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Faithfulness and Prosodic Circumscription*

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§1. Introduction

Faithfulness constraints have been an essential part of Optimality Theory since its inception with Prince & Smolensky (1991, 1993). As OT has developed, though, the original structural implementation of faithfulness has evolved. McCarthy & Prince (1995a) propose that faithfulness constraints are formalized within a Correspondence Theory of relations between linguistic structures. Correspondence constraints regulate a broad range of types of faithfulness, including features, segments, and prosody. Furthermore, faithfulness constraints can be generalized from the original underlying/surface comparison to other types of linguistic relations, such as base/reduplicative copy. Indeed, Benua (1995, 1997) argues that a transderivational or output-output correspondence relation holds between the surface form of a base word and the surface form of its immediate morphological derivative.

Here, I propose to derive some further results of this extended view of faithfulness, reanalyzing some of the phenomena attributed to operational prosodic circumscription (McCarthy & Prince 1990a). The Yidiɲ contrast shown in (1) is a typical example of this type:

(1) Yidiɲ Reduplication (Dixon 1977, Nash 1979, Marantz 1982, McCarthy & Prince 1990a, Spring 1990)

Singular	Plural	
$[\text{mula}]_{Ft}$ri	mula-$[\text{mula}]_{Ft}$ri	'initiated man'
$[\text{t}^{j}\text{ukar}]_{Ft}$pa	t^{j}ukar-$[\text{t}^{j}\text{ukar}]_{Ft}$pa-n	'unsettled mind'

Whether or not *r* reduplicates depends on the foot structure of the base; just exactly the initial foot is copied. In the operational circumscription model, the initial foot is parsed out (circumscribed) and then copied, accounting for the difference between these two forms.

Below, I argue that a significant subset of putative circumscriptional systems like Yidiɲ are better understood in terms of satisfaction of high-ranking prosodic faithfulness constraints — often constraints on transderivational correspondence relations. The results obtained here therefore converge with the very similar conclusions reached by Itô, Kitagawa, & Mester (1996) in their study of the Japanese *zuuja-go* secret language, which also depends crucially on prosodic faithfulness. Farther afield, there is an even more striking convergence with the Optimality-Theoretic reanalysis

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of infixation via circumscription in terms of the interaction of prosodic-structure and alignment constraints (Prince & Smolensky 1991, 1993; McCarthy & Prince 1993ab). Taken together, all these lines of investigation lead to a single result: there is no role for operational prosodic circumscription at all, its descriptive effects having been usurped by mechanisms that are independently required in phonological theory.

This argument supports the reductionist position of McCarthy & Prince (1994b), which sees the ultimate goal of Prosodic Morphology (PM) as explaining itself out of existence. The program of eliminating PM-specific devices like circumscription, templates, or reduplicative copying leads ultimately to a more explanatory account of prosodic-morphological phenomena. Furthermore, these results reflect back on and thereby support the premises from which they are derived: Optimality Theory in general and the Correspondence Theory of faithfulness in particular. Of special interest is the parallel character of the analysis, evaluating fully formed output candidates against one another. This stands in contrast to the strongly serial implementation of the operational model of circumscription, an important difference with consequences for the kinds of explanations and generalizations that each approach offers, as I will show later.

The research discussed here builds on previous work in the theory of operational circumscription, particularly Broselow & McCarthy (1983), Crowhurst (1994), Itô, Kitagawa, & Mester (1992), Lombardi & McCarthy (1991), McCarthy & Prince (1990a), and Mester (1990). (For a comprehensive list of references on operational circumscription, see McCarthy & Prince 1995b.) Furthermore, it owes a significant debt to earlier studies of circumscriptional phenomena within Optimality Theory: Avery & Lamontagne (1995); Benua (1995); Crowhurst (1997); de Lacy (1996); Downing (1995ab, 1996); Hung (1992); Itô, Kitagawa, & Mester (1996); Kager (1995a); McCarthy (1996); Prince & Smolensky (1991, 1993); and Samek-Lodovici (1992, 1993). It has important connections with the emerging body of work on prosodic faithfulness constraints in Optimality Theory: Alderete (1995, 1996); Beckman (1997); Burzio (1994ab); Bye (1996); Inkelas (to appear); Itô, Kitagawa, & Mester (1996); Kenstowicz (1994, 1996); McCarthy (1996); and Pater (1995). Burzio (1994ab). Finally, because it depends crucially on transderivational faithfulness constraints, this work lends support to that extension of Correspondence Theory (Benua 1995, 1997) and to related approaches: Archangeli (1996); Buckley (1995); Bybee (1985); Burzio (1994ab, 1996, 1997); Crosswhite (1996); Kager (1995b); Kenstowicz (1996); Kraska-Szlenk (1995); Orgun (1994, 1996); Pater (1995); Wilson (1996).

The organization of this article is as follows. In section 2, I introduce several of the core examples of prosodic circumscription, and I show how they are analyzed within the operational model of McCarthy & Prince (1990a). Section 3 presents and illustrates the premises of Optimality Theory and Correspondence Theory that are essential elements of the explanation, and sections 4 and 5 apply them to two distinct types of circumscriptional phenomena. Section 6 concludes the article with an overview of the results. The appendix treats a further example, imperfective gemination in Berber, that can tentatively but not definitively be accommodated within the model presented here.

§2. Operational Prosodic Circumscription

As formalized by McCarthy & Prince (1990a), prosodic circumscription is based on a factoring function $\Phi(C, E, B)$ which returns the prosodic constituent *C* standing at edge *E* of a base form *B*. The factors induced by Φ on *B* can be notated as $B{:}\Phi$ for the part that satisfies the (*C*, *E*) conditions, called the kernel, and B/Φ for the residue, the complement of $B{:}\Phi$ within *B*. These terms are combinable with the following equation, where "*" gives the relation (normally left- or rightconcatenation) that holds between the factors:

(2) Factoring of B by Φ

$$B = B{:}\Phi * B/\Phi$$

The central element of the McCarthy & Prince (1990a) theory is the idea of applying a morphological operation to one of the factors in (2) rather than to *B* as a whole. If the kernel, the *B*:Φ factor, is the target of the morphological operation, then we have **positive** prosodic circumscription. If the residue, the *B*/Φ factor, is targeted, then we have **negative** prosodic circumscription.

The Yidiɲ example in (1) is a typical case of positive prosodic circumscription. The foot standing at the left edge of B is the factor returned by Φ(*Ft*, *Left*, *B*). This foot is subject to a morphological operation of reduplicative copying, so the foot structure of the base determines whether a consonant is copied at the juncture of the second and third syllables.

This means that the result of applying a morphological operation to *B* under positive prosodic circumscription is the result of applying that operation to just the kernel:

(3) Definition of Operation Applying under Positive Prosodic Circumscription

$$O{:}\Phi(B) = O(B{:}\Phi) * B/\Phi$$

Paraphrastically: To apply *O* to *B* under positive prosodic circumscription is to apply *O* to the kernel, *B*:Φ, concatenating the result with *B*/Φ in the same way ("*") that *B*:Φ concatenates with the residue *B*/Φ in the base *B*. In effect, the relation "*" puts the pieces back together, combining the transformed *B*:Φ factor with the intact *B*/Φ factor. The following derivations show how the system plays out in Yidiɲ, letting *O*:Φ stand for the morphological operation applied under positive prosodic circumscription:

(4) Application of Positive Prosodic Circumscription to Yidiɲ

a.	i.	O:Φ([*múla*]$_{Ft}$*ri*)	=	O([*múla*]$_{Ft}$*ri*:Φ) * [*múla*]$_{Ft}$*ri*/Φ
	ii.		=	O([*múla*]$_{Ft}$) * *ri*
	iii.		=	[*múla*]$_{Ft}$[*múla*]$_{Ft}$ * *ri*
	iv.		=	[*múla*]$_{Ft}$[*múla*]$_{Ft}$*ri*
b.	i.	O:Φ([*tʲúkar*]$_{Ft}$*pan*)	=	O([*tʲúkar*]$_{Ft}$*pan*:Φ) * [*tʲúkar*]$_{Ft}$*pan*/Φ
	ii.		=	O([*tʲúkar*]$_{Ft}$) * *pan*
	iii.		=	[*tʲúkar*]$_{Ft}$[*tʲúkar*]$_{Ft}$ * *pan*
	iv.		=	[*tʲúkar*]$_{Ft}$[*tʲúkar*]$_{Ft}$*pan*

Step (i) shows the basic factoring, with the terms simplified in step (ii). At step (iii), the copy operation *O* has applied to the Φ-delimited factor, and the terms are reassembled in step (iv).

The main feature of positive prosodic circumscription, then, is that a morphological operation is applied to some prosodic constituent within a base instead of being applied to the whole base. In this way, the morphological operation can show sensitivity to the prosodic structure of its input. This sensitivity is not usual (Moravcsik 1978, Marantz 1982); compare Lardil *parel-pareli*, with copying of the *l* even though it is not part of the initial foot. According to McCarthy & Prince, Yidiɲ and Lardil differ precisely on this dimension: Yidiɲ reduplicates modulo foot circumscription, while Lardil reduplicates without the intervention of circumscription.

Below, I will argue that positive prosodic circumscription, as has been proposed for Yidiɲ and other cases to be discussed, is not an available option in universal grammar. Rather, I will show that phenomena formerly attributed to positive prosodic circumscription are better understood in terms of prosodic faithfulness requirements. This result is in keeping with OT's focus on markedness and faithfulness constraints applied in parallel rather than operations applied in series.

In §4, I will discuss cases like Yidiɲ that come under the rubric of *picking*-mode prosodic circumscription.[1] In picking mode, positive prosodic circumscription picks out a prosodic constituent C, such as a foot, that is already present in the simple form. I will argue that a superior account of these systems is available in an Optimality-Theoretic grammar that includes prosodic faithfulness constraints referring to C. These constraints require that certain properties of C be conserved in related forms, leading to a variety of effects that have been wrongly identified with the prosodic circumscription mechanism operating in its picking mode.

In §5, I discuss a case that comes under the rubric of *parsing* prosodic circumscription, the Arabic broken plural. In operational terms, parsing-mode prosodic circumscription imposes an analysis in terms of a constituent C when no such constituent is already available, because the form being analyzed lacks one (either entirely or at the designated edge). For example, in the McCarthy & Prince (1990a) analysis of Arabic, circumscription parses out an initial trochaic foot from any stem, even a basically iambic one like *jaziir(+at)*. The result is that the prosodic structure of the original form is disregarded, even to the point of splitting a syllable: B:Φ = *jazi*, B/Φ = *ir*.

Here I will reject this treatment entirely, showing that a radically different account of these systems is available, based on a proper understanding of moraic and associational faithfulness constraints in OT. Details differ, but the core of this proposal recalls some of the insights obtained by Samek-Lodovici (1992, 1993) in analyzing Choctaw. Indeed, the account given here for Arabic generalizes straightforwardly to the Choctaw material.

In the end, these theoretical developments lead to the elimination of a special mechanism for positive prosodic circumscription.[2] This follows on and extends a result already securely established in the OT literature: the elimination of negative prosodic circumscription from universal grammar (Prince & Smolensky 1991, 1993; McCarthy & Prince 1993ab). According to McCarthy & Prince (1990a), positive prosodic circumscription, in which the morphological operation affects the kernel *B*:Φ factor, has a symmetric counterpart in which the morphological operation affects the residual *B*/Φ factor. Construed in this way, negative prosodic circumscription is a kind of extrametricality: a prosodic constituent at some edge is parsed out and the remainder of the word counts as the base for some morphological (or phonological) operation.[3]

Infixation is the most obvious case where negative prosodic circumscription has been invoked. The following examples come from Tagalog (5) and Timugon Murut (6):

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[1]The parsing/picking classification and terminology comes from McCarthy & Prince (1991).

[2]A third type of positive prosodic circumscription is not considered here because it has already been addressed in the OT literature. This is subcategorizational circumscription, where a morpheme is prefixed or suffixed to a prosodic constituent (typically the foot, as in Ulwa and Samoan). The subcategorizational effects are attributed to alignment constraints by McCarthy & Prince (1993a: Chapt. 7; 1993b), building on Broselow & McCarthy (1983).

[3]McCarthy & Prince (1990a) also discuss a third type of prosodic circumscription, in which the Φ function is used to select only those bases meeting a particular prosodic criterion. See Kager (1995a) and Hargus & Tuttle (1997) for recent discussion from an OT perspective.

