonant is syllabified as the coda of the first syllable, eschewing the near universal pattern of avoiding an onsetless syllable in this context. The syllabifications in (60b), on the other hand, can be taken as cross-linguistically unmarked since the intervocalic consonant has become affiliated with the second syllable hence avoiding an

[31] In discussing Barra Gaelic, I rely heavily on the descriptions and insights of Clements (1986).

[32] See Borgstrøm (1940:55-56) for a discussion of the phonetic criterion used to characterize the syllabic distribution of post-vocalic consonants in Barra.

onsetless syllable. The question here is what governs the choice between marked and unmarked syllabifications in this language.

Both Borgstrøm (1937) and Clements (1986) assume the difference between the forms in (60) follows from a contrast between vowel-types: Borgstrøm distinguishes the second vowel of the forms in (60b) from those in (60a) by assuming that the former derive from a historical insertion process; Clements, incorporating Borgstrøm's insights, further assumes that the second vowel in the forms of (60b) follows from a synchronic process of vowel insertion which basically splits up clusters of a sonorant followed by a non-homorganic consonant. Given this difference between the forms in (60), the task of explaining this data must address the following issue:

61. What it is about epenthetic material which would lead to the VC.V--V.CV surface contrast?

The framework assumed here is well positioned to address this question since the presence of epenthetic material disrupts contiguity relations, relations which, through constraint domination, may have wide ranging, yet testable effects. In order to determine the role of contiguity here, we must first have an analysis of the non-epenthetic cases in (60a). For this set of data some constraint favoring coda-association must be ranked higher than the constraints Onset and NoCoda. I will assume that this constraint is a member of the Alignment family and that it requires the right-edge of all syllables to be aligned to the right-edge of a consonant-- essentially this constraint has a preference for syllables which end in a consonant and hence terminate with a coda.[33] I will call this constraint, Align-R(ight):

62. Align-R (σ,C)

[33]Nothing hinges crucially on assuming that the coda-preferring constraint here is a species of Alignment. In fact the relevant constraint might be grounded in metrical phenomena or something of the like (cf. Beckman, 1996, for some interesting ideas involving *Positional Faithfulness*). I leave the task of adequately formalizing this constraint to students of Gaelic phonology.

The following tableau illustrates how the VC.V pattern in (60a) is chosen as optimal when faithfulness is not at issue.

63. VC.V over V.CV-- Non-epenthesis cases (60a)

/ʃæʀak/	Align-R	Onset	NoCoda
(i) ☞ ʃæʀ.ak		*	**
(ii) ʃæ.ʀak	*!		*

Turning to the epenthesis cases in (60b), we must assume that a constraint prohibiting sonorant-consonant sequences outranks the faithfulness constraint prohibiting insertion. I'll call this constraint *RC, where R stands for *sonorant*. The interactions of this constraint with faithfulness alone will only determine that a vowel must be inserted to break up an illicit sonorant-consonant cluster-- the actual syllabification of the string including this epenthetic vowel will be determined by other constraints. Before turning to such constraints, the following tableau generally illustrates the motivation behind epenthesis.

64. Epenthesis in Sonorant-Consonant Clusters

/ʃærk/	*RC	Max-I/O	Dep-I/O
(i) ☞ ʃær.***a***k			*
(ii) ☞ ʃæ.r***a***k			*
(iii) ʃærk	*!		

(iv) ʃæk		*!	
(v) ʃær		*!	

Both *RC and Max-I/O must be ranked above Dep-I/O to insure epenthesis in these cases by ruling out the final three candidates.

Now we can't rely on Align-R to select the actual surface form of the words exhibiting epenthesis. Align-R will simply choose the VC.V candidate, incorrectly conflating any difference between epenthesis and non-epenthesis cases:

65. Align-R predicting incorrect surface form for epenthesis cases (60b).

/ʃærk/	Align-R	Onset	NoCoda
(i) *☞ ʃær.*a*k		*	**
(ii) ʃæ.r*a*k	*!		*

It is at this point where an understanding of the effects of epenthesis allows us to characterize the correlation between the V.CV pattern and vowel-insertion. Epenthesis will create a violation of either juncture contiguity or domain contiguity and it is the ranking of these constraints with respect to the coda forcing constraint Align-R which distinguishes the VC.V forms in (60a) from the V.CV forms in (60b). Assuming juncture contiguity is ranked higher than Align-R and domain contiguity, predicts the attested surface pattern in the epenthesis cases:

