# Anti-faithfulness and Subtractive Morphology†

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*"I find your lack of faith disturbing."*
*– D.V.,* Star Wars*, 1977*

**0.0 Introduction**

Truncative morphological operations have received considerable attention from generative morpho-phonologists of the past two decades. The primary locus of interest in such operations has been in so-termed *templatic* truncation, that involving—in as theory-neutral terms as possible—some mapping of a morphological constituent onto a (smaller) prosodic template, resulting in some net loss of segmental structure. The maturation of ideas surrounding templatic truncation has been both colorful and complex and has contributed substantially to the theory of Prosodic Morphology (McCarthy & Prince (1986), McCarthy & Prince (1993a), *et seq.*). Lurking sometimes quietly behind the wealth of work in this area, however, has been a smaller body of literature on a different species of truncative operation which we shall refer to—after Martin (1988)—as *subtractive morphology*. Subtractive morphological operations are definitionally those in which a grammatically characterizeable unit (typically prosodic) is truncated from the right or left periphery of some morphological unit (typically a root or morphological word). Such constitute, then, a conceptual inverse of templatic truncation phenomena.

In fig. (1), we have one of the subtractive paradigms most discussed in recent treatments of the subject[1], the Koasati Plural (Kimball 1991; Broadwell 1993; Lombardi & McCarthy 1991; Weeda 1992). In Koasati, a Muskogean language still spoken in parts of Louisiana and Texas, the plural form of an indicative verb may be formed by one of several means: affixation, suppletion, and—most interestingly for our purposes—truncation. In the truncative plurals, two distinct patterns emerge. The first, shown (1a), is most straightforwardly described as truncation of a root-final rhyme; the second, (1b), manifests truncation of the root-final coda.

(1) Koasati Singular > Plural allomorphy[2]

a. <u>Rhyme-Deletion</u>

| *singular* | *plural* | *gloss* |
|---|---|---|
| pit**áf**-fi-n | pít■■-li-n | 'to slice up the middle' |
| akocof**ót**-li-n | akocóf■■-fi-n | 'to jump down' |
| tiw**áp**-li-n | tíw■■-wi-n | 'to open s.t.' |
| sim**át**-li-n | sím■■-mi-n | 'to cut up tanned skin' |
| atak**á:**-li-n | aták■-li-n | 'to hang something' |
| albit**í:**-li-n | albít■-li-n | 'to place on top of' |
| apoł**ó:**-ka-n | apół■-ka-n | 'to sleep with someone' |

b. <u>Coda-Deletion</u>

| | | |
|---|---|---|
| asikó**p**-li-n | asiko:■-li-n | 'to breathe' |
| łató**f**-ka-n | łató:■-ka-n | 'to melt' |
| kacá**ł**-łi-n | kacá:■-li-n | 'to bite s.t.' |
| akapó**s**kan | akapó:■kan | 'to be pinched' |

For the present, it is crucial to note the following facts of the Koasati data. One: that in each case it is the size of the *truncated* material that remains constant. For each class of plurals, we find a single, grammatically describable

† This work could not have been completed without invaluable discussion and insight ( and moral support) from Alan Prince and Hubert Truckenbrodt. The work has also benefited in diverse ways from the comments of John Alderete, Young -Mee Yu Cho, Laura Benua, Nicole Nelson, and assembled audiences at RUMD '98, RUMJCLAM 4, WAIL II, and the Rutgers Optimality Research Group. All errors are on the author.

[1] For an exhaustive compilation of truncative morphological phenomena of all sorts, the reader is directed to Weeda (1992).

[2] Here and throughout this paper, the original site of each truncated segment will be denoted by "■". Note that "■" shows the segmental difference between surface forms in all cases, not necessarily between the truncated form and an underlying representation.

constituent (whether rhyme or single coda consonant) *in absentia* from the plural form. Two: conversely, the size of the segmental material remaining in the plural is variable. This fact is particularly dramatic in the rhyme deletion cases, where we find plural forms shaped CVC-, CVCVV-, VCCVCCVC-, etc. Three: the alternations involved are paradigmatic. Where templatic truncation typically involves word variation (hypocoristics, language games, etc.), subtractive truncation typically (i.e., in all diagnosed instances of the phenomenon) signals semantic or categorial modification of a type of consistent with "normal" inflectional or derivational morphology. These facts motivate our designation of the Koasati phenomena as subtractive, rather than templatic, truncation.

A simple approach to the problem might be to argue against the generalization. Suppose that what we have taken as subtraction of material from a derived/inflected word is in fact simple affixation of material to its morphological relative (i.e., the singular). Martin (1988) very effectively argues against such an approach to the Koasati data, pointing out that such a stipulation would result in significant loss of generalization—thirteen distinct singular affixes and lexical classes vs. **one** subtractive plural operation for the rhyme deletion cases alone—and employment of a cross-linguistically unattested morphological phenomenon, *singularization*. Arguments similar to these extend to other attested cases of subtraction: where affixation would be possible, significant linguistic generalization is lost. Another approach—found in some recent accounts of the residual phonological effects of subtractive morphology (Benua 1995, 1997)—would be to simply attribute subtractive alternations to lexical irregularity, on par with suppletion. As this approach would seem to belie both the inter-linguistic regularities and the cross-linguistic similarities of subtractive phenomena, we shall not consider it further, and focus our energies on a *grammatical* explanation for the alternations.

Previous serial analyses (Kimball 1985, Martin 1988, Lombardi & McCarthy 1991) of such alternations have—by autosegmental or prosodic circumscriptional rules—functioned to pick out a prosodic unit and truncate it from the underlying structure of the derived word. For Koasati, Kimball (1985) posits a complex system of rules to account for the paradigms in (1); some examples of Kimball's rules include: CiBaC → CiBa:, where B = /p/ or /b/; $C_1iC_2aC_3 \rightarrow C_1iC_2$; $CV_icV_iC \rightarrow CV_icV{:}_i$; $C_1V_iC_2V_iC_3 \rightarrow C_1V_iC_2$. Martin (1988) accounts for the data more economically with two morpheme-specific rules: $(\text{Rhyme}]_{\text{Stem}} \rightarrow \text{Ø})_{\text{Plural}}$ and $(\text{Coda}]_{\text{Stem}} \rightarrow \text{Ø})_{\text{Plural}}$; he notes that such an approach speaks strongly in favor of the item-and-process theory of word structure advocated since Anderson (1982). In an approach similar in spirit to Martin's, Lombardi & McCarthy (1991) posit a positive prosodic circumscriptional operation which deprosodicizes the stem-final syllable, the onset of which is resyllabified into the preceding syllable and the rhyme of which is deleted under Stray Erasure. All of these approaches rely essentially on the same heuristic: realize the plural morphology by factoring out a string or prosodic constituent and, by whatever means, delete it. The descriptive power of this method goes without saying, but the objections made by Prince & Smolensky (1993), McCarthy & Prince (1993a), and McCarthy (1997) to operational prosodic circumscription lead us to question the ultimate desirability of it for our theory of Universal Grammar. It is noted in those works that a prosodic-circumscriptional account of infixation in Tagalog and Timugon Murut predicts a variety of cross-linguistically unattested infixation patterns. Let us note as well that a like account of subtractive morphological phenomena leads to a diverse array of typological predictions—an array too diverse, in fact, as we can hypothesize under such an approach cross-linguistically unattested subtractive alternations of almost any prosodic size (iamb, heavy syllable, etc.).

In the Optimality Theory of Prince & Smolensky (1993), McCarthy & Prince (1993a, *et seq.*), we anticipate a more explanatory account of the problem, but not, as I will argue here, without some emendation to currently standard assumptions. Several notable challenges for OT present themselves in analysis of subtractive morphology. First: since as it is obviously not the case that standard *faithfulness* constraints can be held accountable for an effective corruption of surface material from an underlying form, we would expect subtractive morphology to in some manner result from *markedness*. However, if the underlying forms are—but for some abstract morphosyntactic specification or zero morpheme—identical in alternations such as the Koasati singular > plural shown above, why do we find subtraction in one and not the other? Barring morpheme-specific markedness (a matter we will return to in §2), we would expect the grammar of a language to return identical optima for two inputs not differing in segmental make-up. Second: subtractive morphology is, like affixation, local to an edge. As affixal locality effects in OT are principally got with *alignment* (McCarthy & Prince 1993b) of morphological and prosodic categories in the output—e.g., a suffix aligns to the right edge of the prosodic word, and a prefix, the left—we would expect similar constraints to play a part in designating the locus of truncation in the cases considered here. Unfortunately (and obviously), since alignment constraints must refer to material present in the output, there is no means by which they may position a morpheme which has no surface exponence. In short, there is no way to align subtraction. Third:

consulting the Koasati data (1) and more importantly the full cross-linguistic typology of subtractive morphology—which we will consider in §3—it is notable that some subtractive processes seem to target a rhyme or even syllable for truncation. This fact seems at first glance intractable to an OT hewing closely to the Goals of Prosodic Morphology set out in McCarthy & Prince (1994b, 1995, 1997)—those being to show that the prosodic template, as such, is a linguistic epiphenomenon, resultant from other constraints on the morphology-prosody interface.