(5) Infixation in Tagalog (Prince & Smolensky 1991, 1993; Avery & Lamontagne 1995; Crowhurst 1997)

a. Data

bilih	b<u>um</u>ilih	'buy'
ʔakyat	ʔ<u>um</u>akyat	'climb'
gradwet	gr<u>um</u>adwet	'graduate'

b. Circumscriptional Analysis

Φ(Onset, Left), O = Prefix *um*

O/Φ(*gradwet*)	=	O(*gradwet*/Φ) * *gradwet*:Φ
	=	O(*adwet*) * *gr*
	=	*umadwet* * *gr*
	=	*grumadwet*

(6) Infixation in Timugon Murut (Prentice 1971, McCarthy & Prince 1993ab)

a. Data

bulud	<u>bu</u>bulud	'hill/ridge'
limo	<u>li</u>limo	'five/about five'
ulampoy	u<u>la</u>lampoy	no gloss
abalan	a<u>ba</u>balan	'bathes/often bathes'
ompodon	om<u>po</u>podon	'flatter/always flatter'

b. Circumscriptional Analysis

Φ(Onsetless Syllable, Left), O = Prefix σ_μ (reduplicative prefix)

O/Φ(*ompodon*)	=	O(*ompodon*/Φ) * *ompodon*:Φ
	=	O(*podon*) * *om*
	=	*popodon* * *om*
	=	*ompopodon*

In Tagalog (5), the kernel of circumscription (*B*:Φ) is the initial onset of the stem. It is stripped away, and *um* is prefixed to the residue (*B*/Φ). In Timugon Murut (6), the kernel of circumscription is an initial onsetless syllable, if any. It too is stripped away, and a reduplicative morpheme is prefixed to the residue. From this perspective, infixes are just ordinary prefixes (or suffixes) attached to a base that has been modified by prior negative circumscription.

Though it's surely correct to regard these infixes as basically prefixes, the implementation of this idea in circumscriptional terms is deeply flawed. Three objections can be adduced, the first two from Prince & Smolensky (1991, 1993) and the last from McCarthy & Prince (1993a):

> •Tagalog loans like *gr<u>um</u>adwet* present obvious empirical difficulties. If the Onset is not recognized as a category of prosody, then there is no actual constituent to substitute for C in Φ(C, E) (cf. Anderson 1992). If, however, the Onset is admitted as a constituent, then we would expect to find a free choice between circumscribing the whole Onset or just the initial consonant. This does not seem right, though, since words with initial clusters, recently borrowed into various Austronesian languages, consistently admit the form with infixation after the whole initial cluster.

•Negative circumscription also fails to explain why it is just exactly a VC-shaped affix that is found in prevocalic position. From the phonological point of view, locating a VC affix before a vowel makes good sense, since it is consistent with an unmarked …CVCV… syllable structure, as Anderson (1972) and Cohn (1992) observe.

•Along the same lines, but even more dramatically, negative circumscription cannot explain why it is only reduplicative infixes that are located after an initial onsetless syllable. This pattern is observed in Timugon Murut and more than a few other languages. Remarkably, though, no ordinary, non-reduplicative infix ever has that distribution.

These observations reveal significant failures of explanatory and typological accountability on the part of negative circumscription, at least as applied to infixation. They support the development of alternatives within OT.

Two key insights underlie the OT approach to infixation developed by Prince & Smolensky and extended by McCarthy & Prince. One, inherited from the circumscriptional treatment, is the idea that infixes are inherently prefixes (or suffixes) which have been minimally displaced from peripheral position by some outside force. Formally, this means that there are constraints of the Alignment family demanding initial (resp. final) placement of prefixes (resp. suffixes). The other factor, the “outside force” demanding non-peripheral affixation, is a higher ranking constraint of the syllabic markedness family, ONSET (Itô 1989) or NO-CODA (Prince & Smolensky 1991, 1993). The following ranking arguments, drawn from these two languages, show the crucial constraint interactions.

(7) NO-CODA >> ALIGN-*um* in Tagalog

Candidates	NO-CODA	ALIGN-*um*
a. um.grad.wet.	*** !	
b. gum.rad.wet.	*** !	g
c. ☞ gru.mad.wet.	**	gr
d. grad.wu.met.	**	gra ! dw

(8) ONSET >> ALIGN-RED in Timugon Murut

Candidates	ONSET	ALIGN-RED
a. u.u.lam.poy.	** !	
b. ☞ u.la.lam.poy.	*	u

The ranking in Tagalog asserts that *um* is located as far to the left as possible (ALIGN-*um*) subject to the requirement that it contribute no avoidable codas (high-ranking NO-CODA). Similarly, the ranking in Timugon Murut asserts that the reduplicative affix is located as far to the left as possible (ALIGN-

RED) subject to the requirement that it contribute no avoidable onsetless syllables (ONSET).

Obviously, no special Prosodic-Morphology-specific mechanism of negative circumscription is necessary in such cases. The analyses of Tagalog and Timugon Murut are constructed out of the very stuff of phonological and morphological theory: constraints on syllabic markedness, which are independently needed for language typology; the constraints asserting prefixality of these affixes, which any analysis requires in some form or other; and the ranking between the two constraint types, which is shared by the two systems and which derives from the notion of factorial typology, central to OT. Reliance on syllable markedness to force infixation explains why a VC prefix like *um* should seek post-onset position and why only a reduplicative prefix should be attracted to the first syllable with an onset. (For full exploration of these points, see Prince & Smolensky 1993 and McCarthy & Prince 1993a, respectively.) Operational circumscription offers no illumination of these points, nor can it hope to, since it does nothing more than stipulate the locus of infixation independent of any properties of the form of the infix itself.

For these and other reasons, the mechanism of negative circumscription no longer has a place in current thinking about Prosodic Morphology or prosody generally.[4] It follows, then, that any presumed symmetry between negative and positive circumscription is illusory. Positive circumscription must stand or fall on its own merits; no crutch of negative circumscription is available to prop it up. Here I will argue that positive circumscription should be eliminated from linguistic theory as well. In its place, the analyses here call on independently motivated constraints demanding faithfulness to prosodic structure or prosodic roles. This new view brings out a range of connections and explanations that are superior to what the operational model had, with its (ultimately misconceived) positive/negative symmetry.

§3. Prosodic Faithfulness

In Optimality Theory (Prince & Smolensky 1991, 1993), each grammar is a ranking of the constraints of Universal Grammar. These include the markedness constraints, which militate against structural elaboration of various kinds, and the antagonistic faithfulness constraints, which demand identity of linguistically related forms.

Faithfulness constraints are formulated under Correspondence Theory (McCarthy & Prince 1993a, 1995a), which posits the following general relation between linguistic forms:

(9) Correspondence

> Given two related linguistic forms S_1 and S_2, **correspondence** is a relation $\Re$ between any subset of elements of S_1 and S_2. Any element α of S_1 and any element β of S_2 are **correspondents** of one another if $\alpha\Re\beta$.

Each candidate S_2 comes equipped with a correspondence relation which shows how it is the same as or different from S_1. When full explicitness is necessary in a particular example, the correspondence relation is shown by coindexation of correspondent elements in S_1 and S_2.

In addition to this very general idea, common to all implementations of Correspondence Theory, I also adopt certain additional assumptions, as specific answers to the following questions:

[4] In prosody generally, the notion of extrametricality, which is another type of negative circumscription, has been much transformed in OT works like Prince & Smolensky (1993) and Hung (1994).

(i) What elements of S_1 and S_2 are related by $\Re$?

(ii) What kinds of linguistic forms stand in correspondence with one another? That is, how are S_1 and S_2 related independently of $\Re$?

(iii) What are the faithfulness constraints?

I will now take each of these questions in turn. The responses I give are not intended to be exhaustive, but rather to supply a working framework that is sufficient for present purposes, though not comprehensive.

(i) *What elements of S_1 and S_2 are related by $\Re$?*

If an element stands in correspondence, then it may receive faithful treatment independent of any other elements of the representation. At a minimum, then, correspondence is a relation between segments. Whether or not features stand in correspondence is a subject of current discussion, irrelevant to our concerns here. Of the various prosodic units, the clearest case can be made for correspondence between moras, to account for the broad class of compensatory lengthening phenomena. Below (§5) I will also present evidence for moraic correspondence based on the analysis of the parsing type of prosodic circumscription. On the other hand, there appears to be no justification for setting up correspondence relations among feet or syllables. Instead, faithfulness to feet and perhaps syllables is mediated by the edge or head segments that make up those constituents (see immediately below and the appendix). In this implementation of correspondence, then, moras are reified as segment-like entities, but other aspects of prosodic structure are not.

(ii) *What kinds of linguistic forms are related by correspondence?*

Correspondence Theory was originally conceived as a relation between the base and its reduplicative copy, called the reduplicant (McCarthy & Prince 1993a). The many parallels between exactness of base-reduplicant (B-R) matching and faithfulness of input-output matching led McCarthy & Prince (1995a) to extend correspondence to the familiar input-output (I-O) faithfulness relation. Benua (1995, 1997) argues that morphologically related output forms must also stand in a transderivational correspondence relation (dubbed O-O, for output-output), to account for phenomena that have previously been attributed to mechanisms like the cycle or strata. A given candidate form, then, may simultaneously bear several distinct correspondence relations — with its underlying input, with some related base word, and between reduplicated parts. Separate, and hence separately rankable, faithfulness constraints on each correspondence relation negotiate the demands of faithfulness in the I-O, B-R, and O-O dimensions, which may compete with each other and with markedness constraints.

(iii) *What are the faithfulness constraints?*

Various constraints of Universal Grammar demand completeness of correspondence or identity of correspondent elements under various conditions. Among them are the anti-deletion faithfulness constraint MAX-*seg* and its symmetric anti-epenthesis counterpart DEP-*seg*.

(10) MAX-$seg_{S1\text{-}S2}$
Every segment in S_1 has a correspondent in S_2.

(11) DEP-$seg_{S1\text{-}S2}$
Every segment in S_2 has a correspondent in S_1.

Additional constraints demand that $\Re$ not join or split segments, that it preserve linear order, that $\Re$-related segments be featurally identical, and so on (see McCarthy & Prince 1995a). Names of particular constraints also include the correspondence relation involved, so MAX-seg_{IO} and MAX-seg_{OO} are distinguished.

Of particular importance in the current context are **prosodic** faithfulness constraints. Three types of prosodic faithfulness constraints will be called upon in the course of this work:

•**Constraints demanding conservation of autosegmental association.** There is a faithfulness cost to altering autosegmental associations by spreading or delinking. Universal Grammar must therefore include faithfulness constraints which have the effect of conserving autosegmental association. Thus, there are constraints militating against spreading and delinking, with separate constraints for each pair of associated autosegmental tiers. (For instance, the constraint against tone spreading is different from the constraint against place spreading.) From these considerations, we obtain two families of constraints that, respectively, prohibit gain and loss of autosegmental associations:

(12) NO-SPREAD$_{S1\text{-}S2}(\tau, \varsigma)$

Let τ_i and ς_j stand for elements on distinct autosegmental tiers in two related phonological representations S_1 and S_2, where

τ_1 and $\varsigma_1 \in S_1$,
τ_2 and $\varsigma_2 \in S_2$,
$\tau_1 \Re \tau_2$, and
$\varsigma_1 \Re \varsigma_2$,

if τ_2 is associated with ς_2,
then τ_1 is associated with ς_1.

(13) NO-DELINK$_{S1\text{-}S2}(\tau, \varsigma)$

Let τ_i and ς_j stand for elements on distinct autosegmental tiers in two related phonological representations S_1 and S_2, where

τ_1 and $\varsigma_1 \in S_1$,
τ_2 and $\varsigma_2 \in S_2$,
$\tau_1 \Re \tau_2$, and
$\varsigma_1 \Re \varsigma_2$,

if τ_1 is associated with ς_1,
then τ_2 is associated with ς_2.

The various antecedent conditions limit the relevance of these constraints to situations where τ and ς are present in both S_1 and S_2. If either τ or ς is added or inserted, I assume, the concomitant changes in association lines do not transgress these constraints. It is an empirical question whether this detail of formulation is correct, but it is a reasonable first guess.

Some relevant examples: the (σ, *tone*) versions of both these constraints are violated in the Kikuyu tone shift process (Clements & Ford 1979); the (*[asp], seg*) versions of both are violated in forms undergoing Grassmann's Law in Sanskrit. Below, in §5, which deals with prosodic circumscription of the parsing variety, we will see a role for the (μ, *seg*) versions.

•**Constraints demanding conservation of prosodic constituents *per se*.** As I noted above, phenomena like compensatory lengthening show that moras are subject to faithfulness requirements independent of the segments that sponsor them. This fact justifies including moras in the scope of the correspondence relation $\Re$, as is necessary for well-definition of the constraints MAX-μ and DEP-μ:

(14) MAX-$\mu_{S1\text{-}S2}$

Every mora in S_1 has a correspondent in S_2.

(15) DEP-$\mu_{S1\text{-}S2}$

Every mora in S_2 has a correspondent in S_1.

These constraints will be important in §5, when parsing mode circumscription is discussed.

