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# Prosodic Faithfulness in Cupeño\*

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## 1. Introduction

In studies of word stress, the distinction is often made between a default or canonical pattern, and one or more exceptional stress patterns. While the latter class of patterns has been studied in some detail, there is little consensus in the theoretical literature concerning the formal treatment of exceptional stress. Some have taken a representational approach, namely one in which the idiosyncratic properties of exceptions are encoded in underlying forms, and where the canonical patterns result from the absence of these underlying prosodic specifications (Lieberman & Prince 1977, Hayes 1980, Selkirk 1984, Halle & Vergnaud 1987, and Idsardi 1992; see Inkelas 1994, McCarthy 1995, Pater 1995 for recent work in Optimality Theory, OT henceforth). In endowing lexical structures with prosodic features, these representational theories differ from alternatives which attribute exceptional stress to divergent phonological systems (Harris 1987; Pater 1994, Rosenthal 1994, Katayama 1995), or which encode the irregularities in morpheme specific rules or constraints (Franks 1985; Hammond 1995, cf. Russell 1995).

With this range of alternatives to the representational approaches, one might reasonably ask if underlying prosodic specifications are truly necessary in the description of exceptional stress. In this paper, a set of observations in the Uto-Aztecan language Cupeño are examined which bear on this issue. These observations are sketched directly below as an overview of the paper, accompanied by an explanation of their theoretical relevance.

The accent system of Cupeño is characterized as a lexical stress system because stress alone may introduce lexical contrast among roots (Hill & Hill 1968, Munro 1977). While the contrast is effectively neutralized in roots with long vowels, accent is unpredictable

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elsewhere, manifesting lexical distinctions. One goal of this paper, which will be accomplished in section 2, is to account for this kind of **restricted** lexical contrast.

In Optimality Theory (Prince & Smolensky 1991, 1993; McCarthy & Prince 1993a), phonemic contrast is an emergent property of surface forms, derived by the interaction of faithfulness and markedness constraints. This point applies with equal force when stress is a distinctive feature in the system; distinctive stress is characterized by ranking a faithfulness constraint which encourages the realization of underlying prosodic features above the relevant prosodic markedness constraints. The restricted set of stress contrasts in Cupeño shows that this constraint interaction is more complicated, requiring that prosodic faithfulness assume both a dominated and a dominating position in the constraint system. In section 2, this constraint interaction will be examined in detail, and the end result will be a fully formal constraint-based account of the inventory of root stress patterns.

A second fundamental observation concerns the interaction between root and affix stress. Roots are classified in Cupeño according to their behavior when combined with inherently stressed affixes. Unaccented roots surface without stress when they combine with inherently stressed affixes, such as the person prefixes *nó-*, *pó-*, or *čám-* (1a). Affix stress is suppressed, however, in forms with accented roots (1b), supporting the observation, dating back to Hill & Hill's work, that root stress overrides affix stress.

- |        |                |               |    |                        |                |
|--------|----------------|---------------|----|------------------------|----------------|
| (1) a. | <i>nó-yax</i>  | I say         | b. | <i>pə-háw-pə-qal</i>   | He sang        |
|        | <i>pó-yax</i>  | S/he, it says |    | <i>pə-pulín-qal</i>    | She gave birth |
|        | <i>čám-yax</i> | We say        |    | <i>nə-ŋjy-qal-i-pə</i> | When I go away |

Dominant root stress may be interpreted in OT as an effect of a high ranking faithfulness constraint governing the relation between stress in underlying roots and their counterparts in surface forms. This approach will be argued to provide further empirical support for a recent development in OT in which the faithfulness constraints are segregated along morphological dimensions, i.e., Root Faith and Affix Faith. The account of dominant root stress in terms of a high ranking Root Stress Faith constraint has the positive consequence of relating this observation to a general fact about structural inventories, namely that roots generally permit a wider range of contrasts than affixes (McCarthy & Prince 1994, 1995). This analysis will be developed below in section 3, and subsequently contrasted with other plausible alternatives to characterizing root-affix stress interaction.