A solution to these dilemmas presents itself in several recent developments in OT—developments which require some re-tuning of standard assumptions about faithfulness theory. Crucial to the approach advocated here is the notion that an Optimality-theoretic grammar is not limited to only two constraint types—faithfulness and markedness—but rather must admit *anti-faithfulness* constraints to the inventory of CON. It will be shown in this paper that a Faith/Markedness/Anti-faith OT can account for subtractive morphological phenomena in a conceptually simple, highly constrained manner. In §1, I will argue that subtraction in the Koasati plural is best explained by the interaction of high-ranked anti-faithfulness constraints—constraints, after Alderete (1999), promoting segmental contrast with the morphologically related singular output—with otherwise provably active constraints on prosodic and morphological well-formedness. Locality conditions on the subtraction will be shown to follow from the ranking of standard positional faithfulness constraints, and subtractive allomorphy will result from a two-way morphological class distinction in the plural forms. In §2 we will see the extensibility of the theory to other subtractive morphological operations which have received attention in the OT literature. Subtraction analyses of perfective truncation in Tohono 'O'odham (Fitzgerald 1997) and Lardil nominative truncation (Prince & Smolensky 1993) will each be considered in turn; it will be argued that in each case the anti-faithfulness approach presents a more explanatory solution than those extant. §3 will tackle some of the thornier typological problems which fall out from the theory advocated; it will be argued that standard Optimality Theoretic assumptions about anchoring effects are in fact erroneous, and that a positional faithfulness model correctly predicts the known typology of locality effects in subtractive morphological phenomena.

## 1.0 Anti-faithfulness and the Koasati Plural

Where faithfulness constraints seek to maintain phonological identity between correspondent stings, anti-faithfulness constraints seek to penalize such relations. In a grammar, where a family of faithfulness constraints preserves input material from the degenerative effects of markedness, anti-faithfulness constraints may countermand some—but not necessarily all—of the constraints preserving structure and featural identity. I will here argue that the grammar of Koasati is such a one, but not without briefly setting out some basic assumptions about the anti-faithfulness framework.

### *1.1 Transderivational Anti-faithfulness*

The essential framework we will assume is that of Alderete (2001), Transderivational Anti-Faithfulness Theory (TAFT), which—not surprisingly—is predicated largely on the larger body of assumptions implicit in the Transderivational Faithfulness Theory of Benua (1997; see also Kenstowicz 1996, Burzio 1995, 1999). Benua's theory aims to formalize the observation that surface phonological similarity may be required in morphologically related words to a degree not predicted simply by the underlying structures they share. It is argued that morphologically related surface (output) forms stand in correspondence, and that faithfulness constraints may be defined over these correspondence relations just as they are defined over input-output relations. The ranking of these output-output faithfulness constraints relative to the fixed hierarchy of markedness constraints in a grammar results in phonological similarity between morphologically related words (a derived word and its output base) not otherwise predicted by faithfulness to underlying structure. Alderete argues that a grammatical force exactly antithetical to the O-O faithfulness constraints of Benua's theory, O-O *anti*-faithfulness constraints, *penalize* phonological similarity between morphologically related forms. Furthermore, it is argued that anti-faithfulness is *only* morphological in nature, and that formulation of an anti-faithfulness constraint over an IO-correspondence relation is impossible. The importance of these assertions is twofold. The first follows from the typically idiosyncratic nature of the types of alternations which lend themselves to an anti-faithfulness analysis (polarity reversal in Luo and various morpho-accentual phenomena in Japanese and Russian (Alderete 2001), circular chain shifts in Taiwanese (Horwood 2000), Turkish emphatic reduplication (Kelepir 1999), and segmental reversal in Tagalog and Australian English secret languages (Bauer 2001)). The second is necessary to prevent a considerable amount of leakage from Optimality-theoretic learning theory (Prince & Tesar 1999)—the inclusion of I-O anti-faith in a grammar explodes the space of possible grammars the learner must consider.

An anti-faithfulness constraint in Alderete's theory is defined as the logical negation of a faithfulness constraint. Taking for example a constraint immediately applicable to the problem at hand, consider ¬MAX, negatively quantified from MAX (McCarthy & Prince 1999):

(2) ¬MAX-*Cat*: ('Delete at least one *Cat*.')
It is **not** the case that every element of type *Cat* in $S_1$ has a correspondent element of type *Cat* in $S_2$.

$$\neg\forall x[x \in \{S_1 \cap Cat\} \rightarrow \exists y[y \in \{S_2 \cap Cat\} \wedge x\Re y]]$$

The introduction of logical *not* to our theory of CON should not be taken lightly, and it is worthy of mention here that, logically speaking, there are in fact two possible formulations of a ¬MAX, depending on the scope of negation in the expression of the constraint. Under the wide-scope negation found in (2) above, the anti-faithfulness constraint can only effect minimal changes in $S_2$ from $S_1$ ("Delete at least one"). Under the narrow-scope formulation (i.e, $\forall x[x \in \{S_1 \cap Cat\} \rightarrow \neg\exists y[y \in \{S_2 \cap Cat\} \wedge x\Re y]]$), however, the anti-faith effects are more pronounced and potentially too powerful ("Delete everything"). In the interests of restrictiveness and barring evidence to the contrary, then, we will assume that only constraints of the former type should be allowed to our theory of constraint composition.

*1.2 Anti-faith Motivates Segment Deletion*

We now have a conceptually simple and highly constrained means of motivating morphologically-conditioned subtraction. ¬MAX will penalize any candidate whose output segmentism is *maximally* identical to that of some corresponding output base; if a single segment of the corresponding output base is not present in the surface form of the derived word, the constraint will be satisfied. Where ¬MAX dominates all related MAX constraints (i.e., "related" referring to all constraints, I-O, O-O, or B-R, of the same segment, feature, tone, position, etc. type) in a grammar, subtraction will occur[3].

In (3) below, we may see how application of this morphological architecture is played out in the Koasati case, for a singular form *pitáffin* and rhyme-truncated plural *pít■■lin*, with correspondence (ℜ) relations shown by arrows[4].

(3)

| | Singular | | Plural |
|---|---|---|---|
| Input | /pitaf-li-n/ | | /pitaf-li-$n_{PL}$/ |
| | ↑↓ | | ↑↓ |
| Output | pitáffin | ← | **pít■■lin** |
| | $O_S$ | | $O_{PL}$ |

It is immediately apparent from the surface exponence of each input string that faithfulness constraints defined over the $O_S$-$O_{PL}$ relation are *violated*. The first violation results from some imperative to preserve underlying segmental identity, as the underlying segmentism of the indicative morpheme *-li-* resists in the plural the place assimilation that it undergoes in the singular[5]. This fact highlights the nonderivational nature of the system at hand; were the plural directly derived from the singular, we would expect an unattested output *pít■■fin*, where the product of place assimilation (/fl/ → [ff]) in the singular is carried over to the plural. It is the parallel nature of the architecture we assume here that allows surface morphological similarity along with adherence to underlying morphological structure. The second—and more pronounced—violation of faith along $O_S$-$O_{Pl}$ is obviously the truncation of the root-final rhyme. Further examples of this type of truncation are shown (4) below[6].

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[3] Note that markedness constraints, too, may play a role in blocking anti-faithfulness effects, as we will see in §2.

[4] We denote the plural 'morpheme' as a subscript on inputs here and throughout the paper for ease of reference. The exact status of the morpheme, as a zero morpheme or morphosyntactic feature, is beyond the scope of the current work.

[5] Underlying [l] assimilates to any preceding [+labial] consonant; we assume here that this distributional fact is the result of some high-ranked markedness constraint(s) and leave it at that.

[6] Koasati has a relatively simple segmental inventory: consonants /p, t, c, k,ʔ, b, f, ɬ, s, h, m, n, l, w, y/ and vowels /i, a, o/. c and s are palato-alveolar stop and fricative respectively. Note also that V́ is not penultimate stress, but rather high pitch-accent,

(4) VC Rhyme deletion (adapted from Martin 1988 and Kimball 1991)

| | | |
|---|---|---|
| a. *af* ~ Ø. | | |
| pitáffin | pít■■lin | ‘to slice up the middle’ |
| akoláfkan | akol■■ká:cin[7] | ‘to erode and collapse’ |
| tosáffin | tós■■lin | ‘to cut a piece out of’ |
| latáfkan | lát■■kan | ‘to kick s.t.’ |
| kaláffin | kál■■lin | ‘to mark s.t.’ |
| tałáfkan | táł■■kan | ‘to whittle s.t.’ |
| baháffin | báh■■lin | ‘to stab s.t.’ |
| b. *ap* ~ Ø | | |
| tiwáp-li-n | tíw■■-wi-n | ‘to open s.t.’ |
| lofáp-li-n | lof■■-fí:ci-n | ‘to chip lengthwise’ |
| yiłáp-li-n | yíł■■-łi-n | ‘to tear s.t. down’ |
| lasáp-li-n | lás■■-li-n | ‘to lick s.t.’ |
| łomáp-li-n | łóm■■-mi-n | ‘to whip s.t.’ |
| kaháp-li-n | káf■■-fi-n | ‘to dip s.t. up’ |
| wilap-lí:ci-n | wil■■-lí:ci-n | ‘to tear up the earth’ |
| c. *ip* ~ Ø | | |
| cíłip-ka-n | cíł■■-ka-n | ‘to spear s.t.’ |
| misíp-li-n | mís■■-li-n | ‘to wink’ |
| obakhitíp-li-n | obakhít■■-li-n | ‘to go backward’ |
| d. *it* ~ Ø | | |
| limít-ka-n | lín■■-ka-n | ‘to swallow s.t.’ |
| e. *op* ~ Ø | | |
| fotóp-ka-n | fót■■-ka-n | ‘to pull s.t. up’ |
| iyyakkohóp-ka-n | iyyakkóh■■-ka-n | ‘to trip’ |
| f. *of* ~ Ø | | |
| łobóf-fi-n | łób■■-bi-n | ‘to pierce s.t.’ |
| g. *ot* ~ Ø | | |
| akocofót-li-n | akocóf■■-fi-n | ‘to jump down’ |
| h. *as* ~ Ø | | |
| tipás-li-n | típ■■-li-n | ‘to pick s.t. off’ |
| i. *at* ~ Ø | | |
| simát-li-n | sím■■-mi-n | ‘to cut up tanned skin’ |
| j. *ał* ~ Ø | | |
| kawáł-łi-n | káw■■-wi-n | ‘to snap s.t.’ |
| k. *am* ~ Ø | | |
| tafilám-mi-n | tafíl■■-li-n | ‘to overturn s.t.’ |
| l. *ay* ~ Ø | | |
| onasanáy-li-n | onasan■■-ní:ci-n | ‘to twist s.t. on’ |