•**Constraints demanding faithfulness to the edges or heads of prosodic constituents.** There is nothing like compensatory lengthening at foot level.[5] That is, there are no effects of conservation of feet *independent of the segments that make them up*.Yet there are surely foot-faithfulness constraints, as the existence of lexical stress systems proves (Alderete 1996; Bye 1996; Inkelas to appear; Itô, Kitagawa, & Mester 1996; McCarthy 1996; Pater 1995). The key to the difference is this: foot faithfulness is never direct; it is always mediated by segments bearing head or edge roles in the foot. Constraints of the Anchoring family (successors to Alignment) are responsible.[6] This last point requires extended discussion.

The original Alignment constraints were defined within the PARSE/FILL/Containment-based model of Prince & Smolensky (1991, 1993), which posits a single output representation containing information about underlying morphological structure and surface prosodic structure. They require coincidence of the edges of prosodic and/or morphological constituents within the output structure:

(16) Generalized Alignment (McCarthy & Prince 1993b)

Align(Cat1, Edge1, Cat2, Edge2) $=_{def}$

$\forall$ Cat1 $\exists$ Cat2 such that Edge1 of Cat1 and Edge2 of Cat2 coincide.

Where

Cat1, Cat2 $\in$ PCat $\cup$ GCat

Edge1, Edge2 $\in$ {Right, Left}.

In Correspondence Theory, which allows direct reference to the input (or other related representation), Anchoring replaces Alignment in some applications:[7]

(17) {RIGHT, LEFT}-ANCHOR(S_1, S_2) (McCarthy & Prince 1995a: 372)

Any element at the designated periphery of S_1 has a correspondent at the designated periphery of S_2.

Let *Edge*(X, {R, L}) = the element standing at the *Edge* = {R, L} of X.

RIGHT-ANCHOR . If x = Edge(S_1, R) and y = Edge(S_2, R) then x$\Re$y.

LEFT-ANCHOR. Likewise, *mutatis mutandis*.

Starting from the basic schema in (17), I will present several refinements here based on more recent

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[5]Whether there are syllable-faithfulness constraints is an open question; see the appendix..

[6]In this respect, foot faithfulness is analogous to featural faithfulness in the IDENT sense, rather than the MAX sense. (For the distinction, see McCarthy & Prince (1995a).

[7]Alignment in the sense of McCarthy & Prince (1993b) and Anchoring in the sense of McCarthy & Prince (1995a) differ in two respects. First, Alignment can have a subcategorizational effect, by demanding coincidence of different edges of the two constituents. The Anchoring schema does not include that possibility — a defect, since cases of this type exist (e.g., SFX-TO-PRWD in McCarthy & Prince 1993a). Second, Alignment can demand the coincidence of edges of two constituents which are present *only* in the output, such as ALIGN(Ft, L, PrWd, L). Anchoring does not generalize to these cases unless we assume that the correspondence relation is reflexive.

developments.[8] Not all of these refinements will be important when we look at prosodic circumscription, but it is useful to have a full picture of the system of constraints before looking at an application of one part of it.

First, in accordance with a standard move in the Alignment literature (McCarthy & Prince 1993b, Pierrehumbert 1994), Anchoring will be extended to include identity of constituent heads as well as edges. This will be important in §4, where it will be shown that circumscriptional effects can involve faithfulness to foot-head position.

Second, following Benua (1997) and Gafos (1997b), I will assume the existence of distinct but symmetric Anchoring constraints from S_1 to S_2 and from S_2 to S_1. This move parallels an established symmetry in Correspondence Theory, such as the parallel between MAX and DEP or between I-CONTIG "no skipping (maintain contiguity of input string)" and O-CONTIG "no intrusion (maintain contiguity of output string)". The Anchoring constraints distinguished in this way will be referred to as I-ANCHOR and O-ANCHOR.

Third, also following a proposal by Benua (1997) (which is itself based on postional faithfulness and allied notions in Beckman 1995, 1997 and Alderete 1995), I will assume a distinction between two senses of Anchoring:

- ANCHOR-POS is satisfied when a segment's position as constituent-initial, -final, or -head is conserved under correspondence;

- ANCHOR-SEG is positional faithfulness *per se*, conserving the segment itself standing in the designated position.

As Benua points out, the Alignment theory fuses these two notions into a single constraint-type, but the richer Correspondence framework allows them to be treated separately, and, she argues, they must be.

Crossing the I-ANCHOR/O-ANCHOR distinction with the ANCHOR-POS/ANCHOR-SEG distinction gives four main types of Anchoring constraints, . Within each constraint type, a particular constraint token must also specify the constituents involved, the type of correspondence relation between them (I-O, B-R, O-O), and the position *P* anchored to (initial, final, head).

The ANCHOR-POS constraints will be important here, since they produce the kinds of prosodic faithfulness effects that replace operational prosodic circumscription:

(18) Anchoring as Alignment & Prosodic Faithfulness: ANCHOR-POS

a. I-ANCHOR-$\text{POS}_{S1\text{-}S2}(\text{Cat}_1, \text{Cat}_2, \text{P})$

If $\varsigma_1, \text{Cat}_1 \in S_1$,
$\varsigma_2, \text{Cat}_2 \in S_2$,
$\varsigma_1 \Re \varsigma_2$, and
ς_1 stands in position P of Cat_1,
then ς_2 stands in position P of Cat_2.

[8] Another refinement: Zoll (1996) and Gafos (1997b) develop a distinction between categorical and gradient senses of Anchoring/Alignment. This distinction does not appear to be relevant to the analysis of prosodic circumscription and so I will not address it here.

b. O-ANCHOR-POS$_{S1\text{-}S2}$(Cat_1, Cat_2, P)

If ς_1, $Cat_1 \in S_1$,
ς_2, $Cat_2 \in S_2$,
$\varsigma_1 \Re \varsigma_2$, and
ς_2 stands in position P of Cat_2,
then ς_1 stands in position P of Cat_1.

When $Cat_1 = Cat_2$, we have prosodic faithfulness *per se*: for instance, I-ANCHOR-POS$_{IO}$(Ft, Ft, Head) says that the locus of stress must not change in the input→output mapping. Constraints of this type are important in lexical stress systems and in the analysis of prosodic circumscription. When Cat_1 = Base and Cat_2 = Reduplicant, we have a typical Base-Reduplicant Anchoring effect of the type explored in McCarthy & Prince (1993b: Chapt. 5), Alderete et al. (1996), and Gafos (1997b). When Cat_1 = Stem and $Cat_2 = \sigma$, I-ANCHOR-POS subsumes the effects of classic (MCat, PCat) alignment, demanding that every stem-edge coincide with a syllable-edge.

The ANCHOR-POS constraints, because of the antecedent conditions in (18), are irrelevant when a segment is deleted or inserted at the designated edge. But deletion or insertion at edges — that is, positional faithfulness in Beckman's (1997) sense — is regulated by Anchoring constraints of the other type, ANCHOR-SEG. I-ANCHOR-SEG is a position-specific MAX constraint; O-ANCHOR-SEG is a position-specific DEP constraint:[9]

(19) Anchoring as Positional Faithfulness: ANCHOR-SEG

a. I-ANCHOR-SEG$_{S1\text{-}S2}$(Cat, P)

If ς_1, Cat $\in S_1$,
$\varsigma_2 \in S_2$, and
ς_1 stands in position P of Cat,
then there exists ς_2 such that $\varsigma_1 \Re \varsigma_2$.

b. O-ANCHOR-SEG$_{S1\text{-}S2}$(Cat, P)

If $\varsigma_1 \in S_1$,
ς_2, Cat $\in S_2$, and
ς_2 stands in position P of Cat,
then there exists ς_1 such that $\varsigma_1 \Re \varsigma_2$.

When Cat is a prosodic category, these are prosodically-sensitive faithfulness constraints. When Cat is a morphological category, they express resistance of, say, stem-edges to epenthesis or deletion. In this way, ANCHOR-SEG and ANCHOR-POS separate the faithfulness and parsing consequences of (MCat, PCat) alignment, in a way that Correspondence Theory permits but its Containment-based predecessor did not.

The ANCHOR-SEG constraints are not essential to the program of reanalyzing prosodic circumscription, and they will not be discussed again in this article, but the ANCHOR-POS constraints.are crucial. Specifically, I will argue that conservation of foot structure in the S_1 to S_2 mapping, as required by I-ANCHOR-POS(Ft, Ft, Initial/Final/Head), goes far toward eliminating the need for operational prosodic circumscription. For example, the pattern of reduplication in Yidiɲ is determined by undominated I-ANCHOR-POS$_{BR}$(Ft, Ft, F) — any foot-final segment in the base must correspond to a foot-final segment in the reduplicant. This constraint makes exactly the right

[9] A full account of positional faithfulness will also require IDENT-like constraints that militate against featural alteration in edges or heads. See Beckman (1997).

distinction: I-ANCHOR-POS$_{BR}$(Ft, Ft, F) is satisfied by *[mula$_i$]$_{Ft}$-[mula$_i$]$_{Ft}$ri* but not by the failed candidate **[mula$_i$r$_j$]$_{Ft}$-[mula$_i$]$_{Ft}$ri*. This is clearly a reasonable idea: similarity between base and reduplicant is improved if they have similar foot structure. It is also a simple idea: it is nothing more than a straightforward application of familiar Alignment notions combined with equally familiar faithfulness notions. And it is an idea with ample independent support, since such constraints are also required to enforce faithfulness to lexical prosody in the input→output mapping (Alderete 1996; Bye 1996; Inkelas to appear; Itô, Kitagawa, & Mester 1996; McCarthy 1996; Pater 1995). Yet, as I will now show, this idea is sufficient to account for a range of prosodic circumscription phenomena of the picking type.

§4 Prosodic Circumscription as Prosodic Anchoring

Operational prosodic circumscription in the picking mode locates a prosodic constituent (typically a foot) at one end of a form and then performs a morphological operation on it, such as reduplication or mapping to a template. Here, I will examine several systems that have been analyzed in these terms. I will show that empirically equivalent and explanatorily superior accounts can be obtained by calling on prosodic faithfulness constraints of the form I-ANCHOR-POS(Ft, Ft, Initial/Final/Head), as proposed in §3.[10] The cases I will discuss include reduplication in Yidiɲ and mapping to a template in Rotuman and Cupeño. (A more speculative example, medial gemination in Berber, is discussed in the appendix. Yet another case, reduplication in Makassarese, is addressed in McCarthy & Prince 1994ab and McCarthy 1997.) I conclude this section by summing up the results and discussing why the prosodic faithfulness theory constitutes a conceptual advance over operational circumscription theory.

The most straightforward case comes from reduplication in the Australian language Yidiɲ. Recall the following contrast, which shows that foot structure plays a role in determining the well-formedness of the Yidiɲ reduplicant:

(20) Yidiɲ Reduplication

a.	[mula$_4$]-[mula$_4$]ri	vs.	*[mular$_5$]-[mula$_4$]ri
b.	[t^{j}ukar$_5$]-[t^{j}ukar$_5$]pa-n	vs.	*[t^{j}uka$_4$]-[t^{j}ukar$_5$]pa-n

In (a), the initial foot of the base is *mula*, and the reduplicant consists of a copy of that foot. Likewise, in (b) the foot *t^{j}ukar* is copied. No condition on the reduplicant alone can account for this distinction; rather, it is a matter of matching the foot structure of the reduplicant with the foot structure of the base.

The operative high-ranking constraint here is I-ANCHOR-POS$_{BR}$(Ft, Ft, Final), which requires that base-reduplicant correspondence preserve a segment's status as foot-final. This matching of prosodic structures is obtained even at the expense of more complete reduplication of the base's segments, as the following ranking argument proves:

[10] In most cases discussed here, O-ANCHOR-POS would do as well as I-ANCHOR-POS. For a case where they yield crucially different results, see the appendix.

(21) Ranking Argument: I-ANCHOR-POS$_{BR}$(Ft, Ft, Final) >> MAX$_{BR}$

	Candidates	I-ANCHOR-POS$_{BR}$(Ft)	MAX$_{BR}$
a.	☞ [mula$_4$]-[mula$_4$]ri		**
b.	[mular$_5$]-[mula$_4$]ri	*!	*

Candidate (b) achieves more complete copying than (a) does, but it is not optimal, because the foot-to-foot match is imperfect. This ranking argument shows that, in prosodic circumscriptional phenomena, prosodic faithfulness may take precedence, through ranking, over segmental faithfulness. Observe that there is no need to place feet (or syllables) themselves in correspondence. Rather, the ANCHOR-POS constraints match prosodic constituency through correspondence of the segments contained in those prosodic constituents. Requiring prosodic B-R similarity in this fashion is no different in kind, though undoubtedly less familiar, than requiring segmental similarity.