The third observation concerns unbounded stress in forms with unaccented roots. In such forms, an inherently stressed prefix surfaces with stress (2a), only if the form does not also contain an inherently stressed suffix, in which case the rightmost underlying accent surfaces with stress (2b).

- |        |          |   |        |    |             |   |               |
|--------|----------|---|--------|----|-------------|---|---------------|
| (2) a. | /áf-rt/  | → | áf-rt  | b. | /áf-rt-áf/  | → | af-rt-áf      |
|        | /nó-yax/ | → | nó-yax |    | /nó-ya-qál/ | → | nə-ya-qál     |
|        | /pó-yax/ | → | pó-yax |    | /pó-ya-qál/ | → | pə-ya-qál     |
|        |          |   |        |    |             |   | I was saying  |
|        |          |   |        |    |             |   | He was saying |

It is a common observation in unbounded stress systems that the edgemost unit is stressed in words with more than one intrinsically prominent category, e.g. a stressed affix, or heavy syllable.

The third goal of this paper is thus to show how faithfulness to lexical prosody may play a crucial role in deriving observations of this kind in accent systems. In the analysis developed below, prosodic faithfulness will maintain the stresses on inherently stress

morphemes (2a). And only when more than one such morpheme is present in a word, i.e., in cases where the prosodic faithfulness cannot be fully satisfied, will the edge orientation constraint have an effect (2b). In this way, unbounded stress in accent systems can be treated on a par with other known stress systems.

To recapitulate, the observations characterizing the behavior of Cupeño accent are argued to warrant a representational approach which employs a notion of faithfulness to underlying prosody. First, prosodic faithfulness will be defined and used in a surface-oriented account of the root stress inventory. The restricted set of stress patterns will be derived by giving the prosodic faithfulness constraint an intermediate position in the constraint hierarchy. Second, the representational account provides an avenue for explaining dominant root stress in terms of a universal ranking which gives Root Faith high rank in the constraint system. Third, the prosodic faithfulness constraint may be employed in the analysis of unbounded stress in an accent system, effectively extending the theory of unbounded stress to characterize these systems. These results therefore complement the findings based on other material in Inkelas 1994 and McCarthy 1995, where prosodic faithfulness also plays a crucial role in deriving exceptional stress.

## 2. Root Stress Inventory

In this section, the observations characterizing the root stress inventory in Cupeño are presented (§2.1), and analyzed in a framework which employs a notion of prosodic faithfulness (§2.2). The analysis is then summarized in the closing subsection (§2.3), and some cross-linguistic implications are considered.

### 2.1 Data and Observations<sup>1</sup>

Recent work on Cupeño has shown that the set of observed root stress patterns is not completely irregular (Munro 1990, Crowhurst 1994). While stress is contrastive in certain contexts to be described below, if a root has a long vowel, that vowel is stressed. The examples below are typical, showing long vowel stress in bare roots (3), and with conjugated verbs (4). Most of these examples contain disyllabic roots, which apparently reflects the canonical pattern (Hill 1967).<sup>2</sup>

<sup>1</sup>The Cupeño examples presented in this section and subsequent ones are drawn from a range of different sources: Hill & Hill 1968 (HH), Crowhurst 1994 (C), Hill & Nolasquez 1973 (with page and line number given), and from excerpts from fieldnotes provided for me by Jane Hill (JH). I have used the principles outlined in Hill & Hill to determine root classification for the examples from Hill & Nolasquez.

<sup>2</sup>It is rare to find roots composed of three or four syllables with post-penultimate stress, and this observation has prompted Crowhurst 1994 to invoke an initial two syllable window for stress in roots. Closer examination of the grammatical literature, however, suggests that such a constraint may in fact be unnecessary. First, Hill 1967 prefaces a discussion of canonical morpheme shape with a disclaimer that many of the longer forms may have complex morphological analysis: "[...] a number of forms which appear to be [...] single morphemes are almost certainly made up of multiple morphemes by compounding, incorporation of affixes, and so forth (p. 184)." If the longer forms are composed of two roots, or a root followed by a suffix, initial stress may simply be the result of the general pattern of leftmost root stress observed elsewhere in the language in the former case (Hill & Hill 1968, p. 236), or in the latter case, simply a case of dominant root stress. Second, Hill's discussion reveals a tendency for morphemes to be no greater than two syllables in size, "The most common [shapes] are CV and CVCV [...]. Somewhat less common are morphemes of the shape CVCVCV [...]. Morphemes of the shape CVCVCVCV are also found, but these are considerably less common." In light of these observations, it may be possible to describe the absence of stress on the third or fourth root syllable as an effect of the nonexistence of