The purpose of this welter of examples is simple: to alert the reader to the simple absence of any distributional regularity in the singular > plural mappings which might condition the prosodic shape (rhyme) of the subtraction.

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morphologically conditioned in all forms. I assume here, after Martin (1988), that vowel length under this pitch accent is some form of compensatory lengthening and ancillary to the matter at hand. Evidence that the truncation occurs independently of pitch accent placement and lengthening in the plural may be seen in forms in which a pluralizing suffix -ci occurs simultaneously with plural truncation: nisáf-fi-n > nis■■-lí:-ci-n. Here pitch accent does not fall on the root at all, as lengthening of the suffix -li shows.

[7] *-ci-* appears idiosyncratically in some forms, indicating repeated or extended action.

Bi-, tri-, and quadra-syllabic roots are all equally subject to the process; selection for the following auxiliary suffixes -*ka*-, -*li*-, or -*lici*- is arbitrary; high pitch accent (marked [´]) falls regularly on the penultimate syllable—of either the singular or plural—and conditions lengthening; and any of the following ten vowel-consonant pairs may be subject to the deletion: {af, ap, ay, as, at, aɬ, op, of, ot, ip, it}. It is fair to conclude[8] that a purely phonological explanation for the phenomena will not be found. As general markedness cannot be the force triggering deletion, as was argued in the introduction, we will contend here that the following anti-faithfulness constraint motivates the subtraction:

(5) ¬MAX-V: (‘Delete at least one vowel.’)
It is not the case that every V in $S_1$ has a correspondent V in $S_2$.

¬MAX-V explicitly penalizes correspondence of vocalism. In a case where both a vowel and consonant delete, as in *pitáffin* > *pít■■lin* above, something more must come into play to effect VC rhyme truncation, else we might anticipate a “gapped” plural form such as *pit■f-fi-n*. Kimball (1992) reports of Koasati that “three member consonant clusters are very rare, and most are the result of the h-grade[9].” Kimball’s generalization admits a simple analysis in OT terms.

(6) *COMPLEX
No more than one C or V may associate to any syllable position node. (Prince & Smolensky 1993)

Ranked above MAX-IO, *COMPLEX effectively prohibits word-medial consonant clusters of more than two members—exactly the structural configuration which would emerge if ¬Max-V were satisfied *without* deletion of a proximate consonant. And as we can see from candidate (e) in tableau (1), where anti-faith would leave a syllable structure marked by prosodic well-formedness conditions, additional truncation takes place. Note that subtraction is still constrained in the theory by the lower-ranked MAX; being gradiently violable, the faithfulness constraint prohibits gratuitous truncation of material, as shown in candidate (b).

**Tableau 1.**
VC]$_{root}$ deletion. (*pitáffin* > *pít■■lin*)

| | /pitaf-li-n$_{PL}$/ | *COMPLEX | ¬MAX-V [pi.táf.fin] | MAX-IO |
|---|---|---|---|---|
| ☞ | a. pít■■.lin | | | ** |
| | b. pí:■■■.lin | | | *** |
| | c. pi.táf.fin | | *! | |
| | d. pi.tá:■.lin | | *! | * |
| | e. pít■f.fin | *! | | * |

A sixth possible candidate *pit■f-■i-n*, where the second root vowel is truncated to satisfy ¬MAX and the initial consonant of the suffix is truncated to satisfy *COMPLEX, is effectively ruled out by the I-CONTIG(uity) constraint of McCarthy & Prince (1999), no matter its ranking in the grammar[10].

[8] Along with Martin (1988), Hardy & Montler (1988), Weeda (1992), Lombardi & McCarthy (1993), Broadwell (1993), and Anderson (1992).

[9] The *h*-grade is a process of internal change in Koasati best described as infixation, where *h* is infixed before the ultimate syllable of the root.

[10] Undominated, I-CONTIG would redundantly rule out candidate (e) of tableau (1). This ranking is neither necessary nor advocated here, primarily because the ranking *COMPLEX » MAX-IO is independently justified in the language as we have seen, and because a ranking of I-CONTIG » MAX-IO suggests that we might find a paucity of infixational morphology—such is not the case in Koasati, as shown by glottal infixation in the imperative (e.g., /is-hica-to-/ → [ishi:cáʔto-]) and the *h*-grade (/ficip-ka-n/ → [ficíphkan]).

(7) I-CONTIG ('No skipping.')
The portion of $S_1$ standing in correspondence forms a contiguous string.
Domain(ℜ) is a single contiguous string in $S_1$.

So we see how the interaction of anti-faithfulness with another active constraint in the grammar may result in subtraction of more than a single segment. In the long-vowel deletion cases, the effects of the ANTI-FAITH » FAITH ranking are even more straightforward.

(8) Long-vowel Rhyme Deletion

a. *aː* ~ Ø

| | | |
|---|---|---|
| ataká:-li-n | aták■-li-n | 'to hang something' |
| icoktaká:-li-n | icokták■-li-n | 'to open one's mouth' |
| acokcaná:-ka-n | acokcán■-ka-n | 'to quarrel w/ someone' |

b. *iː* ~ Ø

| | | |
|---|---|---|
| albití:-li-n | albít■-li-n | 'to place on top of' |
| atiní:-li-n | atín■-ni-n | 'to burn s.t.' |
| acití:-li-n | acít■-li-n | 'to tie s.t.' |

c. *oː* ~ Ø

| | | |
|---|---|---|
| facó:-ka-n | fás■-ka-n | 'to sleep with someone' |
| apołó:-ka-n | apół■-ka-n | 'to sleep w/ someone' |

Since there is no errant consonant to potentially violate high-ranked *COMPLEX or any other constraint but MAX-IO, subtraction proceeds simply.

**Tableau 2.**
V:]$_{root}$ deletion. (*ataká:lin* > *aták■■lin*)

| | /ataka-li-n$_{PL}$/ | ¬MAX-V [a.ta.ká:.lin] | MAX |
|---|---|---|---|
| ☞ | a. a.ták■.lin | | * |
| | b. a.ta.ká:.lin | *! | |

*1.3 Localizing Subtraction*

An obvious question arises at this point: Why is truncation from the right edge of the root rather than the left? Nothing in the anti-faithfulness constraints we have considered here is capable of localizing truncation to one edge or the other, since ¬Max is satisfied by any deletion, anywhere. This is a complicated matter, one with serious implications for the typology of subtractive morphology predicted by the theory, and one to which we will return in §3. For the present, let us take the following tack: the ranking of L(eft)- and R(ight)-ANCHOR (McCarthy & Prince 1999) relative to root CONTIG(uity) may localize the site of deletion in a given grammar.

(9) {RIGHT, LEFT}-ANCHOR($S_1$, $S_2$)
Any element at the designated periphery of $S_1$ has a correspondent at the designated periphery of $S_2$.
Let *Edge*(X, {L, R}) = the element standing at the *Edge* = L,R of X.
R-ANCHOR. If x=Edge($S_1$, R) and y=Edge($S_2$, R) then xℜy.
L-ANCHOR. Likewise, *mutatis mutandis*.

L- and R-ANCHOR are *positional* faithfulness constraints and, when composed over the I-O faithfulness dimension, act to penalize truncation from one edge of the input string or the other. Medial truncation is penalized similarly by I-CONTIG.

(10) I-CONTIG ('No skipping.')
The portion of $S_1$ standing in correspondence forms a contiguous string.
Domain(ℜ) is a single contiguous string in $S_1$.

The essential argument here is that, in Koasati, L-ANCHOR and I-CONTIG dominate R-ANCHOR, and, since it is not apparent what markedness constraints could effect the positioning of *nothing* within a string, this ranking determines the default edge for segmental truncation by anti-faithfulness. The workings of this are shown in Tableau (3).