An important detail remains: what about candidates like *[múla]ri-[múla]ri*, which fully satisfy both I-ANCHOR-POS$_{BR}$(Ft, Ft, F) and MAX$_{BR}$? The ill-formedness of these candidates is a typical templatic effect, independent of circumscription proper: *[múla]ri* is too big as a reduplicant, since Yidiɲ limits the reduplicant to a foot or minimal word. Relevant here is Generalized Template Theory (GTT) (McCarthy & Prince 1994ab, to appear; Urbanczyk 1995, 1996ab; Itô, Kitagawa, & Mester 1996; Gafos 1996, 1997a; Downing 1996, to appear; Spaelti 1997), which asserts that prosodic-morphological templates are not free-standing constraints or entities,[11] but rather are consequences of particular rankings of constraints that are independently motivated. (This conception of templates also furthers the self-annihilatory goal of Prosodic Morphology mentioned in §1.) The Yidiɲ minimal-word template can be analyzed in the same way as Diyari, discussed by McCarthy & Prince 1994ab. The minimal word is the most harmonic type of prosodic word: it contains a foot which is properly aligned at both edges and it contains no stray syllables. Thus, through domination of MAX$_{BR}$, constraints on foot alignment and syllable parsing ensure the disyllabicity of the Yidiɲ reduplicant and rule out candidates like *[múla]ri-[múla]ri*.

Two other cases of operational positive circumscription involve mapping B:Φ to a template: the formation of the "incomplete phase" (a kind of morphological category) in Rotuman and the habilitative in Cupeño. The Rotuman phenomenon is exemplified in (22):

[11] The impossibility of positing a morpheme consisting of a free-standing foot follows from the assumption made in §3 that feet (and syllables) do not stand in correspondence, so foot-faithfulness is always mediated by segments. An underlying foot with no segments is invisible to the faithfulness theory, and so by the logic of Stampean occultation (Prince & Smolensky 1993) it plays no useful role in the lexicon. Effectively, it does not exist.

(22) Phase in Rotuman (Churchward 1940)

	Complete	Incomplete	
a. Deletion (Some Final ...VCV)			
	to.ki.ri	to.kir	‘to roll’
	ti.ʔu	tiʔ	‘big’
	mo.se	mös	‘to sleep’
b. Metathesis (Some Final ...VCV)			
	se.se.va	se.seav	‘erroneous’
	pu.re	puer	‘to rule’
	pa.ro.fi.ta	pa.ro.fiat	‘prophet’
c. Diphthong Formation (All Final ...VV)			
	pu.pu.i	pu.pui	‘floor’
	ke.u	keu	‘to push’
	jo.se.u.a	jo.se.uɑ	‘Joshua’
d. No Formal Distinction of Phase (Final Long Vowel)			
	rī	rī	‘house’
	si.kā	si.kā	‘cigar’

In (a), the incomplete phase is formed by dropping the final vowel, leaving a final heavy CVC syllable. (Syllable boundaries are indicated by “.”.) In (b), the result is also a final heavy syllable, achieved in this case by metathesizing the final CV sequence to yield a diphthongal CVVC syllable. Case (c) shows how a final heterosyllabic V.V sequence is syllabified as tautosyllabic in the incomplete phase, producing a final CVV syllable. Finally, case (d) consists of words with final long vowels, which do not alternate in phase. The choice of how to form the incomplete phase is fully determined by the phonological properties of the complete phase, depending on whether it ends in VCV or VV, vowel quality, and other factors addressed in detail by Churchward (1940), McCarthy (1996), and references cited there.

Stress in Rotuman falls on the penultimate mora, so stress is on the penultimate syllable in, say, *pa.ro.fi.ta*, and it is on the final heavy syllable in *pa.ro.fiat*. The foot type in Rotuman is thus the moraic trochee (Hayes 1987, McCarthy & Prince 1986), which consists of exactly two moras, grouped into two light syllables or a single heavy syllable: *pa.ro.[fi.ta]*$_{Ft}$, *pa.ro.[fiat]*$_{Ft}$. Indeed, a consistent finding is that incomplete-phase words end in a monosyllabic foot — a single heavy syllable parsed as a bimoraic trochee. This generalization cross-cuts the differences in (22a-d).

Schematically, the foot structure of corresponding complete and incomplete phase forms is this:

(23)	Complete	Incomplete
a.	to.[kí.ri]Ft	to.[kir]
	[tí.ʔu]	[tiʔ]
b.	se.[sé.va]	se.[seav]
	[pú.re]	[puer]
c.	pu.[pú.i]	pu.[pui]
	[ké.u]	[keu]
d.	[rī]	[rī]
	si.[kā]	si.[kā]

The relevance of prosodic circumscription to Rotuman is now apparent. There is a templatic requirement on the incomplete phase: it must end in a monosyllabic foot (i.e., a heavy syllable). But this template is imposed only on the segments belonging to the corresponding (usually disyllabic) foot of the complete phase. Extra-podal syllables (*B*/Φ) are not involved in the phase alternation.

In terms of the operational theory of circumscription in McCarthy & Prince (1990a), this phenomenon requires circumscription of the final foot by Φ(Ft, Right) followed by an operation *O* mapping *B*:Φ onto a monosyllabic foot template:

(24) Operational Circumscription Applied to $to.[kí.ri]_{Ft} \rightarrow to.[kir]_{Ft}$

i.	$O{:}\Phi(to[kíri]_{Ft})$	=	$O(to[kíri]_{Ft}{:}\Phi) * to[kíri]_{Ft}/\Phi$
ii.		=	$O([kíri]_{Ft}) * to$
iii.		=	$[kír]_{Ft} * to$
iv.		=	$to.[kír]_{Ft}$

At step (iii), the positively circumscribed foot is mapped onto a heavy-syllable template, in this case transforming it into CVC by deleting the final vowel. In other cases, there is metathesis, formation of a diphthong, and so on, as was noted above.

These observations readily lend themselves to an analysis in terms of prosodic faithfulness. The foot of the incomplete phase is a transformed version of the foot in the corresponding complete phase, reliably retaining some properties of that foot (its left edge and head) and often altering others (its right edge). Hence, the constraints I-ANCHOR-POS(Ft, Ft, Initial) and I-ANCHOR-POS(Ft, Ft, Head) are high-ranking — undominated, in fact. The constraint I-ANCHOR-POS(Ft, Ft, Final) is low-ranking, violated systematically in deleting and metathesizing cases like (23a, b). All of these constraints hold over the O-O correspondence relation, the transderivational correspondence relation between the output form of the complete phase and the output form of the incomplete phase, in accordance with the general program of Benua (1995, 1997).[12] Similarity in foot structure between the complete phase and the incomplete phase is a consequence of obedience to these constraints.

The effects of the high-ranking ANCHOR-POS constraints are most apparent in candidates like the following:

(25) Some Plausible But Failed Incomplete Phase Candidates

a. Complete Phase	b. Incomplete Phase	
$[r_1á_2.k_3o_4]$	$[r_1a_2k_3]$	*vs. failed candidate* $*r_1a_2.[ó_4k_3]$
$he.[l_3é_4.ʔ_5u_6]$	$he.[l_3e_4ʔ_5]$	*vs. failed candidate* $*he.l_3e_4.[ú_6ʔ_5]$

Were it not for ANCHOR-POS, the failed candidates in (b) would be more harmonic than the actual output forms. The reason: all other constraints are independently ranked in a way that favors the failed candidates (see McCarthy 1996 for fuller development of these arguments).

•The form *he.leʔ* violates MAX-*seg* and obeys ONSET, while **he.le.uʔ* obeys MAX-*seg* and violates ONSET. But we known independently that MAX-*seg* >> ONSET because onsetless syllables are abundantly attested in Rotuman.[13]

•The form *he.leʔ* also obeys LINEARITY (no metathesis), while **he.le.uʔ* violates LINEARITY. But we also know independently that MAX-*seg* >> LINEARITY, because

[12]Segmental evidence for the O-O relation in Rotuman is presented by McCarthy (1996).

[13]Epenthesis is out of the picture because DEP-*seg* is undominated.

metathesis is preferred to deletion in incomplete-phase formation. Deletion occurs only when metathesis is impossible because the resulting diphthong would violate a congeries of undominated constraints (which require that diphthongs in closed syllables be light, and that light diphthongs rise in sonority).[14]

Therefore, we cannot appeal to LINEARITY or ONSET to explain the ill-formedness of **he.le.[úʔ]*.

Rather, what distinguishes the failed candidate **he.le.[úʔ]* from the actual output *he.[leʔ]* is prosodic faithfulness to the related complete-phase form *he.[lé.ʔu]*. High-ranking I-ANCHOR-POS_{OO} ensures the required prosodic match:

(26) I-ANCHOR-POS_{OO}(Ft, Ft, Initial) >> MAX-seg_{OO}

he.[$l_3é_4.ʔ_5u_6$]		I-ANCHOR-POS_{OO}(Ft, Ft, Initial)	MAX-seg_{OO}
a.	☞ he.[$l_3é_4ʔ_5$]		*
b.	he.l_3e_4.[$ú_6ʔ_5$]	*!	

The incomplete phase form in (a) is more faithful to the prosody of the corresponding complete phase than its competitor in (b) is, because in (a) the foot-initial segments of the complete phase and incomplete phase match. (Equivalently, I-ANCHOR-POS_{OO}(Ft, Ft, Head) could be adduced, ensuring a match of foot-head segments.) This ranking is the core of the circumscriptional effect in Rotuman.

A few details remain. One involves the basic character of the incomplete phase template. Under GTT, the requirement that the incomplete phase end in a monosyllabic foot must be understood in terms of some independently necessary constraint of universal grammar. Two likely candidates: the constraint(s) responsible for neutralization of weight distinctions word-finally in many languages (McCarthy 1996); or a constraint demanding word-final stress (Pater 1996).

Another detail involves the stress system. Forms like *he.[lé.uʔ]* or *he.[lé].uʔ* might be expected to fare better than *either* candidate considered in (26), since they violate neither ANCHOR-POS nor MAX-*seg*. But they do so by positing metrical structures that are never attested in Rotuman: a light-heavy trochee in *he.[lé.uʔ]* and an unaligned foot in *he.[lé].uʔ*. Undominated constraints foreclose both options.

To sum up, certain aspects of foot structure must match between the Rotuman complete phase and the related incomplete phase. This is by no means surprising; there are many ways in which the (underlying and derived) segmental phonology of the two phases must also match (McCarthy 1996). No special mechanism of circumscription is needed, since the matching of foot structure is obtained by faithfulness constraints, no different in kind from those that enforce segmental similarity between the phases.

Another case of circumscription plus template-mapping comes from the formation of the habilitative verb in the Uto-Aztecan language Cupeño. When the verb root is consonant-final, the

[14] For this reason, we need not concern ourselves with candidates like **he.[leuʔ]*. Though they achieve satisfactory prosodic faithfulness, they violate undominated constraints by including a falling diphthong in a closed syllable.

habilitative is constructed by a complex pattern of vowel reduplication:[15]

(27) Cupeño Habilitative (Hill 1970; McCarthy 1979, 1984; McCarthy & Prince 1990a; Crowhurst 1994)

	Simple Stem	Habilitative	
a.	čál	čáʔaʔal	'husk'
	tə́w	tə́ʔəʔəw	'see'
	həl^{y}ə́p	həl^{y}ə́ʔəʔəp	'hiccup'
	kəláw	kəláʔaʔaw	'gather wood'
	ʔatís	ʔatíʔiʔis	'sneeze'
b.	páčik	páčiʔik	'leach acorns'
	čáŋnəw	čáŋnəʔəw	'be angry'
	čəkúk^{w}il^{y}	čəkúk^{w}iʔil^{y}	'joke'
c.	pínəʔwəx	pínəʔwəx	'sing enemy songs'
	xáləyəw	xáləyəw	'fall'

With oxytone roots (27a), the habilitative adds two syllables (underlined) to the simple stem. Each added syllable consists of a ʔ onset and a copy of the last vowel. The root-final consonant remains in place, with the reduplicative action occurring to its left. With paroxytone roots (27b), the habilitative adds a single syllable, which likewise has a ʔ onset and a copy of the last vowel. With proparoxytone roots (27c), the habilitative and the simple stem are identical.

Hill (1970) is responsible for the original insight that all subsequent accounts have tried to refine: the habilitative is based on a target of having two post-stress syllables, and this target is achieved by copying the last vowel as many times as necessary. (The ʔ is provided as a default onset, in conformity with a regular pattern of the language.) This core idea has evolved in various ways:

•*McCarthy (1979, 1984):* mapping to a template with variable and fixed portions. The template is Xσ́σσ. The variable X licenses the pretonic material, if any, and the σ́σσ sequence determines the shape of the rest of the habilitative.

•*McCarthy & Prince (1990a):* positive prosodic circumscription and mapping to a fixed template. Every stem is assumed to end with a left-headed foot of one to three syllables: *[čál]$_{Ft}$, ʔa[tís]$_{Ft}$, [páčik]$_{Ft}$, [pínəʔwəx]$_{Ft}$*. This foot is circumscribed by Φ(Ft, Right), and the *B*:Φ portion is mapped onto a template consisting of the maximal expansion of this foot, a dactyl [σ́σσ]$_{Ft}$.