- (3) a. máasivət grass C 185  
 xəənə blow (wind) C 185  
 pəəxwən nothing but 10.57  
 náači soon, quick 38.4  
 híimaʔay donate goods to burning  
 ceremony C 185
- b. təvxáa-qa ... is working C 185  
 ʔiyúunə fast C 185  
 muháan shoot with bow C 185
- (4) a. pəm-təəčiq-wən They ordered ...41.7  
 čəm-náaxčín We passed on 21.9
- b. pəʔ-ičáay-wən They did ... 24.51  
 taváan-pə-qal He put him... 58.13

The same patterns of long vowel stress are observed in forms of Spanish origin (5).

- (5) a. váaka-ʔam cattle 21.4  
 káarpa tent 21.10  
 ráaču-ŋa at (the) ranch 22.15
- b. kaváayu-ʔum horses 21.4  
 ramáada-ʔəp (lived in) shelters 21.11  
 əskwéela-ka to school 22.37  
 kapíiya chapel 23.19  
 guvyéernu government 24.33

There are no roots with long vowels where stress falls on a syllable with a short vowel. The historical development leading up to Cupeño stress described in Munro 1990 supports this observation: pre-Cupeño stressed the root initial vowel or the second vowel if it was long, otherwise default stress fell on the initial syllable; subsequently, contrastive vowel length was lost in unstressed syllables. Thus, the fact that vowel length was only preserved in stressed syllables effectively rules out the possibility of short vowel stress in forms with long vowels. Summarizing the above discussion in synchronic terms, one key observation governing the distribution of stress in roots is that long vowels attract stress.

In contrast to this predictable element of the stress system, stress is contrastive in roots which do not contain long vowels: stress may fall on either the first or second syllable, as shown in the nouns in (6) and the conjugated verbs in (7).

- (6) a. súʔiš jackrabbits 10.63  
 púki-yka by (to) the door 9.25  
 máxiʔč-am greens 9.4  
 kúpa-ŋax from Cupa 29.1  
 k<sup>w</sup>mil<sup>v</sup> acorns 29.1  
 híəxvəl goods, clothing 41.65
- b. təmál ground 29.4  
 atáxʔ-am the people 29.1  
 savál grass 29.4  
 kawíš rock 29.4  
 səvəl wind 9.16  
 əmáy now, today 21.1  
 siʔáviš cracked acorns 29.7  
 ələlʔiš bad, ugly 1.12

morphologically simplex roots greater than two syllables. Indeed, there seem to be some exceptions to the claim that root stress is restricted to the first two syllables of the root, both from the native vocabulary (i), and from Spanish loans (ii).

- (i) išmivíy things 38.5/52.4  
 tukumáy tomorrow 9.36  
 pišʔəmáy just then 9.37
- (ii) kumesanáadu-ʔum commissioner 21.14  
 kapitáan-im captains

- |     |    |            |               |      |    |              |                 |      |
|-----|----|------------|---------------|------|----|--------------|-----------------|------|
| (7) | a. | pə-míʔawlu | He came       | 9.1  | b. | pə-pulin-qal | ... gives birth | 43.5 |
|     |    | čəm-yáyax  | We try to ... | 9.7  |    | čəm-təwás    | We lost         | 125  |
|     |    | pəm-híwən  | They stopped  | 21.9 |    |              |                 |      |
|     |    | pəm-náyxi  | They fought   | 1.15 |    |              |                 |      |

Constraints on canonical root shape yield a set of forms which are essentially disyllabic (see fn. 2), and within this set, stress placement does not conform to any regular pattern.