**Tableau 3.**
Positional faithfulness selects truncation site.

| | /pitaf-li-n$_{PL}$/ | L-ANCHOR | I-CONTIG | R-ANCHOR |
|---|---|---|---|---|
| ☞ | a. pít■■.lin | | | * |
| | b. ■■táf.fin | *! | | |
| | c. pí■■f.fin | | *! | |

Note two problems with this approach. First, we have yet to explain why the truncation is from the root rather than from the affix. McCarthy & Prince (1993a) propose the universally fixed ranking ROOT-FAITH » AFFIX-FAITH, holding to the generalization that affixal material is universally less marked than root material. This universal seems to be at odds with the Koasati data. If ROOT-MAX is ranked above AFFIX-MAX, and ¬MAX is ranked above both, there should never be truncation of root material before truncation of affix material. Second, while anchoring and contiguity adequately capture the surface facts of Koasati, a factorial typology of their ranking produces a cross-linguistically unattested truncation pattern: constituent medial deletion. We will leave these problems unsolved for the time being, returning to them in §3.

*1.4 Subtractive Allomorphy*

Part of the inherent interest of the Koasati problem comes in the form of apparent subtractive allomorphy in the plural. The second plural allomorph is characterized by truncation of the final coda consonant of the root and compensatory lengthening of the remaining root-final vowel under penultimate pitch-accent. Obviously, the effects of ¬MAX-V are not seen in these data.

(11) Coda-deletion

a. *t* ~ Ø

| *singular* | *plural* | *gloss* |
|---|---|---|
| famót-ka-n | famó:■-ka-n | 'to wave' |
| bikót-li-n | bikó:■-li-n | 'to bend s.t. between the hands' |
| libát-li-n | libá:■-li-n | 'to get burned by s.t.' |
| asipát-li-n | asipá:■-li-n | 'to get a splinter' |
| tabát-ka-n | tabá:■-ka-n | 'to catch s.t.' |
| topát-ka-n | topá:■-ka-n | 'to recede' |

b. *s* ~ Ø

| | | |
|---|---|---|
| akapós-ka-n | akapó:■-ka-n | 'to be pinched' |
| okhabós-ka-n | okhabó:■-ka-n | 'to sink' |
| labós-li-n | labó:■-li-n | 'to extinguish s.t.' |
| alabós-li-n | alabó:■-li-n | 'to close up [of flowers]' |
| łibós-li-n | łibó:■-li-n | 'to squash s.t.' |
| hifós-ka-n | hifó:■-ka-n | 'to breathe' |

c. *f* ~ Ø

| | | |
|---|---|---|
| łatóf-ka-n | łató:■-ka-n | 'to melt' |
| yicóf-ka-n | yicó:-ka-n | 'to shrivel' |
| łicóf-fi-n | łicó:■-li-n | 'to chip by accident' |
| kocóf-fi-n | kocó:■-li-n | 'to pinch s.t.' |

d. *p* ~ Ø

| | | |
|---|---|---|
| asikóp-li-n | asikó:■-li-n | 'to breathe' |
| łiyáp-li-n | łiyá:■-li-n | 'to step on s.t.' |

e. *ł* ~ Ø

| | | |
|---|---|---|
| kacáł-łi-n | kacá:■-li-n | 'to bite s.t.' |

It has been argued in the analyses of Broadwell (1993), Weeda (1992), Martin (1988), and Hardy & Montler (1988)[11] that the rhyme-deletion/coda-deletion allomorphy in Koasati must be to some degree a matter of lexical idiosyncrasy[12]. Taking this observation for fact, let us posit that there are, in effect, two independent Koasati subtractive plurals—we will refer to the rhyme-deletion plural as Plural-1 and the coda-deletion plural as Plural-2—and that each may be subject to a different anti-faithfulness effect. We now see the full benefit of the Alderetian approach to anti-faithfulness outlined in §2. Crucial to the transderivational correspondence model of Benua is the notion that the morphological identity relation between a derived word and its base is subcategorizational: a given morpheme selects for a given correspondence relation just like it selects for its status as a pre- or suffix and the categorial status of the stem to which it attaches. This provides us with a simple means of encoding the lexically specified nature of Koasati allomorphy without completely depriving the grammar of its role in realizing the phonological form the subtraction is to take. Because each morpheme selects for a different OO-correspondence relation (ℜ), and since the set of transderivational (anti-)faithfulness constraints is re-rankable for each ℜ, it follows that the anti-faithfulness constraint "active" (i.e., ranked above MAX-IO) in the rhyme-deletion plural, ¬MAX-V, need not have any effect at all on the coda-deletion plural, which is in turn subject to a different, but similarly high-ranked, anti-faithfulness constraint, general ¬MAX. This is schematized in fig. (12) and *tableauifié* (4).

(12) Lexical selection for O-O relation (ℜ)

| | | |
|---|---|---|
| morpheme: | Plural-1 | Plural-2 |
| relation: | $O_S$ ℜ $O_{PL1}$ | $O_S$ ℜ $O_{PL2}$ |
| active constraint: | ¬MAX-V | ¬MAX |

**Tableau 4.**
Coda-deletion allomorph. (*fomotkan – fomo:■kan*)
Singular Output: [fo.mót.kan]

| | /fomot-ka-n-Ø/ | ¬MAX-$O_S O_{PL2}$ [fo.mót.kan] | ¬MAX-V-$O_S O_{PL1}$ (n/a) | MAX-IO |
|---|---|---|---|---|
| ☞ | a. fo.mó:■.kan | | | * |
| | b. fo.mót.kan | *! | | |
| | c. fóm■■.kan | | | *!* |

If we did not find two distinct types of morphologically (i.e., *non*-phonologically) conditioned subtraction in Koasati, we could convincingly argue for a more general anti-faithfulness, simply mandating that two corresponding outputs be different in some way, much as Urbanczyk (1998) argues for reduplicative allomorphy in Halq'eme ylem (Central Coast Salish). In (5) we can see how this would work in the abstract. Supposing that an input "A" is morphologically complex, and that our anti-faithfulness constraint DISTINCT is active upon the OO-correspondence relation extant between "A" and an identical output base (i.e., also "A"). Suppose further the existence of two faithfulness constraints, one militating against mutation of "A" to "B" (FAITH:A↛B) and another, "C" (FAITH:A↛C).

**Tableau 5.**
Anti-faithfulness countermands FAITH
Output Base: [A]

| | /A/ | DISTINCT | FAITH:A↛B | FAITH:A↛C |
|---|---|---|---|---|
| | A | *! | | |
| | B | | *! | |
| ☞ | C | | | * |

[11] Hardy and Montler's (1988) analysis was of identical morphological alternations in Alabama, another Muskogean language, mutually intelligible with Koasati.
[12] Kimball (1985, 1993) argues for a highly unnatural set of phonological rules (eleven) which account for the subtractive allomorphy. Kimball's rules fail to account for abundant exceptions, however, and, as is pointed out in Broadwell 1993 and Hardy and Montler (1988), fail to extend to the similar subtractive allomorphy found in Alabama, Choctaw, and Mikasuki.

As can be seen in the tableau, this results in the availability of only one species of anti-faithful optimum: the one that violates the bottom-most faithfulness constraint in the hierarchy (whatever it may be). Where phonological factors intervene, as in Halq'emeylem, more than one type of subtraction may arise, resulting in apparent allomorphy. In Koasati, where no phonological factors condition the subtractive allomorphy, we could predict only one type of subtraction.

**2.0 Other approaches to Subtraction**

The above analysis of Koasati presents us with a general program: to account for a wide cross-linguistic variety of subtractive morphologies under an anti-faithfulness approach. In the coming sections, we will consider two recent approaches to subtractive morphology within Optimality Theory, and in each case argue for the primacy of a readily apparent anti-faithfulness account.

*2.1 Morpheme-constraints and the Tohono 'O'odham Perfective*

Subtractive alternations similar to those of Koasati are found in the Uto-Aztecan language Tohono 'O'odham[13]. As shown in fig. (i), we again find two varieties of constituent-final subtraction, rhyme- and coda-deletion:

(13) Tohono O'odham Rhyme deletion

a. <u>Rhyme deletion</u>.

| *Impf.* | *Perf.* | *gloss* |
|---|---|---|
| ceposid | cepos■■ | 'branded' |
| hupan | hup■■ | 'pulled out thorn' |
| huḍuñ | huḍ■■ | 'descended' |
| keliw | kel■■ | 'shelled corn' |
| bijim | bij■■ | 'turned around' |

b. <u>Coda deletion</u>.

| | | |
|---|---|---|
| ñeok | ñeo■ | 'spoke' |
| bisck | bisc■ | 'sneezed' |
| ma:k | ma:■ | 'gave' |
| dagṣp | dagṣ■ | 'pressed with hand' |

Fitzgerald (1997) proposes a simple analysis of the TO data, based on the following observations. First, perfective verbs are always (at least) one consonant shorter than correlate imperfectives: *ñeok* > *ñeo■*. Second, truncation is always from the right edge of the morphological word: *bisck* > *bisc■*, **bis■k*, **■isck*. Finally, in the perfective data high vowels do not occur after coronals word-finally: *ceposid* > **ceposi■*. Fitzgerald proposes to account for these generalizations in the following manner. First, it is argued that the perfective morpheme is formulated as a constraint:

(14) TRUNC: The perfective output contains fewer segments than the imperfective output.

The motivating of perfective morphology is a simple matter. If TRUNC is ranked above MAX-IO, some segmentism must be lost in the optima, just as with ¬MAX in the above analysis of Koasati. Given the loose comparative formulation of TRUNC—"fewer than"—truncation of more than one segment is prohibited by a gradiently violable MAX-IO.