•*Crowhurst (1994):* negative prosodic circumscription and mapping to a fixed template. Every stem is argued to begin with an iambic foot of one or two syllables (modulo final-consonant extrametricality): *[čá]$_{Ft}$l, [pá]$_{Ft}$čik, [kəlá]$_{Ft}$w, [čəkú]$_{Ft}$k^{w}il^{y}*. This foot is circumscribed by Φ(Ft, Left), and the B/Φ portion is mapped onto a template consisting of a binary foot, [σσ]$_{Ft}$.

Though they differ in many ways, these previous accounts have one important property in common: they all take special precautions to ensure that the habilitative template affects only the post-tonic portion of the verb. From the stressed vowel leftward, pre-tonically, the habilitative is identical to the simple stem. In the more recent works, this partitioning of the stem into affected and unaffected portions has been obtained circumscriptionally. In McCarthy & Prince's analysis, the pre-tonic string

[15] I am indebted to John Alderete for his detailed comments on the Cupeño material.

is *hors de combat* because it is outside the scope of positive circumscription. And in Crowhurst's analysis, the pre-tonic string is segregated out (together with the stressed syllable) by negative circumscription.

In operational theories like these, circumscription is necessary to protect the pretonic string from being affected by the template. But Optimality Theory offers another way of protecting it: directly, by faithfulness constraints, which have no counterpart in operational theories. If we rely on Crowhurst's well-motivated assumptions about Cupeño prosody,[16] then it is apparent that the habilitative faithfully reproduces the initial foot of the basic stem:

(28) Prosodic Faithfulness in the Cupeño Habilitative

	Simple Stem	Habilitative
a.	[$\check{c}_1$á$_2$l]	[$\check{c}_1$á$_2$][ʔaʔal]
	[k$_1$əlá$_4$w]	[k$_1$əlá$_4$][ʔaʔaw]
	[ʔ$_1$atí$_4$s]	[ʔ$_1$atí$_4$][ʔiʔis]
b.	[p$_1$á$_2$]čik	[p$_1$á$_2$][čiʔik]
	[$\check{c}_1$əkú$_4$]k^{w}il^y	[$\check{c}_1$əkú$_4$][k^{w}iʔil^y]
c.	[p$_1$í$_2$]nəʔwəx	[p$_1$í$_2$][nəʔwəx]

The left-aligned, mono- or disyllabic foot of the basic stem is preserved unchanged in the habilitative, except for displacement of the stem-final consonant in (a). The habilitative is otherwise dramatically different from the basic stem, since it adds a second, disyllabic foot. By virtue of high-ranking prosodic faithfulness constraints, the disyllabic foot template added in the habilitative is not permitted to disrupt the foot inherited from the basic stem. What circumscription does indirectly, prosodic faithfulness does directly, and it does so without the liabilities that circumscription brings, such as the duplication of effort apparent below in (31).

This is the essential element of the analysis of Cupeño, and it is nothing but a straightforward application of the same ideas called on in Yidiɲ and Rotuman. As the co-indexation of correspondent elements in (28) shows, the foot-heading segment in the simple stem stands in correspondence with a foot-heading segment in the habilitative. Thus, I-ANCHOR-POS(Ft, Ft, Head) is unviolated and undominated. (Equivalently, starting from the observation that the foot-initial segment in the simple stem stands in correspondence with a foot-initial segment in the habilitative, we could equally assert that I-ANCHOR-POS(Ft, Ft, Initial) is undominated.)

A particularly striking effect of I-ANCHOR-POS can be observed from its interaction with the anti-epenthesis constraint DEP-*seg*. The habilitative *[k$_1$əlá$_4$][ʔaʔaw]* has a total of two epenthetic syllables containing four epenthetic segments, the two default ʔ's and the two copied *a*'s. Now compare this form to the failed candidate **[k$_1$ə́][la$_4$ʔaw]*, which avoids epenthesizing one whole syllable by the artifice of moving stress onto the initial syllable. The problem with this candidate does not lie with prosody per se — compare the prosodically identical form *[$\check{c}_1$á$_2$][ʔaʔal]*. Rather, what's wrong with **[k$_1$ə́][la$_4$ʔaw]* is that it's prosodically unfaithful to the simple stem *[k$_1$əlá$_4$w]*, because the foot-head of the simple stem does not stand in correspondence with a foot-head in the habilitative. The following tableau completes the argument at the level of formal detail:

[16] Crowhurst observes that Cupeño roots are regularly stressed on the first or second syllable — the choice is lexically determined. She therefore proposes that roots are provided lexically with a left-aligned mono- or disyllabic iambic foot. (See Alderete (1996) for a detailed discussion of the system in OT terms.) This analysis supports the idea that the native foot type is binary and iambic, just as in Crowhurst's assumed simple stem forms and habilitative template.

(29) I-ANCHOR-POS(Ft, Ft, Head) >> DEP-*seg*

[k$_1$ə$_2$lá$_4$w]	I-ANCHOR-POS(Ft, Ft, Head)	DEP-*seg*[17]
a. ☞ [k$_1$ə$_2$lá$_4$][ʔaʔaw]		****
b. [k$_1$ə́$_2$][la$_4$ʔaw]	*!	**

This ranking argument emphasizes that prosodic faithfulness in the stem→habilitative mapping may be purchased at a cost in segmental faithfulness, such as epenthesis.

We have seen, then, that the foot-heading (and foot-initial) segments must stand in correspondence in stem and habilitative. Foot-finally, though, a mismatch is possible. I-ANCHOR-POS(Ft, Ft, **Final**) is violated by the habilitative of oxytone stems, as can be seen from (28a). The responsible constraint here is a different kind of Anchoring — one that is more in the nature of classic MCat-PCat alignment effects. Specifically, I-ANCHOR-POS(Stem, Word, Final) must dominate I-ANCHOR-POS(Ft, Ft, Final), as the following tableau shows:

(30) I-ANCHOR-POS(Stem, Word, Final) >> I-ANCHOR-POS(Ft, Ft, Final)

[čál$_3$]$_{Ft}$	I-ANCHOR-POS(Stem, Wd, Final)	I-ANCHOR-POS(Ft, Ft, Final)
a. ☞ [čá] [ʔaʔal$_3$]		*
b. [čál$_3$] [ʔaʔa]	*!	

Hence, absolutely perfect foot-faithfulness is not always achieved — it suffers when it would run afoul of right-edge stem alignment. Effects like this, here attributed to I-ANCHOR-POS(Stem, Wd, Final), are familiar from the literature on Alignment constraints (and earlier from extrametricality-based approaches like Crowhurst's). For example, the constraints dubbed ALIGN-L and ALIGN-R have very similar edge-preserving consequences in the phonologies of Axininca Campa and Lardil.[18]

To sum up, undominated I-ANCHOR-POS(Ft, Ft, Head) (or I-ANCHOR-POS(Ft, Ft, Initial)) accounts for the inertia of the stem-initial foot in forming the habilitative. The habilitative template must be satisfied without altering the headedness or segmental contents of the initial foot (except for a stem-final consonant, whose disposition falls to undominated I-ANCHOR-POS(Stem, Word, Final)).

In Crowhurst's (1994) analysis, by comparison, inertia of the initial foot is a matter of negative circumscription. Here is how she derives the habilitative of some representative oxytone and paroxytone roots:

---

[17] The violation marks for DEP-*seg* are here presented under the assumption that the added vowels in e.g. *kəláʔaʔaw* have epenthetic root nodes (though their Place nodes are supplied by autosegmental spreading). Alternative assumptions are possible and certainly compatible with the argument made here. (I am indebted to Ania Łubowicz for a question on this point.)

[18] Caroline Jones points out that the candidate *[čal$_3$]ʔaʔal$_3$*, with doubling of the *l*, is anchored in both dimensions simultaneously. Candidates like this, with long-distance consonant gemination, are not just less harmonic but in all likelihood impossible. For relevant discussion, see Clements & Hume (1995) and Gafos (1996, 1997a).

(31) Negative Circumscription in Cupeño (Simplified from Crowhurst 1994: (17))

a. Basic Stem

```
Ft                    Ft
|                    / \
σ                   σ   σ
|\                  |\ /|\
pá …ik              kə láw
```

b. Final Consonant Extrametricality: *B*/Φ(C, Right)

```
Ft                    Ft
|                    / \
σ                   σ   σ
|\                  |\ /|
pá …i {k}           kə lá {w}
```

c. Negative Prosodic Circumscription of Initial Foot: Φ(Ft, Left)

```
 Ft                   Ft
 |                   / \
 σ                  σ   σ
 |\                 |\ /|
{pá} …i {k}         {kə lá} {w}
```

d. Left-to-right Mapping of *B*/Φ to $[\sigma\sigma]_{Ft}$ Template

```
 Ft    Ft             Ft    Ft
 |     /\            /  \   /\
 σ    σ  σ           σ   σ σ  σ
 |\  /|              |\ /|
{pá} …i   {k}       {kə lá}    {w}
```

e. Spreading from *B*/Φ to Satisfy $[\sigma\sigma]_{Ft}$ Template

```
 Ft    Ft             Ft    Ft
 |     /\            /  \   /\
 σ    σ  σ           σ   σ σ  σ
 |\  /|/             |\ /|
{pá} …i   {k}       {kə lá}    {w}
```

f. Restore *B*:Φ Portion and Proceed Again with Spreading Step (e)

```
Ft   Ft              Ft    Ft
|    /\             /  \   /\
σ   σ  σ            σ   σ σ  σ
|\ /|/              |\ /|/ /
pá …i   {k}         kə la    {w}
```

g. Restore Extrametrical Consonant

```
Ft   Ft              Ft    Ft
|    /\             /  \   /\
σ   σ  σ            σ   σ σ  σ
|\ /|/  \           |\ /|/ / \
pá …i   k           kə lá     w
```

Inactivity of the initial foot is obtained by negative circumscription at step (c). This temporarily removes the initial foot and its contents from consideration, leaving template satisfaction to any post-tonic segments in steps (d) and (e).

This is the main idea of the circumscriptional analysis, but it is buttressed by an auxiliary assumption that renders the overall package somewhat less attractive. With oxytones like *kəláw*, consonant extrametricality and negative circumscription leave no visible segments whatsoever, and so there is nothing to map onto the template at steps (d) and (e). This is the reason for step (f), which attempts to spread the vowel again after the negatively circumscribed material has been restored. The problem revealed here is that operational circumscription goes too far; it has a protective effect on the initial foot, as desired, but it also has the undesirable consequence of rendering the contents of the initial foot entirely inaccessible to phonological manipulation. Merely copying the stressed vowel does no violence to the initial foot, but negative circumscription, over-protectively, bans even that. In contrast, the prosodic faithfulness constraints require only that the initial foot be preserved intact; they say nothing about processes, such as vowel copying, that do not and can not affect the initial foot. Hence, a significant complication in the circumscriptional analysis is avoided.

Having sketched an analysis of Cupeño based on prosodic faithfulness and having presented some reasons to prefer it to alternatives, I now need to clear up a few remaining details. The matters to be addressed are these:

(i) The stem→habilitative correspondence relation.

(ii) The nature of the template.

(iii) The choice of epenthetic material.

(i) The correspondence relation. In Cupeño, many roots have lexical stress, always on the first or second syllable. Except in compounds, the lexical stress of roots will always emerge faithfully on the surface, by virtue of high-ranking I-O prosodic faithfulness constraints (Alderete 1996). For instance, surface *[kəláw]* is derived from underlying /[kəláw]/, with faithful preservation of the underlying foot structure. This leads to a question: in tableaux like (29), is I-ANCHOR-POS enforcing prosodic faithfulness on the I→O mapping (/[kəláw]/→*[kəlá][ʔaʔaw]*) or the O→O mapping *[kəláw]→[kəlá][ʔaʔaw]* ? Equivalently, is this a faithfulness effect of the familiar type or a transderivational one of the type studied by Benua (1995, 1997) and exemplified above in Rotuman?

Decisive evidence comes from roots that are underlyingly unaccented. Unaccented roots can be diagnosed by the fact that they are unstressed in the presence of an accented affix; otherwise, accented roots take precedence over accented affixes. (See Alderete 1996 for discussion and analysis.) By this criterion, the root /təw/ 'see' is unaccented, though it receives default initial stress, surfacing as *[tə́w]*, outside the presence of an accented affix. Significantly, the habilitative of /təw/→*[tə́w]* is *[tə́][ʔəʔəw]* — just like the habilitative *[čá][ʔaʔal]* from the accented root /[čál]/→*[čál]*. Unaccented and accented roots, which are distinguished in the input and identical in the output, form their habilitatives in exactly the same way. This fact proves that prosodic faithfulness is enforced on an O-O correspondence relation between the output form of the simple stem and the output form of the habilitative, and the constraint involved should properly be called I-ANCHOR-POS_{OO}(Ft, Ft, Head).

(ii) The template. The habilitative consists of two feet. The first, which is mono- or disyllabic, is faithfully inherited from the simple stem. The second, which is always disyllabic, is added in response to some constraints whose force is limited to the habilitative. Under GTT, we must locate those constraints of Universal Grammar which explain why the added foot is disyllabic and why it is added at all.