To summarize, the inventory of stress patterns observed in roots is given in (8). Below, "H" and "L" denote syllables with long vowels and syllables with short vowels, respectively.

(8) Root stress inventory

HL	LH	LL	L $\acute{L}$
xəónə	təvxáa	šúʔiš	təmál

Bringing the inventory under grammatical control will therefore involve an account of the fact that long vowels are always stressed, and at the same time, an adequate analysis will need to allow lexically determined initial or peninitial stress in forms with no long vowels.<sup>3</sup>

## 2.2 Analysis

Grammatical unpredictability implies that lexical distinctions are emergent in surface forms, and that is how I plan to account for the initial and peninitial LL syllable patterns. Underlying forms may thus be specified for stress prominence, indicated with the appropriate lexical prosodic analysis. Further, a requirement on faithfulness to lexical prosody will ensure that these underlying structures are maintained in the output. From this brief sketch, it is clear that the analysis of lexical stress in Cupeño will be consistent with the general approach to inventories in OT: lexical suprasegmental distinctions are emergent properties of surface forms, licensed by high ranking faithfulness.

The constraint which will play a central role in the analysis is one which ensures that input prosodic analysis will be preserved in output structures. It may be viewed as a specific form of prosodic faithfulness in the mapping of inputs to outputs, as employed in McCarthy 1995 in an account of exceptional stress in Rotuman and Turkish. See also

<sup>3</sup>Before moving on, it is worth mentioning some linguistic evidence supporting the approach to the initial-peninitial contrast in terms of stress, and not, for example, as a tonal contrast as in well-studied pitch accent languages like Japanese. First, as demonstrated in this section, long vowel length is strongly correlated with stress. This propensity for heavy syllables to attract stress is a common pattern in 'stress languages', and yet Pike 1974 observes that in languages with contrastive tone, syllables with a high tone rarely have greater duration than syllables marked with a low tone, when the contrasted syllables occur in analogous environments. Second, low vowels reduce to schwa in certain unstressed syllables (Hill 1967), e.g. pə-yə-qál 'He was saying,' cf. yáxəm 'Say!'. While this is a robustly attested characteristic of stress-timed languages, syllables are typically the timing units for pitch accent and tone languages, and vowel reduction is rather rare in these syllable-timed languages (Pike 1945, Catford 1977).

An independent form of evidence supporting the use of the syntagmatic feature of stress is that there is no suprasegmental contrast in monosyllables. Monosyllabic content words are minimally bimoraic and consistently receive a stress (Crowhurst 1994). This is expected if stress is the distinctive feature: a stressed syllable is only strong relative to a weak one. But if a high tone was the distinctive feature, a paradigmatic contrast is predicted in monosyllabic words.

Inkelas 1994 for a first approximation of prosodic faithfulness in Containment-based OT. Related work has called upon similar prosodic faithfulness constraints in different domains: McCarthy 1995 in a nonderivational treatment of prosodic circumscription, Itô, Kitagawa, & Mester 1995 in a parallelist approach to prosodic type preservation in a Japanese argot *zuija-go*, and Kenstowicz 1994a and Buckley 1995 for cyclic stress. While I will not delve into the details of how to formulate the prosodic faithfulness constraint (but see McCarthy for discussion), I assume a correspondence theoretic formulation.

Correspondence is defined in McCarthy & Prince 1995 as a relation between the elements of two strings.

(9) Correspondence (McCarthy & Prince 1995)

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

These elements, assume they are segments, are then targetted in a set of constraints on correspondent segments. For example, one important faithfulness constraint, MAX, militates against loss of underlying segments in the mapping of inputs to related outputs.

(10) MAX: Every segment in the input has a correspondent present in the output.

The input-output prosodic faithfulness constraint employed below has a more narrow interpretation than MAX. It targets those segments contained in an input prosodic head, and asserts an output prosodic analysis in which the related segments are also heads.

(11) HEAD-MAX (McCarthy 1995)

If  $\alpha \in S_1$  is a prosodic head in a word and  $\alpha R \beta$ , then  $\beta$  is a prosodic head.