66. Contiguity and Alignment Interactions-- Epenthesis case predicted (60b).

/ʃæ**rk**/	J-CONTIG	Align-R	D-CONTIG
(i) ʃæ**r**.*a***k**	*!		
(ii) ☞ ʃæ.**r***a***k**		*	*

The contrast in surface syllabification exhibited by Barra Gaelic is now formally accounted for: the VC.V cases follow from the effects of Align-R; epenthesis, however, brings other constraints into play, constraints which interact with and, in the case of J-CONTIG, override the effects of Align-R. Contiguity constraints correlate with the presence of epenthesis and, by virtue of constraint domination, play a crucial role in selecting the V.CV pattern as optimal in vowel-insertion environments. The task of understanding why epenthesis cases trigger a shift in surface syllabification is now accomplished (cf. 61).

4.0 CONCLUSION

In this paper I have proposed that string modification processes like deletion and epenthesis can receive a unified explanation by assuming that contiguity requirements are relativized for prosodic domains. Assuming contiguity constraints appeal to the syllable precisely specifies the locus of various types of cluster simplification processes. This approach also properly characterizes phenomena like epenthesis-reversals where a word-medial pattern of cluster simplification is inverted at the peripheries of the word. Finally, several factorial typologies involving relativized contiguity constraints, faithfulness, and other syllable-related constraints were presented: in all cases the predictions of these typologies were fully instantiated.

What remains is to illustrate contiguity effects at prosodic levels supraordinate to the syllable--clearly a task meriting it's own paper. What might such effects look like? One promising case discussed at length in Lamontagne (in progress) is the ambiguous behavior of epenthetic vowels with respect to processes of stress assignment. Given the theoretical and empirical gains of the present paper, the toils of further research along these lines looks promising.

REFERENCES

Aronson, H. (1968) *Bulgarian Inflectional Morphophonology*. Slavistic Printings and Reprinting, 70. The Hague: Mouton.

Beckman, J. (1996) *Positional Faithfulness*. Doctoral Dissertation, University of Massachusetts, Amherst.

Borgstrøm, C. H. (1937) "The Dialect of Barra in the Outer Hebrides," *Norsk Tidsskrift for Sprogvidenskap* 8, 71-242.

Borgstrøm, C. H. (1940) "*A Linguistic Survey of the Gaelic Dialects of Scotland*, vol. 1: *The Dialects of the Outer Hebrides. Norsk Tidsskrift for Sprogvidenskap*, Suppl. Bind 1, Oslo.

Broselow, E. (1980) "Syllable structure in two Arabic dialects," *Studies in the Linguistic Sciences* 10, 13-25.

Broselow, E. (1982) "On predicting the interaction of stress and epenthesis," *Glossa* 16, 115-132.

Broselow, E. (1983) "Non-obvious Transfer: on Predicting Epenthesis Errors," *Language Transfer and Language Learning*. eds. L. Selinker and S. Gaas, 269-280. Newbury House. Rowley Ma.

Broselow, E. (1992) "Parametric variation in Arabic dialect phonology," in E. Broselow, M. Eid, and J. McCarthy, eds., *Current Issues in Linguistic Theory, 85: Perspectives on Arabic Linguistics lV*, John Benjamins, Amsterdam.

Buckley, E. (1994) *Theoretical Aspects of Kashaya Phonology and Morphology*. CSLI, Standford University.

Clements, G. (1986) "Syllabification and Epenthesis in the Barra Dialect of Gaelic," in *The Phonological Representation of Supresegmentals.* Foris Press.

Duncan, E. (1993) "Directionality Effects through Alignment: Vowel Merging in Jilotepequeño Pocomam," in *Phonology at Santa Cruz,* Vol. 3, eds. J. Merchant, J. Padgett, and R. Walker.

Farwaneh, S. (1995) *Directionality Effects in Arabic Dialect Syllable Structure*. Doctoral Dissertation, University of Utah.