The added foot is disyllabic to satisfy FT-BIN, foot binarity (Prince 1980, McCarthy and Prince 1986, Hayes 1995), which demands that all feet be disyllabic (or bimoraic, in quantity-sensitive systems). True, FT-BIN is little honored in Cupeño, since faithful treatment of lexically specified feet takes precedence (Crowhurst 1994, Alderete 1996). But the added foot of the habilitative has no faithfulness commitments to honor; it is created *ex nihilo*. By the logic of emergence of the unmarked (McCarthy & Prince 1994a), novel structures that have no faithfulness commitments will satisfy markedness constraints that inherited structures, bound by faithfulness, routinely violate. The added foot in the habilitative is binary because binary feet are good, by FT-BIN.

The overall structure of the habilitative is bipodal. This is reminiscent of *zuuja-go* secret language forms in Japanese. Itô, Kitagawa, & Mester (1996) propose that *zuuja-go* bipodality is an effect of NON-FINALITY, which requires that the head foot be foot-wise non-final (i.e., that it be followed by another foot). The same idea can be recruited in Cupeño: the head foot, which has an overt stress, is rendered non-final in the habilitative by supplying another foot to follow it. The situation is much like the placement of main stress in English, except that it is limited to a specific morphological category instead of extending to the whole language.

(iii) Epenthesis. The choice of epenthetic material for added syllables in the habilitative is also a consequence of emergence of the unmarked. The onset is default ʔ, which satisfies markedness constraints that other consonants violate. The nucleus is filled by epenthesizing a root node and spreading a place node spread from the preceding vowel. Beckman (1995) and Alderete et al. (1996) propose that spreading is favored for markedness reasons, because markedness is evaluated on autosegmental units rather than their individual segmental projections.

In principle, the same result could have been achieved by spreading a consonant and inserting a default vowel, yielding **čáčəčəl*, or by spreading both vowel and consonant, yielding **čáčačal*. These outcomes seem impossible, not merely in Cupeño but universally. The property that unites them in impossibility is spreading of a consonant across a vowel. Arguably, this is not met with in any language; see the references in note 18 for discussion.

To sum up, I have argued that inertia of the stem-initial foot in forming the Cupeño habilitative is a consequence of high-ranking prosodic faithfulness constraints. This account is superior to circumscriptional analyses, which go too far, making the initial foot entirely invisible to the phonology, even though visibility for copying purposes is required. The comparison between prosodic faithfulness and operational circumscription is unusually direct and probative in Cupeño, offering strong support for the overall program laid out here.

****

In this section, I have shown how ANCHOR-POS constraints, which require forms to match in specific aspects of prosodic constituency, take on much of the descriptive burden of operational prosodic circumscription. From this perspective, circumscriptional phenomena are seen in terms of prosodic faithfulness rather than successive steps of constituent parsing, performing an operation on that constituent, and then putting the pieces back together.

The approach based on Anchoring appears to be at least as successful empirically as the operational circumscription model. As far as explanation goes, it is surely superior, since it accounts without special pleading for the case of Cupeño, which has never been satisfactorily analyzed in operational terms. More broadly, the connection made between circumscriptional phenomena and faithfulness reveals a truth that the operational model obscured: that circumscription is really a matter of ensuring particular kinds of prosodic similarity between reduplicant and base or within partial paradigms. Thus, this account brings with it interesting connections to the theory and practice of faithfulness, connections that the more parochial notion of operational prosodic circumscription cannot provide. In the end, then, these results support the overarching goal of the theory of Prosodic

Morphology, since they lead to the elimination of the PM-specific device of circumscription in favor of faithfulness constraints, which are surely independently necessary in OT.

§5. Prosodic Circumscription as Moraic Faithfulness: The Arabic Broken Plural

The Arabic broken plural (McCarthy & Prince 1990a) is the classic exemplar of operational prosodic circumscription in the parsing mode. In the Φ-parsing stage, a particular prosodic constituent-type is extracted from the base even at the expense of disrupting any pre-existing prosodic analysis; in the limit, even individual syllables may be rent asunder. Subsequent events then proceed just as they do in the simpler picking-mode cases. The Arabic plural, as well as the similar Choctaw example (Lombardi and McCarthy 1991, Ulrich 1992, Hung 1992, Samek-Lodovici 1992, 1993), calls on the full power of a serial derivation in the operational model, and therefore it presents a particular challenge to the constraint-based approach advocated here. The approach taken here to Arabic is inspired by Samek-Lodovici's work on Choctaw, though of course details are different.

The data of interest, taken from the iambic plural and diminutive pattern, are as follows:

(32) Arabic Iambic Broken Plural & Diminutive

	Sg.	Pl.	Dim.	
a. CvCC Singular Nouns				
	nafs	nufuus	nufays-at	'soul'
	qidħ	qidaaħ	qudayħ	'arrow'
	ħukm	ʔaħkaam	ħukaym	'judgment'
b. CvCvC Singular Nouns				
	ʔasad	ʔusuud	ʔusayd	'lion'
	rajul	rijaal	rujayl	'man'
	ʕinab	ʔaʕnaab	ʕunayb	'grape'
c. CvCvvC+at Singular Nouns				
	saħaab+at	saħaaʔib	suħayyib	'cloud'
	jaziir+at	jazaaʔir	juzayyir	'island'
	kariim+at	karaaʔim	kurayyim	'noble'
	ħaluub+at	ħalaaʔib	ħulayyib	'milch-camel'
d. CvvCvC+at Singular Nouns				
	faakih+at	fawaakih	fuwaykih	'fruit'
	ʔaanis+at	ʔawaanis	ʔuwaynis	'cheerful'
e. CvvCv(v)C Singular Nouns				
	xaatam	xawaatim	xuwaytim	'signet-ring'
	jaamuus	jawaamiis	juwaymiis	'buffalo'
f. CvCCv(v)C Singular Nouns				
	jundub	janaadib	junaydib	'locust'
	sulTaan	salaaTiin	sulayTiin	'sultan'

There are many details to be considered in a full account; see McCarthy & Prince (1990a) for discussion. In keeping with the overall aims of this article, I will focus here on just the relationship between the **prosodic structure** of the singular noun and its plural or diminutive.

The core of the operational analysis of Arabic is circumscription of a bimoraic sequence — the foot type known as a moraic trochee — at the left edge of the singular stem. Thus, the circumscriptional operation is $\Phi(Ft_{\mu\mu}, Left)$. Typically, Arabic stems do not begin with such a foot, and sometimes they begin with a light-heavy sequence that cannot even be wholly parsed into such a foot. But prosodic circumscription in the parsing mode has no regard for such niceties. Its force may be particularly observed in cases like (33d), where the *B*:Φ portion does not even correspond to a whole number of syllables in the singular stem:

(33) Formal Treatment Circumscriptionally

	Sg.	*B*Φ	*B*/Φ	Pl.	Dim.
a.	nafs	naf	s	nufuus	nufays-at
	ʔasad	ʔasa	d	ʔusuud	ʔusayd
b.	jundub	jun	dub	janaadib	jundaydib
	sulTaan	sul	Taan	salaaTiin	sulayTiin
c.	xaatam	xaa	tam	xawaatim	xuwaytim
	jaamuus	jaa	muus	jawaamiis	juwaymiis
d.	saħaab-at	saħa	ab	saħaaʔib	suħayyib
	jaziir-at	jazi	ir	jazaaʔir	juzayyir
e.	kuttaab	kut	taab	kataatiib	kutaytiib
	jilbaab	jil	baab	jalaabiib	julaybiib

Once the *B*:Φ portion has been extracted, it is mapped onto a light-heavy iambic foot template. The form is then reassembled and adjustments are made in the vocalism (not considered further here).

Operational circumscription lays claim to three principal descriptive results in the analysis of Arabic. First, circumscription protects the *B*/Φ portion from alteration by the template. That effect is clearest in the contrast between *jundub/janaadib* and *sulTaan/salaaTiin* (33b) — the weight of the final syllable is preserved in the mapping from singular to plural, despite the havoc the iambic template wreaks on the rest of the form. More subtly, the protected *B*/Φ factor consists of a syllable fragment like *ab* in *saħaab+at* (33d), and this fragment is preserved (with an epenthetic onset) in the corresponding plural *saħaaʔib*. Second, there is a more abstract effect of circumscription that can be seen from a contrast in the distribution of epenthetic consonants in (33c, d). In *xaatam/xawaatim*, the circumscribed portion *xaa* contains just a single root consonant, *x*, so the templatic portion *xawaa* is supplied with an epenthetic consonant *w*.[19] But in *saħaab+at/saħaaʔib*, the circumscribed portion *saħa* contains two root consonants, and then the epenthetic consonant appears in the *B*/Φ portion. Third, circumscription gives a principled account of why plural/diminutive formation conserves spreading of a root consonant, as in (33e) — even to the point of swapping local spreading for long-distance (*kuttaab* → *kataatiib*).

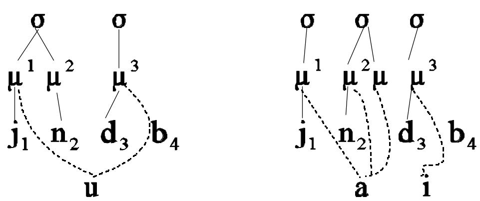
Here I will argue that these empirical consequences of operational circumscription can also be obtained from prosodic faithfulness constraints in OT. The preservation of the weight of the final syllable is a typical prosodic faithfulness effect — a consequence of high-ranking MAX-μ and DEP-μ. The contrast in position of the epenthetic consonant — *xawaatim* versus *saħaaʔib* — and the conservation of consonantal spreading are also a matter of faithfulness, but in this case it is faithfulness to autosegmental associations. Both are effects of preserving corresponding segment-to-mora linkage — that is, they are anti-spreading, anti-delinking faithfulness effects of the type that are commonplace in tone systems.

Before these results can be secured, though, it is necessary to develop a fuller picture of the prosodic structure and the correspondence relations in the singular → plural/diminutive map. As I

[19]The choice between epenthetic ʔ in *saħaaʔib* and epenthetic *w* in *xawaatim* is made on phonological grounds — see McCarthy & Prince (1990a).

noted above (§3), both moras and segments stand in correspondence. As a notational convenience, superscripted indices will be used for the mora-to-mora correspondence relation and subscripted indices for the segment-to-segment correspondence relation. Thus, the *jundub* → *janaadib* mapping can be characterized as follows:[20]

(34) *jundub* → *janaadib* Correspondence Relations



These representations reflects several analytic assumptions being made here to simplify the discussion:

- •Onsets are linked to the nuclear mora, forming CV moraic sequences (as in Hyman 1985, Itô 1986, 1989, Zec 1988, etc.).
- •Final consonants are effectively extrametrical, not participating in the prosody of the stem as a whole (as in McCarthy & Prince 1990ab).
- •The "added" mora that separates *jundub* from *janaadib* appears at the end of the second syllable. In (34), this mora is shown without a superscript, since it lacks an O-O correspondent.[21]
- •Because vowel melodies are prescribed for the plural and diminutive, the vowels of *jundub* and *janaadib* are not in correspondence with one another (and so are shown without subscripts).

None of these assumptions is absolutely indispensable to the working-out of the proposal, but all are helpful.

For compactness, tree structures like (34) can be folded into a single string with both super- and subscripts (with ⁀ showing shared CV moras), yielding the following summary of the O-O correspondence relations in the relevant data:[22]

(35) Singular → Plural Correspondence Relations

a. *nafs/nufuus*

$\overset{\frown}{n_1a^1}\ f_3^{\,2}\ s_4$ $\quad$ $\overset{\frown}{n_1u^1}\ \overset{\frown}{f_3u^2}\text{ː}\ s_4$

b. *ʔasad/ʔusuud*

$\overset{\frown}{ʔ_1a^1}\overset{\frown}{s_3a^2}d_5$ $\quad$ $\overset{\frown}{ʔ_1u^1}\ \overset{\frown}{s_3u^2}\text{ː}\ d_5$

c. *jundub/janaadib*

$\overset{\frown}{j_1u^1}\ n_3^{\,2}\ \overset{\frown}{d_4u^3}\ b_6$ $\quad$ $\overset{\frown}{j_1a^1}\ \overset{\frown}{n_3a^2}\text{ː}\ \overset{\frown}{d_4i^3}\ b_6$

---

[20] In order to maintain the closest possible parallel to the McCarthy & Prince (1990a) analysis, I continue to assume with them that Arabic has CV tier segregation. For a different view, see Gafos (1996, 1997a).

[21] If it is an affix though, as suggested below, it does have an I-O correspondent.