Since, as noted above, distributional evidence seems to be in favor of rhyme-deletion only where a word-final [+cor][+high] sequence would arise after truncation of a final C, Fitzgerald attributes the apparent subtractive allomorphy in TO to a phonological force:

---

[13] The language formerly known as Papago. Note the following orthographic conventions relative to IPA: e = [ɨ], ḍ = [ɖ], c = [tʃ], ṣ = [ʂ], j = [dʒ].

(15) *CORONAL-HIGH: [+cor][+high] sequences are prohibited.[14]

Ranked above MAX-IO but below CONTIG, *CORHI effectively prevents any candidate with a word-final [+cor][+hi] sequence from emerging. The ranking of CONTIG » *CORHI is necessary to prevent the markedness constraint from ruling out candidates with word-medial [+cor][+hi] sequences.

Fitzgerald's analysis is straightforward and conceptually appealing, but suffers some formulaic challenge. Fitzgerald's constraint, at the heart of it, enforces the realization of a morphosyntactic feature, PERFECTIVE, where there is no overt affix to do the work. This sort of morpheme-as-constraint approach to word-formation has emerged in OT (see, for example, Yip 1995) as an apparent reflex of the "item-and-process" model of morphology advocated by Anderson (1992). Such an approach supposes that the phonological component of the grammar receives from the syntax a fully featured, but otherwise simplex word, and that the surface segmental realization of affixal material is brought about by phonological rules (or constraints) which explicitly give phonological content to abstract morphosyntactic features. Words are not, as in the traditional "item-and-arrangement" approach, formed by the concatenation of independent lexical entities; there is no plural morpheme "-s" in the English lexicon, for example, but a rule or constraint in the phonology: PLURAL="-s".

The principal objection to this approach is that there is, in effect, no upper bound on what may constitute a "process", whether formalized as a rule or as a constraint. While TRUNC is relatively innocuous from a typological standpoint, its present conception might permit to our theory of UG a host of other constraints of a highly arbitrary and construction-specific nature, ultimately voiding the theory of much predictive power. Imagine, for example, a constraint TRUNC-4: "The perfective output contains exactly four fewer segments than the imperfective output." Segment counting in this manner—and any of the myriad other possible changes wrought by such constraints—seems highly undesirable. While it is obvious that a considerable body of morphological processes, including subtractive ones, cannot be attributed to concatenative morphology alone, it is incumbent upon the researcher to posit a *constrained* theory of processual morphology, rather than coin parochial morpheme-constraints on an ad hoc basis.

A treatment of the phenomenon within the larger body of TAFT—simply construing a high-ranked ¬MAX-C over the imperfective > perfective correspondence relation—situates it within such a constrained theory of non-concatenative morphology. The formulation of an anti-faithfulness constraint is restricted and non-arbitrary; from a finite body of faithfulness constraints can only come a finite body of anti-faithfulness constraints. Furthermore, designation of segmental type in the constraint provides simple explanation for two additional classes of perfective, one which does not truncate at all, and one which shows only truncation of a medial laryngeal.

(16) "Exceptional" Perfectives (Hill & Zepeda 1992)

a. <u>No truncation</u>.

| *Impf.* | *gloss* |
|---|---|
| gagswua | 'combing' |
| dada | 'arriving' |
| mu: | 'wounding by shooting' |
| bia | 'dishing out food' |
| ʔeñga | 'owning' |

b. <u>Laryngeal truncation</u>.

| *Impf.* | *Perf.* | *gloss* |
|---|---|---|
| giʔa | gi■a | 'grasped' |
| huʔa | hu■a | 'raked together' |

[14] To my knowledge, this constraint doesn't actually account for the full range of subtractive allomorphy in TO (e.g., *hu:pan* > *hu:p■■*, *wakona-mid* > *wakona-m■■*, and non-truncating *gagswua* > *gagswua*), and coronal-high sequences are elsewhere attested in the language, but numerous authors (Hale 1965, Hill & Zepeda 1992) agree that there is some phonological basis for the loss of final vowels in this context.

mu?a mu■a 'killed-SG-OBJ'

The data in (16a) demonstrate that imperfectives which end in a vowel cannot truncate[15]. This follows simply if the anti-faithfulness constraint is attuned to consonantism. In (16b), we find medial truncation of a laryngeal in the perfective. This surprising fact can be made to follow if we assume that the laryngeal is underlyingly word-final in the imperfective, and metathesizes on the surface, as hypothesized by Hill & Zepeda (1992); its truncation in the perfective would not, therefore, result in violation of Contiguity, as shown in Tableau (6) below.

**Tableau 6.**
C-truncation in TO

| | /gagswua$_{\text{IMPF}}$/ | CONTIG | L-ANCHOR | ¬MAX-C | MAX |
|---|---|---|---|---|---|
| ☞ | a. gagswua | | | * | |
| | b. gagswu■ | | | * | *! |
| | c. ■agswua | | *! | | * |
| | d. ga■swua | *! | | | * |
| | /gia?$_{\text{IMPF}}$/ | | | | |
| ☞ | e. gia■ | | | | * |
| | f. gi'■ | | | *! | * |
| | g. ■i'a | | *! | | * |

*2.2 Containment OT and the Lardil Nominative*
We have seen a recurring theme in Koasati and TO: where anti-faithfulness mandates minimal truncation of a single segment, well-formedness conditions on the language may force deletion of additional material. In Koasati rhyme-deletion, truncation of a root-final consonant is enforced by a prohibition against complex consonant clusters. In TO, the deletion of a stem-final high vowel results from a prohibition against coronal-high sequences. These facts are argeeably in accord with an observation made by Alderete (1999) about anti-faithfulness effects, namely that they are *grammar dependent*. Anti-faithfulness requires minimal non-identity between a derived word and its base. The ultimate surface realization of that non-identity, however, is subject to other forces in the grammar, resulting in a conspiratorial realization of morphology. In this section, we will consider yet another case of subtractive morphology in which phonological forces external to an anti-faithfulness constraint conspire with it to produce subtractive alternation.

Lardil nominative truncation, shown fig. (17), has received considerable attention in prosodic circumscriptional and Optimality Theoretic literature alike. The salient generalizations to be gleaned from the data below are: 1) that underlying stem-final vowels only surface when proximate to an overt affix; 2) that non-coronal consonants[16] delete when they would otherwise syllabify as codas.

(17) Lardil Nominative Truncation (from McCarthy & Prince (1993a))

a. C loss from stem

| *UR* | *nominative* | *nonfut. acc.* | *fut. acc.* | *gloss* |
|---|---|---|---|---|
| ŋaluk | ŋalu■ | ŋaluk-in | ŋaluk-ur̩ | 'story' |
| wuŋkunuŋ | wuŋkunu■ | wuŋkunuŋ-in | wuŋkunuŋ-kur̩ | 'queen-fish' |
| waŋalk | waŋal■ | waŋalk-in | waŋalk-ur̩ | 'boomerang' |

b. V loss from stem

| | | | | |
|---|---|---|---|---|
| yiliyili | yiliyil■ | yiliyili-n | yiliyili-wur̩ | 'oyster sp' |
| mayařa | mayař■ | mayařa-n | mayařa-r̩ | 'rainbow' |

[15] Fitzgerald presents a single exception to this, *híwa* > *híw*.
[16] Coronals of Lardil include: [t], [n], [l], [r], [ty], [ny], [ t̩], and [r̩]. [t̩], and [r̩] are apicodomal.

c. CV loss from stem

| | | | | |
|---|---|---|---|---|
| yukařpa | yukař■■ | yukařpa-n | yukařpa-ṛ | ‘husband’ |
| wuṭalt$^y$i | wuṭal■■ | wuṭalt$^y$i-n | wuṭalt$^y$i-wuṛ | ‘meat’ |
| ŋawuŋawu | ŋawuŋa■■ | ŋawuŋawu-n | ŋawuŋawu-ṛ | ‘termite’ |
| muřkunima | muřkuni■■ | muřkunima-n | muřkunima-ṛ | ‘nullah’ |

d. CCV loss from stem

| | | | | |
|---|---|---|---|---|
| muŋkumuŋku | muŋkumu■■■ | muŋkumuŋku-n | muŋkumuŋku-ṛ | ‘wooden axe’ |
| t$^y$umput$^y$umpu | t$^y$umput$^y$u■■■ | t$^y$umput$^y$umpu-n | t$^y$umput$^y$umpu-ṛ | ‘dragonfly’ |

Prince & Smolensky (1993) analyze the truncation as resultant from two interacting forces, one phonological, one morpho-phological. The truncation of the stem-final consonant in the nominative (as in (28a)) is argued to result from the following phonological condition on Lardil codas, otherwise motivated by distributional facts of the language (Wilkinson 1988).

(18) CODACOND : A coda C must have only Coronal place or else no place specification of its own at all.

This constraint, appropriately ranked above constraints preserving underlying structure, will mandate that an underlying form /ŋaluk/ surface as [ŋa.lu] unless some affixal structure presents itself for the potentially offending C to syllabify with, as in the future accusative, /ŋaluk-uṛ/ → [ŋa.lu.kuṛ]. Prince and Smolensky attribute final-vowel truncation in the nominative to a more general grammatical imperative: stems or words should end in a consonant rather than a (relatively) weak open syllable. This is formalized as follows:

(19) FREE-V: Word-final vowels must not be parsed (in the nominative).