Goodman, B. (1990) “Implications of Pomo Epenthesis for a Theory of Syllabification,” in CLS 26, Vol. 2.

Harris, J. (1983) *Syllable Structure and Stress in Spanish: A Nonlinear Analysis*. *Linguistic Inquiry* Monograph 8, MIT Press, Cambridge, MA.

Hayes, B. (1980) *A Metrical Theory of Stress Rules*, Doctoral Dissertation, MIT.

Hayes, B. (1982) "Extrametricality and English stress," *Linguistic Inquiry*, 13, 227-276.

Hayes, B. (1995) *Metrical Stress Theory: Principles and case studies.* The University of Chicago Press: Chicago, IL.

Itô, J. (1986) *Syllable Theory in Prosodic Phonology*, Doctoral Dissertation, University of Massachusetts, Amherst.

Itô, J. (1989) "A prosodic theory of epenthesis," *Natural Language and Linguistic Theory*, 7, 217-260.

Itô, J. and A. Mester (1993) “Licensed segments and safe paths,” in C. Paradis and D. LaCharite, eds. *Constraint-Based Theories in Multilinear Phonology*. *Canadian Journal of Linguistics* 38, 197-213.

Itô, J. and A. Mester (1994a) “Reflections on the CodaCond and Alignment,” in *Phonology at Santa Cruz*, Vol. 3, eds. J. Merchant, J. Padgett, and R. Walker.

Itô, J. and A. Mester (1994b) “Realignment,” to appear in the Proceedings of the June 1994 Utrecht Prosodic Morphology Workshop.

Itô, J. and A. Mester (1995) “The Core-Periphery Structure of the Lexicon and Constraints on Reranking,” in J. Beckman, S. Urbanczyk, and L. Walsh, eds., *University of Massachusetts Occasional Papers in Linguistics* 18: Papers in Optimality Theory. Amherst, MA: GLSA.

Jensen, J. (1977) *Yapese Reference Grammar*. Honolulu: University of Hawaii Press.

Kenstowicz, M. (1994) “Syllabification in Chukchee: A Constraints-Based Analysis,” FLSM 4.

Krauss, M. (1975) “St. Lawrence Island Eskimo Phonology and Orthography,” *Linguistics* 152, pp. 39-72.

Lamontagne, G. (1993) *Syllabification and Consonant Cooccurrence Conditions*. Doctoral Dissertation University of Massachusetts, Amherst.

Lamontagne, G. (in progress) "Relativized Contiguity: Part II: Contiguity and Metrical Prosody".

Lamontagne, G. and S. Rosenthall (1996) "Contiguity and Hiatus Avoidance," Ms. University of British Columbia, and Ohio State University.

Langdon, M. (1970) *A grammar of Diegueño: the Mesa Grande dialect*. University of California Publications in Linguistics 66.

Levin, J. (1985) *A Metrical Theory of Syllabicity*, Doctoral Dissertation, MIT.

Marantz, A. (1982) "Re reduplication," *Linguistic Inquiry* 13, 435-482.

McCarthy, J. (1983) "Ponapean reduplication", unpublished ms., Bell Laboratories, Murray Hill, New Jersey.

McCarthy, J. (1993) "A Case of Surface Constraint Violation," in C. Paradis and D. LaCharite, eds. *Constraint-Based Theories in Multilinear Phonology*. *Canadian Journal of Linguistics* 38, 169-195.

McCarthy and Prince (1986) "Prosodic Morphology," Ms. University of Massachusetts, Amherst, and Brandeis University, Waltham MA.

McCarthy and Prince (1991) "Prosodic Minimality," Talk presented at University of Illinois Conference *The Organization of Phonology*.

McCarthy, J. and A. Prince (1990) "Prosodic morphology and templatic morphology, *UMASS Occasional Papers*, 13, University of Massachusetts, Amherst.

McCarthy, J. and A. Prince (1993) *Prosodic Morphology I; Constraint Interaction and Satisfaction*. Ms., University of Massachusetts, Amherst, and Rutgers University New Brunswick, NJ.

McCarthy, J. and A. Prince (1995) "Faithfulness and Reduplicative Identity," in J. Beckman, S. Urbanczyk, and L. Walsh, eds., *University of Massachusetts Occasional Papers in Linguistics* 18: Papers in Optimality Theory. Amherst, MA: GLSA.