[22] It should be emphasized that there is no inherent sense to the indices. Thus, for example, $n_1af_3s_4$ could just as well be $n_£af_¥s_{P‹}$. The function of the indices is to show the correspondence relation between singular and plural (or any other forms standing in correspondence).

d. *sulTaan/salaaTiin*

$s_1u^1\,l_3^2\;T_4a^{3}\text{ː}^{4}\,n_6$ $\qquad$ $s_1a^1\,l_3a^{2}\text{ː}\;T_4i^{3}\text{ː}^{4}\,n_6$

e. *xaatam/xawaatim*

$x_1a^{1}\text{ː}^{2}\,t_3a^3\,m_5$ $\qquad$ $x_1a^1\;wa^{2}\text{ː}\;t_3i^3\;m_5$

f. *jaamuus/jawaamiis*

$j_1a^{1}\text{ː}^{2}m_3u^{3}\text{ː}^{4}s_5$ $\qquad$ $j_1a^1\;wa^{2}\text{ː}\;m_3i^{3}\text{ː}^{4}\,s_5$

g. *jaziir(+at)/jazaaʔir*

$j_1a^1\;z_3i^{2}\text{ː}^{3}\;r_5$ $\qquad$ $j_1a^1\;z_3a^{2}\text{ː}\;\text{ʔ}i^3\;r_5$

With these preliminaries out of the way, the goal of the analysis can now be described exactly: to characterize the mapping in (35) in terms of a hierarchy of universal constraints, with a focus on faithfulness.

The correspondence relation shown in (35) is of the transderivational or O-O type (Benua 1995, 1997), since the connection is between output forms of singular and plural, rather than between the output plural and the underlying consonantal root (McCarthy & Prince 1990a). Two kinds of faithfulness constraints are relevant to this mapping: faithfulness to the elements standing in correspondence (segments and moras), and faithfulness to the autosegmental association relation between these elements. Faithfulness to segments and moras is a matter of obedience to constraints like MAX-*seg*, DEP-*seg*, MAX-μ, and DEP-μ. Faithfulness to autosegmental association involves obeying NO-DELINK and NO-SPREAD (§3 above). In Arabic, the autosegmental associations of interest are between segments and moras in a representation like (34). The constraints demanding conservation of these associations are therefore NO-DELINK(μ, *seg*) and NO-SPREAD(μ, *seg*). These constraints, which must in any case be part of Universal Grammar, are all that we require to explain the main properties of the Arabic plural.

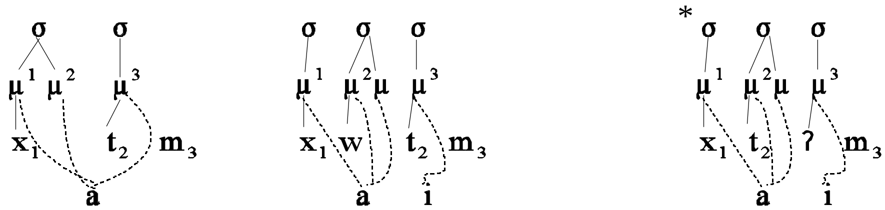
One of the main descriptive results claimed for the operational circumscription model is conservation of the final syllable's weight (see (35c, d, e, f)). From the perspective of OT, however, this is just faithfulness to moras in the singular→plural mapping. MAX-μ_{OO} is undominated in Arabic; DEP-μ_{OO} is violated only by virtue of the the added mora (an affix) in the plural. In short, failed candidates like *janaa<u>diib</u>* (for *jundub/janaa<u>dib</u>*) or *salaa<u>Tin</u>* (for *sulTaan/salaa<u>Tiin</u>*) present no difficulties; they are straightforward consequences of the high-ranking μ-faithfulness constraints.

Another descriptive result claimed for the operational model is its story about the distribution of epenthetic consonants in the plural. It can be seen by comparing (35e) and (35f) to (35g) — the singulars differ only in the locus of the bimoraic syllable relative to the second root consonant, and this somehow translates into a difference in placement of the epenthetic consonant in the plural. To put the matter in terms of candidate selection, it is necessary to explain why the plural of *xaatam* is *xa<u>w</u>aatim* and not *xataaʔim* and likewise why the plural of *jaziir+at* is *jazaa<u>ʔ</u>ir* and not *ja<u>w</u>aazir*.

The autosegmental representations in (36) show how this contrast plays out in the singular/plural O-O correspondence relation:

(36) Correspondence Relations in *xaatam* → *xawaatim*, **xataaʔim*

Singular | Actual Plural | Failed Candidate



xaatam | *xawaatim* | **xataaʔim*

The problem with the failed candidate is that it has undergone a kind of reassociation or "flop" process in relation to the singular: correspondence-wise, t_2 of the failed candidate is linked to a different mora than in the singular. This is a violation of NO-DELINK$_{OO}$(μ, *seg*) and NO-SPREAD$_{OO}$(μ, *seg*), which militate against loss and gain of association lines, respectively. All of the interesting cases in (35e–g) can be subsumed under the same rubric. Here they are, with the epenthetic consonant in boldface and the locus of flop underlined:

(37) Role of NO-DELINK$_{OO}$(μ, *seg*) and/or NO-SPREAD$_{OO}$(μ, *seg*)

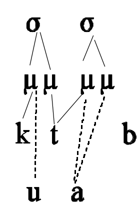
	Singular	Plural	Failed Plural Candidate
e. *xaatam/xawaatim*			
	$x_1a^1{:}^2t_3a^3m_5$	$x_1a^1\,\mathbf{C}a^2{:}\,t_3i^3\,m_5$	$*x_1a^1\,\underline{t_3a^2}{:}\,\mathbf{C}i^3\,m_5$
f. *jaamuus/jawaamiis*			
	$j_1a^1{:}^2m_3u^3{:}^4s_5$	$j_1a^1\,\mathbf{C}a^2{:}\,m_3i^3{:}^4\,s_5$	$*j_1a^1\,\underline{m_3a^2}{:}\,\mathbf{C}i^3{:}^4\,s_5$
g. *jaziir(+at)/jazaaʔir*			
	$j_1a^1\,z_3i^2{:}^3\,r_5$	$j_1a^1\,z_3a^2{:}\,\mathbf{C}i^3\,r_5$	$*j_1a^1\,\mathbf{C}a^2{:}\,\underline{z_3i^3}\,r_5$

The paired successful and failed candidates in (37) differ only in the placement of the epenthetic consonant; they do not differ in any respect that is relevant to the other constraints, such as completeness of moraic or segmental correspondence. This means that NO-DELINK$_{OO}$(μ, *seg*) and/or NO-SPREAD$_{OO}$(μ, *seg*) will settle the matter in favor of the actual output form no matter how they are ranked. In this way, we explain the second main empirical result claimed by the operational model: the complex dependency between the distribution of light and heavy syllables in the singular and the distribution of epenthetic consonants in the plural.

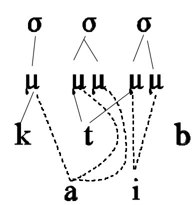
The third main descriptive result that the operational model gets in Arabic involves the treatment of consonantal spreading. Formation of the plural and diminutive preserves consonantal spreading from the singular, even when original geminates must become long-distance linked structures:

(38) Effect of Consonantal Spreading in Operational Circumscription

Sg. | *B*:Φ kut | *B*/Φ taab | Pl.



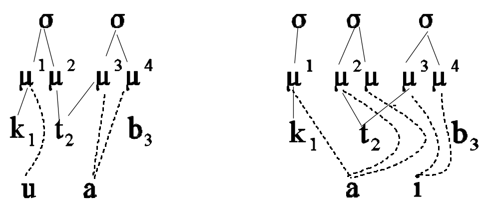
kuttaab



kataatiib

In these spreading configurations, a single consonant occupies more than one syllabic position, either locally or long-distance. Since segmental correspondence goes from root-node to root-node, there is just one root-node *t* in the singular in (38) standing in correspondence with just one root-node *t* in the plural:

(39) O-O Correspondence Relations in Spreading Configurations



Or more compactly:

(40) Principal Cases of Spreading in Singular/Plural Pairs

	Singular	Plural
a. *baSS/buSuus* (common, productive, N > 100)		
	$\widehat{b_1 a}^1\ \widehat{S_3{}^2\ S_3}$	$\widehat{b_1 u}^1\ \widehat{S_3 u}^{2}\!:\ S_3$
b. *jilbaab/jalaabiib* (uncommon, N < 30)		
	$\widehat{j_1 i}^1\ l_3{}^2\ \widehat{b_4 a}^{3}\!:^{4}\ b_4$	$\widehat{j_1 a}^1\ \widehat{l_3 a}^{2}\!:\ \widehat{b_4 i}^{3}\!:^{4}\ b_4$
c. *kuttaab/kataatiib* (common, productive, N > 100)		
	$\widehat{k_1 u}^1\ t_3{}^2\ \widehat{t_3 a}^{3}\!:^{4}\ b_5$	$\widehat{k_1 a}^1\ \widehat{t_3 a}^{2}\!:\ \widehat{t_3 i}^{3}\!:^{4}\ b_5$
d. *tinniin/tanaaniin* (rare, N < 5)		
	$\widehat{t_1 i}^1\ n_3{}^2\ \widehat{n_3 i}^{3}\!:^{4}\ n_3$	$\widehat{t_1 a}^1\ \widehat{n_3 a}^{2}\!:\ \widehat{n_3 i}^{3}\!:^{4}\ n_3$

This conservation of autosegmental spreading in the singular→plural mapping is attributable to NO-DELINK$_{OO}$(μ, *seg*) and NO-SPREAD$_{OO}$(μ, *seg*). The former ensures that spreading in the singular is maintained in the plural. The latter, by dominating DEP-*seg*$_{OO}$, accounts for the fact that spreading is not normally an option in onset-filling situations.[23] Compare:

(41) Spreading in Singular ⇒ Spreading — Not Epenthesis — in Plural

kuttaab	*kataatiib*	
$k_1\ u^1\ t_3{}^2\ t_3\ a^{3}\!:^{4}\ b_5$	$k_1\ a^1\ \underline{t_3\ a^{2}\!:\ t_3}\ i^{3}\!:^{4}\ b_5$	
	$^*k_1\ a^1\ \underline{t_3\ a^{2}\!:\ \text{ʔ}}\ i^{3}\!:^{4}\ b_5$	(with epenthetic ʔ)

(42) No Spreading in Singular ⇒ Epenthesis — Not Spreading — in Plural

a.	*xaatam*	*xawaatim*	
	$x_1\ a^{1}\!:^{2}\ t_3\ a^3\ m_5$	$x_1\ a^1\ \underline{w\ a^{2}\!:\ t_3}\ i^3\ m_5$	(with epenthetic *w*)
		$^*x_1\ a^1\ \underline{t_3\ a^{2}\!:\ t_3}\ i^3\ m_5$	(with spreading of *t*)
		$^*x_1\ a^1\ t_3\ a^{2}\!:\ \underline{m_5\ \ i^3\ m_5}$	(with spreading of *m*)
b.	*jaziir(+at)*	*jazaaʔir*	
	$j_1\ a^1\ z_3\ i^{2}\!:^{3}\ r_5$	$j_1\ a^1\ \underline{z_3\ a^{2}\!:\ \text{ʔ}}\ i^3\ r_5$	(with epenthetic ʔ)
		$^*j_1\ a^1\ \underline{z_3\ a^{2}\!:\ z_3}\ i^3\ r_5$	(with spreading of *z*)
		$^*j_1\ a^1\ z_3\ a^{2}\!:\ \underline{r_5\ i^3\ r_5}$	(with spreading of *r*)

The competition between the actual output and any of the failed candidates in (42) is sufficient to

[23] A few nouns — about 10, all of them C*ii*C*aa*C — show onset-filling spreading in the singular→plural mapping: *diinaar→danaaniir* ‘dinar (unit of currency)’.

prove that NO-SPREAD$_{OO}$(μ, *seg*) >> DEP-*seg*$_{OO}$, ensuring that spreading is dispreferred in onset-filling situations. But when spreading is already present in the basic form, it is preserved in the plural, because of NO-DELINK$_{OO}$(μ, *seg*).

****

I began this section by pointing out three main analytic results obtained by applying operational circumscription to Arabic: conservation of the weight of the final syllable in certain singular→plural/diminutive mappings; the complex relation between the weight of syllables in the singular and the position of epenthetic consonants in the plural/diminutive; and the conservation of consonantal spreading in all singular→plural/diminutive mappings. I have argued that each of these phenomena can be equally well understood within a correspondence-based approach to prosodic faithfulness. Conservation of weight is simply a matter of satisfying DEP-μ and MAX-μ; the other two results follow from the associational faithfulness constraints NO-DELINK$_{OO}$(μ, *seg*) and NO-SPREAD$_{OO}$(μ, *seg*). Unlike parsing-mode prosodic circumscription, which appears to have no applicability beyond a narrow range of cases like Arabic, all of these constraints are independently motivated. Indeed, they are absolutely essential aspects of phonological theory, with obvious ties to other types of faithfulness constraints.