Thus when an underlying form like /yiliyili/ is nominativized and evaluated by the grammar, the word-final /…i/ is underparsed, [yiliyil<i>], and thence phonetically interpreted as null. In this case, the consonant preceding the underparsed vowel is coronal, and so may be syllabified as a coda without violating the CODACOND. In full-syllable deletion cases, such as /yukařpa/ → [yu.kař], however, truncation (=underparsing) of the final vowel alone would result in violation of the CODACOND, and so additional segments are underparsed, [yukař<pa>]. The same obtains in the CCV truncation cases; wherever a non-coronal consonant (or homorganic nasal–consonant cluster) would be left in the wake of final-vowel deletion, that consonant goes underparsed. So, simply, where truncation of a stem - final V would result in a non-coronal coda, the stem-final V *and* the potentially pernicious coda consonant are truncated.

This sort of approach (FREE-V) works perfectly well in the *Containment* model of OT employed in Prince & Smolensky (1993), where structure is not removed completely from phonological representation (in the candidate set), but is rather marked to be phonetically underparsed. With these assumptions, the optimal candidate for a Lardil input /wuŋkunuŋ/ is #wuŋkunu<ŋ>#, with a final underparsed *ŋ* satisfying the CODACOND; this optimum is thereafter phonetically interpreted as [wuŋ.ku.nu]. The presence of the underparsed <ŋ> in the representation prevents the phonetically word-final *u* from being truncated by FREE-V in the phonology.

Unfortunately, as is argued by McCarthy & Prince (1995), the Containment model is better replaced by a Correspondence model (which has been assumed throughout this paper) precisely because the Correspondence model *grammaticalizes* deletion, wresting it from the command of phonetic interpretation. The result: “deleted elements cannot play a role in determining the performance of output structures on constraints defined strictly by output representations” (McCarthy & Prince 1995:30). The grammar cannot underparse material, but must fully delete it. Reformulating FREE-V to align with correspondence-theoretic assumptions, we come to a morphology-specific markedness constraint.

(20) FREE-V: $*V]_{PrWd}$ (in the nominative).

Obviously, this constraint is inadequate to account for the alternations of Lardil under the full-deletion assumptions of correspondence-theoretic OT. Consider fig. (21).

(21) Differing truncated forms by model:

| Model: | Containment | Correspondence |
|---|---|---|
| Desired Optimum: | wuŋkunu<ŋ><br>ŋawuŋa<wu><br>muŋkumu<ŋku> | wuŋkunu<br>ŋawuŋa<br>muŋkumu |
| FREE-V: | ✓ | *! |

Without the presence of underparsed material at the word edge, the forms in the second column above perform no better on FREE-V than untruncated competitors and are bested by candidates which additionally truncate material up to a coronal C (which may be syllabified into a coda) or minimal-word conditions on the nominative (Wilkinson 1988). For example, we expect /wuŋkunuŋ/ to surface [wuŋkun], /ŋawuŋawu/ → [ŋawu], etc.

Prince & Smolensky note that final V truncation in Lardil must be the result of some idiosyncratic morpho-phonological force—hence the designation of FREE-V as "in the nominative". A reasonable explanation of this fact presents itself at this point: anti-faithfulness. If we posit ¬MAX to be the cause of final truncation in Lardil, the erroneous predictions of FREE-V disappear. In the V, CV, and CCV deletion cases, anti-faithfulness engenders truncation of the final vowel, and CODACOND enforces simultaneous deletion of unsyllabifiable consonants. Truncation of extra vowels would simply be a gratuitous violation of MAX-IO[17].

**Tableau 7.**
Final CV and V truncation

| | *candidates* | ¬MAX | CODACOND | MAX | |
|---|---|---|---|---|---|
| | ŋa.wu.ŋa.wu | *! | | | OO-Base: |
| | ŋa.wu.ŋaw■ | | *! | u | [ŋawuŋawu] |
| ☞ | ŋa.wu.ŋa■■ | | | wu | |
| | ŋa.wu■■■■ | | | ŋaw!u | |
| | wuŋ.ku.nuŋ | *! | * | | OO-Base: |
| ☞ | wuŋ.ku.nu■ | | | ŋ | [wuŋkunuŋ] |
| | wuŋ.kun■■ | | | uŋ! | |

It is important to note the environments which show anti-faithfulness to be crucially dominated. In all of the examples shown below, the final segment of the underived stem is somehow protected from the effects of ¬ MAX.

[17] There is, however, a fundamental difficulty for this approach: exactly what is the output base to which the Lardil nominative corresponds? The nominative is typically taken as the unmarked morphological form. We would expect, under Benua's assumptions, that the nominative should always be the simplex output from which other forms are derived. This, coupled with Benua's Priority of the Base Principle, which states that Output-Output faithfulness is unidirectional (i.e., the derived word may be faithful to the simplex word base, but not v.v.), suggests that we should not find transderivational faithfulness (or anti-faithfulness!) effects in the nominative. A solution to this dilemma may present itself in the Uniformity of Exponence approach to paradigmic identity advocated by Kenstowicz (1995), in which the Base of correspondence for a morphologically derived word is the "isolation form" (=most common form across the paradigm) of the stem, rather than the output of a single least-complex derivation. An equally tenable solution holds that the nominative is simply not the OO-base in this paradigm. This is a matter we will leave to future research.

(22) No Truncation (Wilkinson 1988)

| | *UR* | *nominative* | *nonfut. acc.* | *fut. acc.* | *gloss* |
|---|---|---|---|---|---|
| a. | /kela/ | kela | kela-n | kela-r | ‘beach’ |
| | /wite/ | wite | wite-n | wite-r | ‘inside’ |
| b. | /tuŋal/ | tuŋal | tuŋal-in | tuŋal-uṛ | ‘tree’ |
| | /kentapal/ | kentapal | kentapal-in | kentapal-ur | ‘dugong’ |

The cases in (22a) are simply accounted for given word-minimality restrictions in the language. Wilkinson (1988) shows that epenthesis of a final [a] occurs in a number of nominative nouns in which the underlying stem is CVC (ex., /teř/ → *teřa* nom., *teř-in* nfut., *teř-ur* fut. ‘thigh’). Presumably this epenthesis results from some high-ranked word-minimality constraint such as FTBIN. If the same constraint dominates ¬MAX, truncation will be prohibited just in the case that its surfacing effect would be less than a minimal word. The (22b) cases are less straightforward, but as no form in the observed data involves truncation of a lateral consonant at any point, we may account for these facts with appeal to a high-ranking featural faithfulness constraint (of the type advocated in Lombardi 1996) to the feature [+lateral].

The truncative phenomena of Lardil are similar in many respects to those of Lomongo, where the final CV or CCV of personal names will truncate in the vocative (Weeda 1992).

(23) Lomongo Vocative Truncation

a. CV loss

| *source* | *vocative* |
|---|---|
| buku | buu■■ |
| bombuluku | bombuluu■■ |
| yoká | yoo■■ |
| EkOmÉlá | EkomÉE■■ |

b. CCV loss

| | |
|---|---|
| ilónga | ilóo■■■ |
| ilumbé | iluu■■■ |

Again the combined ranking of ¬MAX and a constraint on coda well-formedness—here NOCODA[18]—over MAX-IO will ensure the loss of a final vowel and any proximate consonants. One apparent exception, *bolaá* > *bolaa*, further proves the rule when we note that the final high tone [´] of the source name is lost in the vocative. This follows if the final vowel, with its attendant tone, is truncated to satisfy ¬MAX-V. The remaining final V undergoes lengthening to satisfy undominated FTBIN.

In both Lardil and Lomongo, we once again find the same kind of anti-faithfulness/markedness conspiracy that we saw in Koasati and TO. Anti-faithfulness conditions a truncative effect, and independently motivated phonology brings about the surface realization of that effect. As a point of typological contrast, it is interesting to note an apparent case of grammar-independent subtraction—independent in the sense that it leaves in its wake effects counter to the gross phonology of the language. In Icelandic, deverbal action nouns derive from infinitive verbs by subtraction; ex. *klifra* > *klifr*. Kiparsky (1984) notes that truncated deverbals defy otherwise robust phonological patterns of Icelandic (for example, word-final consonant clusters such as *fr* above are only permissible in the deverbal). Benua (1995) analyzes this *underapplication* of a phonological effect as resultant from transderivational faithfulness: preservation of identity with the structural character of the infinitive supercedes certain markedness effects in the deverbal. I will make no attempt to duplicate Benua’s findings here, but rather will point out that the cause of the truncation—attributed by Benua to lexical stipulation of the deverbal as shorter than the infinitive—easily falls out from the program of subtractive morphology advocated here and that grammar-independent subtractions of this type are predicted by the ganeral ranking: FAITH-OO, ¬MAX-OO » MARKEDNESS » FAITH-IO.

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[18] The employ of NOCODA here is highly motivated by the basic syllable structure of the language—Weeda reports that “Lomongo syllables are open or consist of a word-initial syllabic nasal.”