Mester, A. and J. Padgett (1994) "Directional Syllabification in Generalized Alignment," in *Phonology at Santa Cruz*, Vol. 3, eds. J. Merchant, J. Padgett, and R. Walker.

Michelson, K. (1988) *A Comparative Study of Lake-Iroquoian Accent*. Kluwer, Dordrecht.

Michelson, K. (1989) "Invisibility: Vowels without a Timing Slot in Mohawk," in D. Gerdts and K. Michelson eds., *Theoretical Perspectives on Native American Languages*, SUNY Press, Albany, New York. pp. 38-69.

Moshinsky, J. (1974) *A Grammar of Southeastern Pomo*. University of California Publications in Linguistics 72.

Mous, M. (1993) *A Grammar of Iraqw*, Buske, Hamburg.

Myers, S. (1987) "Vowel Shortening in English," *NLLT* 5, 485-518.

Newman, S. (1944) *Yokuts language of California*. Viking Fund Publications in Anthropology, No. 2. New York.

Oswalt, R. L.(1961) *A Kashaya Grammar (Southwestern Pomo)* Doctoral Dissertation, University of California, Berkeley.

Prince, A. (1980) "A Metrical Theory for Estonian Quantity," *Linguistic Inquiry* 11, 511-562.

Prince, A. (1984) "Phonology with Tiers," in M. Aronoff and R. Oehrle, eds. *Language, Sound, Structure*, pp. 234-244. MIT Press. Cambridge, MA..

Prince, A. (1990) "Quantitative Consequences of Rhythmic Organization," CLS 26, Vol. 2.

Prince, A. and P. Smolensky (1993) *Optimality Theory: Constraint Interaction in Generative Grammar*. Ms., Rutgers University, New Brunswick, and University of Colorado, Boulder. RuCCS-TR-2.

Reg, K. L. and G. Sohl (1981) *Ponapean Reference Grammar*. The University Press of Hawaii, Honolulu, Hawaii.

Rosenthall, S. (1994) *Vowel/Glide Alternation in a Theory of Constraint Interaction*. Doctoral Dissertation, University of Massachusetts, Amherst.

Sapir, J. D. (1965) *A Grammar of Diola-Fogny*, West African Language Monographs 3, Cambridge University Press, London.

Scatton, E. A. (1975) *Bulgarian Phonology*. Slavica Publishers, Cambridge, Ma.

Selkirk, E. O. (1980) "Prosodic Domains in Phonology; Sanskrit revisited," in M. Aronoff and M-L Kean eds., *Juncture*, Studia Linguistica et Philologica.

Selkirk, E. O. (1981) "Epenthesis and degenerate syllables in Cairene Arabic," in H. Borer and J. Aoun, eds., *Theoretical Issues in the Grammar of Semitic Languages*, MIT Working Papers in Linguistics 3.

Sherer, T. (1994) *Prosodic Phonotactics*. Doctoral Dissertation, University of Massachusetts, Amherst.

Spencer, A. (1993) “The Optimal Way to Syllabify Chukchee,” Talk presented at ROW-1, Rutgers University, New Brunswick.

Steriade, D. (1982) *Greek Prosodies and the Nature of Syllabification*, Doctoral Dissertation, MIT.

Teeter, K. V. (1964) *The Wiyot Language*, University of California Publications in Linguistics, 37, Berkeley.

Tranel, B. (1991) “CVC Light Syllables, Geminates, and Moraic Theory,” *Phonology* 8, p. 291-302.

Wilkinson, K. (1986) “Syllable Structure and Lardil Phonology,” Ms., University of Massachusetts, Amherst.

Wilkinson, K. (1988) “Prosodic Structure and Lardil Phonology,” *Linguistic Inquiry* 19, 325-334.

Yip, M. (1991) “Coronals, Consonant Clusters and the Coda Condition,” in C. Paradis and J.-F. Prunet eds., *The Special Status of Coronals*, Foris, Dordrecht.

Zec, D. (1988) “Bulgarian ə epenthesis: a case for moraic structure,” NELS 18.