I have not offered a complete account of the Arabic plural and diminutive in this brief sketch, but I have countered the main arguments for operational circumscription. Before concluding, though, I should say something about the morphology involved in plural and diminutive formation. In the operational approach, the plural/diminutive morphology is based on an iambic template to which *B*:Φ is mapped. In contrast, I have proceeded under the assumption that a mora (or a *y* in the diminutive) is added in a particular position in the word (see (35) for the full picture of the correspondence relations):

(43) Locus of Added Mora in Plural and Diminutive

	Singular	Plural	Diminutive
a.	nafs	nufuus	nufays
b.	ʔasad	ʔusuud	ʔusayd
c.	jundub	janaadib	junaydib
d.	sulTaan	salaaTiin	sulayTiin
e.	xaatam	xawaatim	xuwaytim
f.	jaamuus	jawaamiis	juwaymiis
g.	jaziir(+at)	jazaaʔir	juzayyir

This display establishes a clear equivalence between the added mora of the plural and the added *y* of the diminutive. It also shows that they appear in a consistent position: at the end of the second syllable.

One way to understand these facts is to regard the added μ and *y* as suffixes, but suffixes which are forced into infix position by high-ranking constraints (the symmetric counterparts of Tagalog and Timugon Murut in §2). The constraints responsible for infixation are members of the family of **positional faithfulness** constraints identified by Beckman (1995, 1997). The theory of positional faithfulness asserts that some positions are privileged to receive special faithfulness treatment. Among the positions so privileged are stem-initial and stem-final syllables. If faithfulness to stem-initial and stem-final syllables is high-ranking, then the suffixal μ or *y* will be driven into a stem-medial syllable. With disyllabic stems, there is no medial syllable, of course;[24] in that case, stem-initial syllable faithfulness takes precedence, following a pattern that is widely observed cross-linguistically. The point, then, is that there is a plausible affixational analysis to replace the templatic one of the operational theory.

§6 Conclusion

The theory of Prosodic Morphology is concerned with explaining the properties of phenomena like template-mapping, infixation, and reduplication. In Prosodic Morphology and in linguistics generally, the goal of explanation is advanced when local stipulations and parochial mechanisms are replaced by principles of broad applicability. This article pursues that goal in relation to phenomena coming under the purview of operational prosodic circumscription.

Though it has achieved some significant descriptive and analytic successes, operational prosodic circumscription includes much that is local and parochial and therefore detrimental to explanation. Research in Optimality Theory, however, has already led to significant improvements in our understanding of one type of prosodic circumscription, infixation. Infixation in Tagalog or Timugon Murut (§2) is now understood in a much more fully explanatory way as a consequence of the interaction of syllable-structure constraints with affixal alignment constraints. Both of these constraint types have ample support outside the narrow domain of infixation, and so they supply the kind of independent support and unexpected connections that are essential to further development of any theory. These results in the study of infixation show what can be achieved by re-casting the central idea of Prosodic Morphology — to understand morphological phenomena in terms of independently motivated principles of prosody — within the OT framework.

This article continues that research program by addressing a different body of cases that had also been analyzed in terms of operational circumscription. These include morphological processes of foot reduplication, circumscriptional template-mapping, and gemination. It has been argued that all can be better understood as effects of prosodic faithfulness constraints, which demand preservation of the location of foot or syllable edges or heads, of moras, or of mora-segment associations. Prosodic faithfulness is by no means peculiar or special; rather, it is part of the very stuff of phonology in OT, essential to dealing with facts as diverse as lexical stress, compensatory lengthening, and tone shift. To the extent that they are correct, then, these results carry us further toward the ultimate aim of Prosodic Morphology: to annihilate itself, by explaining all relevant data in terms of the interaction of independently motivated constraints of prosody and morphology.

[24] This then raises the possibility of singular→plural mappings like *nafs*→*nafa̲ʔis*, to force the affixal mora into medial position. In general, though, Arabic prohibits stem-forms consisting of three light syllables (McCarthy & Prince 1990b).

Appendix: Berber Imperfective Gemination

Dell & Elmedlaoui (1988) discuss a process of imperfective gemination in Imdlawn Tashlħiyt Berber (ITB) that appears to involve some kind of circumscriptional effect. At least two distinct accounts are possible, however. The goal of this appendix is to describe these competing analyses and (inconclusively) assess their relative merits.

In ITB, the imperfective verb is formed by geminating a consonant of the root. There is complex conditioning of whether the first or second consonant is the one that geminates. Dell & Elmedlaoui suggest that the best way to understand this conditioning, as a first-order descriptive generalization, is in terms of the sonority contour in the root. The geminating roots, all of which contain three consonants C1-C2-C3, can be classified according to whether sonority increases (I), decreases (D), or stays even (E) between C1-C2 and between C2-C3.

(44) Berber Imperfective Gemination[25]

a.	Roots with Initial Gemination		b.	Roots with Medial Gemination	
	I-D	xng → xxng		I-I	bxl → bxxl, γml → γmml
	I-D	mrz → mmrz		E-I	bħr → bħħr
	I-D	trm → ttrm		D-D	rʃq → rʃʃq
	I-D	frd → ffrd		D-E	ftk → fttk
				D-I	stγ → sttγ

It is not enough to know whether any particular one of C1, C2, or C3 is sonorant, nor is it enough to know just one of the two sonority contours. Both sonority contours are necessary, since just exactly the I-D roots show initial gemination.

Dell & Elmedlaoui make a remarkable observation: the geminating consonant is the leftmost **onset** of the word, given their independently motivated characterization of Berber syllable structure. (As Clements 1996 notes, the effects of post-pausal resyllabification must be disregarded in applying this generalization.) Words like *xng* (44a) are syllabified as O-N-C, with syllabic *n*, which I will indicate by underlining: *xng*. Words like this can be parsed into a single syllable, with sonority increasing from C1 to C2 and decreasing from C2 to C3. In all of the words of (44b) from (44a), the sonority profile is different, and so is the syllabification. Since onsetless syllables are impossible medially in Berber, all of the words in (44b) are parsed into an initial onsetless syllable followed by a final O-N syllable: *b.xl*, *γ.ml*, *b.*ħ*r*, etc. The target of imperfective gemination is indeed the leftmost onset in the word. Here is a complete list of the examples cited above:

(45) Same Examples, But With Syllabification Shown

a.	Roots with Prefixed Gemination		b.	Roots with Infixed Gemination
	xng → x.xng			b.xl → bx.xl
	mrz → m.mrz			b.ħr → bħ.ħr
	trm → t.trm			r.ʃq → rʃ.ʃq
	frd → f.frd			f.tk → ft.tk
				s.tγ → st.tγ

Observe that the syllabification of the derived form differs among the examples in (45b). It is the syllabification of the simple form that determines the locus of gemination.

[25]In Berber examples, emphasis (pharyngealization) is not shown.

Michael Kenstowicz (p.c.) has suggested that Dell & Elmedlaoui's observation can be made sense of in O-O correspondence terms, and in unpublished work Laura Benua has worked out the analysis. Compare the winning and losing candidates in (46); they are correctly distinguished by the constraint O-ANCHOR-POS$_{OO}$(σ, σ, L), which requires that any syllable-initial segment in the derived form stand in correspondence with a syllable initial segment in the simple form:

(46) Violation of O-ANCHOR-POS$_{OO}$(σ, σ, L) With Medial Gemination in (45a)

xng → x.xng, *xn.ng
mrz → m.mrz, *mr.rz
trm → t.trm, *tr.rm
frd → f.frd, *fr.rd

In **xn.ng*, for example, the syllable-initial segments are *x* and *n*. But the correspondent of *n* in the simple form *xng* is not syllable-initial, so O-ANCHOR-POS$_{OO}$(σ, σ, L) is violated. In *x.xng*, the only syllable-initial segment is *x* (twice), and its correspondent in the simple form is also syllable-initial, so O-ANCHOR-POS$_{OO}$(σ, σ, L) is obeyed.[26]

In the forms where medial gemination occurs, both types of candidates equally satisfy O-ANCHOR-POS$_{OO}$(σ, σ, L):

(47) Tie on O-ANCHOR-POS$_{OO}$(σ, σ, L) With Initial or Medial Gemination in (45b)

b.xl → bx.xl, *bb.xl
b.ħr → bħ.ħr, *bb.ħr
r.ʃq → rʃ.ʃq, *r.rʃq
f.tk → ft.tk, *ff.tk
s.tɣ → st.tɣ, *ss.tɣ

In both *bx.xl* and **bb.xl*, the syllable-initial segments are *b* and *x*. They stand in correspondence with segments that are also syllable-initial in the simple form, so O-ANCHOR-POS$_{OO}$(σ, σ, L) is obeyed by both candidates. The same is true for all the other examples cited, indicating that O-ANCHOR-POS$_{OO}$(σ, σ, L) will not decide between them.

For this reason, any account of Berber along these lines must regard medial gemination as the default, with initial gemination compelled by high-ranking O-ANCHOR-POS$_{OO}$(σ, σ, L). This is somewhat unsatisfying, because it would be preferable to think of prefixation as the default condition with infixation occurring under duress (as in Tagalog or Timugon Murut — see §2). Perhaps, though, medial position is a more plausible default with a morpheme whose phonological expression is gemination.

The account of Berber just sketched relies on a prosodic faithfulness constraint, O-ANCHOR-POS. A very different approach is possible, however, based purely on structural principles with no reference to faithfulness. Going beyond the P&S view of sonority in syllabification, it assumes that the sonority *profile* of a syllable is assessable by constraints. A syllable that rises in sonority from onset to nucleus presents a good profile; a syllable that falls in sonority from onset to nucleus presents a bad profile. Call this constraint CV-PROFILE.

I repeat here the relevant examples:

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[26]Observe that O-ANCHOR is crucial in (46); with I-ANCHOR, it would not be possible to distinguish between the good and bad candidates *x.xng* and **xn.ng*, since in both there is a syllable-initial correspondent of the syllable-initial *x* of the basic form *xng*.

(48) Bad Sonority Profile with Wrong Gemination Locus

a.	Roots with Prefixed Gemination	b.	Roots with Infixed Gemination
	xng → x.xng, *xn.ng		b.xl → bx.xl, *bb.xl.
	mrz → m.mrz, *mr.rz		b.ħr → bħ.ħr, *bb.ħr
	trm → t.trm, *tr.rm		r.ʃq → rʃ.ʃq, *r.rʃq
	frd → f.frd, *fr.rd		f.tk → ft.tk, *ff.tk
			s.tɣ → st.tɣ, *ss.tɣ

All the failed candidates in (48a) present a bad sonority profile in the final syllable (and a good one in the initial syllable), earning them a violation of CV-PROFILE. In contrast, initial gemination with the same roots presents two impeccable sonority profiles. So CV-PROFILE is arguably compelling initial placement of a default medial gemination morpheme. (Dell & Elmedlaoui's classification of these roots in (44a) as “DD” shows why CV-PROFILE works.)

The candidates in (48b) all tie on CV-PROFILE. Forms like *bx.xl/*bb.xl* obey it either way, while forms like *rʃ.ʃq/*r.rʃq* violate it either way. So it can't decide between them, which is why we must again say that medial gemination is the default, with initial gemination compelled by CV-PROFILE in those cases where it can be decisive.

No evidence internal to Berber will, so far as I know, decide between these two approaches. Both require medial gemination to be the default, with initial gemination compelled by the respective constraint. And in a broader, cross-linguistic context, both constraints are somewhat troubling:

- O-ANCHOR-POS$_{OO}$(σ, σ, L) is a type of *syllabic* faithfulness constraint — a highly vexatious entity. If there were I-O syllabic faithfulness constraints, then some languages would be expected to contrast (monomorphemic) *pa.ta* with *pat.a*, by ranking ANCHOR-POS$_{IO}$(σ, σ, L/R) above ONSET and NO-CODA. Notoriously, such contrasts are never observed.[27] Likewise, a B-R syllabic faithfulness constraint, through domination of MAX$_{BR}$, would be capable of enforcing syllable-copying reduplication, a pattern that is also unknown (Moravcsik 1978, Marantz 1982, McCarthy & Prince 1986, 1990a). On the other hand, syllabic faithfulness is surely necessary in O-O relations, to account for such well-known contrasts as *night-rate*/*nitrate* or *lightening/lightning*. Clearly, there is an interesting research problem here.
- Except for its role in determining the locus of imperfective gemination, CV-PROFILE is a needless addition to the analysis of Berber (and presumably all languages). The Dell-Elmedlaoui and Prince-Smolensky analyses are predicated on finding optimal syllable peaks, not optimal profiles; indeed, Berber contains some syllables with wretched profiles. There is, then, a dearth of independent justification for CV-PROFILE, in Berber or elsewhere.

[27]The familiar explanation for the non-contrastiveness of syllable structure, underspecification of the input, is not available in OT, which understands contrast in output-oriented terms, as a consequence of markedness/faithfulness interactions (see Prince & Smolensky 1993: Chapter 9; McCarthy & Prince 1995a; Kirchner 1995; McCarthy 1996; Alderete 1996).

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