Another objection may be made to both Prince & Smolensky's and Fitzgerald's analyses: both rely crucially on *morpheme-specific markedness*. The acceptance of morpheme-specific—or to use Hammond's (1995) terminology, *parochial*—markedness in our theory of UG as a strategy for resolving morphological irregularity admits the possibility of a host of typologically unattested phenomena. SON]$_{PL}$ itself is relatively innocuous because its formulation limits its domain of effect to word edges only. Consider, however, the consequences of indexing a more generally applicable markedness constraint—*COMPLEX for example—to a specific morpheme. For an English´, exactly like English but with a plural-specific *COMPLEX ranked above, say, DEP-IO, we would predict productive alternations like: [strɛŋθ]$_{singular}$ > [sətərɛŋəθ]$_{plural}$. This seems undesirable. Furthermore, the acceptance of a single morpheme-specific markedness constraint for a single morpheme in a given language admits the possibility of a language with a fully articulated markedness hierarchy for *every morpheme*. To say that every morpheme of a language constitutes its own grammar would, needless to say, undercut some of the predictive power of Optimality Theory.

A reasonable question to ask is how morpheme-specific markedness practically differs from morphological anti-faithfulness when apparently some of the same effects got with morpheme-specific markedness could arise from O-O anti-faith. For a simplex form X and a derived form Y, consider the simple alternation below, where *A is any markedness constraint, and $*A_Y$ is a parochial markedness constraint specific to a morpheme Y:

**Tableau 8.**
Output-output ¬FAITH; Input $[A]_Y$, OO-base [A].

| | *cand.* | ¬F:A ↛B$_{OO}$ | F:A ↛B | *A |
|---|---|---|---|---|
| | A | *! | | * |
| ☞ | B | | * | |

**Tableau 9.**
Input-output **M**$_{Aff}$; Input $[A]_Y$.

| | *cand.* | $*A_Y$ | F:A ↛B | *A |
|---|---|---|---|---|
| | A | *! | | * |
| ☞ | B | | * | |

In the simplest of cases, the violation profiles are identical; the anti-faithfulness constraint and the morphologically indexed markedness constraint will be antagonistic to the same candidate set. A major distinction remains, however: anti-faithfulness constraints are inextricably tied to the fixed markedness hierarchy of the grammar and can only permute an optimal form a limited distance in relative markedness from the candidate chosen by normal faithfulness/markedness interactions of the grammar—anti-faithfulness is grammar dependent, as we have seen. The specific-morpheme faith/markedness model, however, could result in derived forms not just counter-unmarked for simplex words, but unmarked along a completely different and unrelated grammatical axis.

### 3.0 The Locality Question

In §1.3 we noted that nothing in the formal mechanism of anti-faithfulness itself predicts the locus of segment truncation—or anti-faithfulness effects generally. Some other technology must be implemented to capture the fact that subtractive truncation occurs from the right edge, say, rather than from the left edge or from within the word. Alderete (2000) notes that there are two effective means by which to get locality effects in anti-faithfulness-driven alternations: a) local conjunction (Smolensky 1995, 1997) and b) independent ranking of positional faithfulness constraints (Beckman 1997). The analyses presented in §1-2 adopted the latter strategy, ranking Left-Anchoring and Contiguity over Right-Anchoring to get the attested right-edge truncation in TO and Koasati. As noted, however, two problems arise for this approach, one typological, one theoretical.

#### *3.1 Problem One: Factorial Typology*

As is shown by fig. (i), the factorial typology of allowable truncation types we predict from re-ranking of the L-, R-ANCHOR and CONTIG—independent of other phonological factors—reduces to three: right-edge truncation, left-edge truncation, and constituent-medial truncation. A cross-linguistic survey of subtractive morphology types reveals a distributional fact unfortunate for these predictions: constituent-medial subtraction does not exist[19].

[19] At least, not attested as such. An exhaustive survey of vowel syncope might cast a different light on the matter.

(24) For an input /ABC/:

| Cand: | Wins on Ranking: | **Examples:** |
|---|---|---|
| AB■ | L-ANCHOR, I-CONTIG » R-ANCHOR | Danish (Anderson 1975);<br>Hessian (Golston & Wiese 1997);<br>Icelandic (Kiparsky 1984);<br>Koasati (Kimball 1991);<br>Tohono O'odham (Fitzgerald 1997). |
| ■BC | R-ANCHOR, I-CONTIG » L-ANCHOR | Kashaya, Tagalog (Weeda 1992)<br>Tiberian Hebrew (Prince 1975) |
| A■C | L-ANCHOR, R-ANCHOR » I-CONTIG | ✘ **Not attested!** |

*3.2 Problem Two: An Empirical Challenge*

The second problem faced by the positional faithfulness model used thus far lies in its inability to account for the contrast observed between Tohono O'odham and Koasati subtraction. In Tohono O'odham, material is subtracted from the right-edge of the morphological word; in Koasati, from the right-edge of the root.

| (25) | Koasati | Tohono O'odham |
|---|---|---|
| | pitaf-fi-n > pit■■-li-n | wacuwi-cud > wacuwi-c■■ |
| | → *root truncation* | → *morphological word truncation* |

The Anchoring/Contiguity approach adopted up to this point has made no attempt to explain this fact, primarily because of the intractability of the Koasati data for the Root/Affix Metaconstraint of McCarthy & Prince (1994b): Root-Faith » Affix-Faith. This universal ranking condition is argued for on the strength of the observation that, cross -linguistically, affixes are phonologically less marked (i.e., less preserving of contrast) than are roots. The typological consequences of this ranking are shown in fig. (26).

(26) Applicability of some Constraint **C**

| *Ranking:* | **C** *Domain* |
|---|---|
| **C** » Root-Faith » Affix-Faith | root, affix |
| Root-Faith » **C** » Affix-Faith | affix |
| Root-Faith » Affix-Faith » **C** | none |

For a given language, if **C** is a markedness constraint, (26) shows its effects to be felt a) in both root and affixal material, b) in affixal material alone, or c) in neither; the same holds true where **C** is an anti-faithfulness constraint. In the Koasati case, as we have seen, ¬MAX's domain of applicability is the root, contra the predictions of the metaconstraint. Why do we find *fomó:■-ka-n*, rather than **fomó:t-■a-n* to preserve root segmentism, or **fomó:t-ka-■* to truncate from the morphological word as in TO?

*3.3 A Choice of Two Models*

Alderete (2000) argues that anchoring constraints, when conjoined with anti-faithfulness constraints within a domain *D* (e.g., segment, root, adjacent-segment, etc.), may act to narrow the applicability of the anti-faithfulness constraint to that domain. A local conjunction approach to the Koasati data could sidestep both the typological possibility of constituent-medial truncation and the root/affix deletion problem. I will here present a rough Alderetian analysis of the problem, and go on to argue against it on the grounds that: one, it fails to generalize to other cases of subtractive morphology; and two, it relies crucially on right-edge anchoring constraints, which have been shown by Nelson (1998) to make predictions pathological to our theory of UG.

Consider the following anchoring constraint.

(27) ANCHOR-R(Root, PrWd)$_{IO}$
'The segment standing at the right edge of the root in the input corresponds to the segment standing at the right edge of the prosodic word in the output.'

The lone segment causing violation of this constraint in a derived Koasati verb such as *famót-ka-n* is the root-final one. Therefore, if we conjoin this constraint with ¬MAX and localize the violation of the conjoined constraint to a specific domain, *segment*, we have a constraint which will be violated just in case the root-final segment a) is not final in the prosodic word *and* b) has a correspondent in a specified output base..

(28) (¬MAX-OO $\&_{Seg}$ ANCHOR-R(Root, PrWd)-IO) ≡ ¬Max-OO$_{FinSeg}$
‘Delete the root-final segment.’

In the Koasati plural cases we have been considering, this constraint is violated by any candidate which does not truncate the final segment of the root. Candidates in which material is truncated from the middle of the root or from the affix would violate the constraint, circumventing the constituent-medial deletion problem and the root/affix faithfulness dilemma.

**Tableau 10.**
Coda-deletion with ¬F$_D$.

| | /fomot-ka-n-Ø/ | ¬Max-OO$_{FinSeg}$ [fo.mót.kan] | MAX-IO |
|---|---|---|---|
| ☞ | a. fo.mó:■.kan | | * |
| | b. f■■ót.kan | *! | ** |
| | c. fo.mót.■an | *! | * |
| | d. fo.mót.ka■ | *! | * |

What this approach does *not* capture are the facts of Tohono O’odham, Lardil, Icelandic, Danish, Hessian, etc., since—as Alderete points out—this type of local conjunction approach may only localize an anti-faithfulness effect proximate to *overt* affixal material. The constraint in (28) is a conjoined constraint of the type advocated in Smolensky (1996), and the logic of conjunction tells us that if neither conjunct is violated, the constraint is not violated. Thus it is crucial to the above analysis that there be no potentially optimal candidate which does not violate Root/PrWd anchoring. Consider another competitor against the candidates shown above: *fomót*■■■. With such a candidate, the anchoring conjunct of ¬Max-OO$_{FinSeg}$ is not violated, and thus neither is the constraint. In Koasati, such a candidate is ruled out by MAX-IO. In Tohono O’odham, however, where no other affixal material is present underlyingly in the perfective, the anchoring conjunct wll always be satisfied, and it fails to obtain how right-edge subtraction may be enforced. An additional argument against this type of approach is that it relies crucially upon right-edge anchoring. As has been argued in Nelson (1998), the inclusion of right-anchoring constraints in the grammar leads to pathological predictions for an Optimality Theoretic UG. This is not a surprising arguments to make in a theory which admits a correlation between positional faithfulness and acoustic or psycholinguistic salience (Beckman 1998, Casali 1996)—constituent-initial material is more prominent than constituent-final material.

### *3.4 Solution: There is no Right Anchor*

The negative consequences of the local conjunction approach to subtractive morphology apparent, it remains to be seen what theory might best it. I contend that the positional faithfulness model put to use in §2-3 can surmount the difficulties presented to it above, but not without the sort of modification to our theory of CON argued for by Nelson (1998).

First, note that the positional faithfulness approach presents the typological problem noted above precisely *because* it—by assumption, not by necessity—includes in its formulation the constraint R-ANCHOR. If there is no grammatical imperative to preserve constituent-final material (beyond that of general faithfulness), the right edge suddenly becomes the unmarked edge for truncative effects not resultant from phonological factors (contextual or featural markedness, constraints against vowel hiatus, etc.), as in exactly the cases at hand. This is shown in tableau (11), in which it is also apparent that the right-edge deletion candidate *harmonically bounds* the left-edge and constituent-medial deletion candidates. It follows that—again, independent of markedness effects extrinsic to the processes we have been considering—anti-faithfulness-motivated subtraction should only occur at the right-edge.

**Tableau 11.**
Truncating the unmarked right.

| | /pitaf-li-n$_{PL}$/ | L-ANCHOR | CONTIG$_{Root}$ |
|---|---|---|---|
| ☞ | a. pít■■.lin | | |
| | b. ■■táf.fin | * | |
| | c. pí■■f.fin | | * |

The reader may well ask at this point: what of purported left-edge subtraction cases, as in Kashaya in fig. (24)? While these cases are not as cross-linguistically robust as the right-edge deletion cases[20], it is notable that the theory advocated here does predict them. Alderete (2000) argues that for any faithfulness constraint **F** there may be a like anti-faithfulness constraint ¬**F**—this extends to *positional* faithfulness constraints such as L-ANCHOR. We may capture the facts of left-edge truncation with a high-ranked ¬L-ANCHOR:

**Tableau 12.**
Left-edge truncation

| | /ABC/ | ¬L-ANCHOR | CONTIG | L-ANCHOR |
|---|---|---|---|---|
| ☞ | ■BC | | | * |
| | AB■ | *! | | |
| | A■C | *! | *! | |

As the tableaux demonstrates, the constituent-medial truncation candidate is still harmonically bounded by the right-edge truncation candidate, still reducing the typological possibilities to those attested[21].

(29) Typological predictions: L-, R-Anchoring vs. L-, ¬L-Anchoring

| *cand* | Incorrect Predictions: {L, R}-ANCHOR, CONTIG | Correct Predictions: L-ANCHOR, ¬L-ANCHOR, CONTIG |
|---|---|---|
| ■BC | ✔ | ✔ |
| AB■ | ✔ | ✔ |
| A■C | ✔ | ✘ |

In addition to solving the typological problem previously inherent to the model, the eradication of R-ANCHOR from the grammar also gives us a simple solution to the Root/Affix Metaconstraint problem.

L-ANCHOR has been used throughout this paper to preserve string-initial material from deletion, but, as formulated, also militates against string-initial epenthesis and metathesis. Note that the Root/Affix Metaconstraint entails a fixed ranking of root and affix MAX constraints, and similarly anchoring constraints.

(30)

| Metaconstraint: | ROOT-FAITH » AFFIX-FAITH |
|---|---|
| Fixed MAX Ranking: | ROOT-MAX » AFFIX-MAX |
| Fixed ANCHOR Ranking: | ROOT-L-ANCHOR » AFFIX-L-ANCHOR |

The metaconstraint does not, however, require any fixed ranking between ROOT-MAX and the affix-attuned anchoring constraint. Since these constraints are not ranked with respect to one another, preservation of affix-initial material may take precedence over preservation of root material in a given language. Tableau (13) demonstrates the implementation of these maneuverings in Koasati. Also shown is the further import of *COMPLEX to the analysis, ruling out candidate (d), in which an affix vowel is truncated, leaving a marked syllable structure in its wake.

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[20] Weeda (1992) notes that the evidence for aphaeresis in Tagalog and Kashaya is scant, needing further investigation. A. Prince (p.c.) notes that apparent subtractraction in the Tiberian Hebrew imperative is essentially morpheme trucnation, which is somewhat beyond the scope of the current effort, but might be accounted for by some anti-faith variant of the MORPHREAL constraint (see Samek-Lodovici 1992).

[21] The inclusion of ¬L-Anchor in the grammar does, however, admit precisely the sort of pernicious typological predictions argued against in Nelson (1998)—since anti-faith can be construed over BR-correspondence as well as OO, we allow the possibility of an anti-left-anchored reduplicant.

**Tableau 13.**
Preservation of affix-initial segmentism in Koasati

| | /fomot-ka-$n_{PL}$/ | *COMPLEX | AFFIX-L-ANCHOR | ROOT-MAX |
|---|---|---|---|---|
| ☞ | a. fo.mó:■.kan | | | * |
| | b. fo.mó:.t■an | | *! | |
| | c. fo.mó:t.ka■ | | *! | |
| | d. fo.mó:tk■n | *! | | |

*3.5 The Remainder*
Rigorous attention to factorial typology does, however, present the current analysis with certain challenges not readily met. Since we are allowing for multiple anti-faithfulness constraints of varying types in a given grammar, it obtains that more than one may be active over a given OO-correspondence relation. What would happen if ¬MAX-C and ¬MAX-V were active for a given OO-ℜ and highly ranked? Taking a hypothetical Koasati´ for illustrative example, let us suppose that rhyme deletion, as in *pit**áff**in* > *pít■■lin*, is brought about in precisely this way. What then becomes of the long-vowel deletion cases? We would predict *ata**ká:**lin* > *atá:■■lin*, where the root-final vowel and consonant are truncated. In addition to the fact that this type of truncation is not cross-linguistically attested, it seems in some ways a theoretical step backward. The analysis of Koasati in §1 made the natural prosodic size of the truncated material follow from other constraints active in the grammar; in the Koasati´ example here, we are effectively truncating by segment count. On yet another possible ranking, Koasati´´, we might also allow for truncation which in effect 'chooses' the right or left edge, dependent upon the prosodic shape of the root or word. A simple example proves the point. If we allow a simple faithfulness constraint preserving long-vowels, say, and rank it above the twin anti-faithfulness constraints, so: MAX-LONG-V » ¬MAX-C, ¬MAX-V » $\text{MAX}_1$, we would predict an underlying form like /CVCVC/ to truncate to [CVC■■], but /CVCV:C/ to [■VCV:■]. This is unattested to my knowledge and furthermore seems highly unnatural. A simple solution to these problems would be to simply stipulate that one and only one ¬F constraint may hold over a given OO-ℜ; thus effects such as those described above could never occur. Unfortunately, there is little in the way of external evidence, beyond the ugliness resultant from its absence, to support such a stipulation.

The present analysis also predicts affix-diametrical effects, e.g., overt suffixes that trigger word-initial truncation and prefixes that trigger it word-finally. Though nothing in this paper directly refutes the notion that an overt affix could trigger an anti-faithfulness effect, Alderete (1999) explicitly argues for such effects conditioned by overt morphology, and in fact there exists a non-productive type of reduplication in Koasati, ex., *conók-bi-n* > *con■■-<u>có:</u>-bi-n* 'to be stooped', which shows rhyme-deletion along with affixation of a reduplicant. Thus we could easily construe the OO-ℜ between some prefix to be subject to ¬MAX and predict prefixal affixation with suffixal truncation.

We will leave these matters to the discernment of future research.

## 4.0 The Final Tally

Occam's Razor is a yardstick by which grammatical frameworks must be evaluated. However, when an elegant theory of grammar is confronted with natural language phenomena which it cannot account for in an enlightening way, something must give. A leading idea in OT is that it should be, in the terminolo gy of Moreton (1999), *conservative*—that CON should be composed of only faithfulness and markedness constraints because no other type of constraint is needed. As I believe we have seen in the subtractive morphology cases examined here, this is not a condition which can hold over a grammar of natural language without significant loss of theoretical insight. The anti-faithfulness approach we have advocated here captures the descriptive facts of morphological subtraction in a conceptually simple manner; it makes no reference to a syllable or rhyme template, which have been crucial to pre-OT accounts of the phenomena and are now—by the Generalized Template Theory of McCarthy & Prince (1993a)—considered superfluous to an explanatory theory of UG; and it subsumes subtractive morphology under a single set of theoretical assumptions which also account for other "idiosyncratic" processes of natural language, including segmental exchange processes, morpho-accentual phenomena, and circular chain shifts. The approach is furthermore highly constrained: anti-faithfulness constraints are rigorously defined as the negations of faithfulness constraints and ranked against the rest of a grammar's constraint hierarchy, producing subtractive alternations dependent upon other grammatical principles, as we have seen. This comes to us at the cost of some typological inexactitude, but, in the end, it is preferable for a theory of grammar to say *something* about a patternable natural language phenomenon—even with some questions unresolved—than it is to say *nothing*.

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