The meaning of HEAD-MAX is simply this. If a segment in the input ( $\alpha \in S_1$ ) is a prosodic head and this segment stands in correspondence with a segment (in the output), then the related segment in the output is also a prosodic head. For concreteness, I assume that the prosodic category relevant to the meaning of HEAD-MAX is the moraic head. Therefore, HEAD-MAX asserts that, for every underlying segment dominated by a stressed mora which has a correspondent in the output, the related output segment will also be dominated by a stressed mora. If it happens that a given input is not specified for prosodic structure, or an input prosodic head has no correspondent in the output, then faithfulness to input prosody is not relevant. In such a context, no HEAD-MAX violations may be incurred.<sup>4</sup>

The analysis of the unpredictable initial and peninitial patterns may now be interpreted as a form of faithfulness to prosodic analysis present in the input. For example, if a lexical form is analyzed as a trochee, e.g. *sú?iś*, then it is paired with an output which also has a trochaic analysis. Likewise, an underlying iamb will surface without a stress shift if HEAD-MAX is given sufficiently high rank.

<sup>4</sup>An important point here is that in the formulation of the prosodic HEAD-MAX, the prosodic structures themselves are not in correspondence, only the segments which comprise them. In this way, McCarthy's formulation differs from other recent proposals (Inkelas 1994, Kenstowicz 1994a, and Buckley 1995). See McCarthy 1995 for arguments defending the mediation prosodic faithfulness via the segments dominated by the head categories.

## (12) Unpredictable LL as an effect of HEAD-MAX

a.  $\acute{L}L \rightarrow \acute{L}L$       b.  $L\acute{L} \rightarrow L\acute{L}$   
 súʔiʃ      súʔiʃ      tamál      tamál

In particular, the lexical contrast will be permitted in surface forms if HEAD-MAX dominates the structural constraints on RHYTHM TYPE (from Prince & Smolensky 1993).

## (13) HEAD-MAX dominates TROCHEE

input: tòmál	HEAD-MAX	RHYTHM = TROCHEE
a. (tòmál)	*!	
b. <sup>☞</sup> (tòmál)		*

The input segment /á/ is a correspondent of the head vowel [á] in (13b), while /á/ stands in correspondence with the nonhead [a] in (13a). Only in (13b), therefore, is HEAD-MAX satisfied because only the pairing of /tòmál/ with [tòmál] faithfully parses the underlying head mora as a head in the output form. More generally, with faithfulness to lexical prosody given high rank relative to the RHYTHM TYPE constraint TROCHEE, the output form will be faithful to an underlying iambic analysis. Also, HEAD-MAX necessarily dominates the reverse RHYTHM TYPE constraint IAMB, ensuring faithfulness to underlying trochaic rhythm.

## (14) HEAD-MAX derives lexical contrast

input: súʔiʃ	HEAD-MAX	RHYTHM = IAMB
a. (suʔiʃ)	*!	
b. <sup>☞</sup> (súʔiʃ)		*

The general property of the analysis, as it has taken shape so far, is that lexical contrasts are permitted in output forms by giving the faithfulness constraint HEAD-MAX high rank relative to the structural constraints on rhythm type.<sup>5</sup>

While unpredictable stress implies that HEAD-MAX is relatively high ranked, predictable stress patterns are governed by the opposite constraint ranking, i.e., one in which HEAD-MAX is subordinate to other structural constraints deriving a regular stress pattern. The observation that long vowels attract stress will be accounted for in this way.

## (15) Heavies attract stress

a. /LH.../ → L<sup>h</sup>..., \*L<sup>h</sup>H...      b. /HL/ → <sup>h</sup>L, \*H<sup>h</sup>L  
 təvxaa-qa      təvxáə-qa      xəəəə      xəəəə

<sup>5</sup>Regarding the relative ranking of the RHYTHM TYPE constraints, there is some linguistic evidence for ranking TROCHEE above IAMB. This ranking is supported by the observation that words formed without an inherently accented morpheme surface with word initial stress. For example, /yámə-m/ surfaces as [yáməm] (see §4.1 for further exemplification). When prosodic faithfulness is not relevant, unmarked trochaic rhythm surfaces, aligned to the left edge of the prosodic word, because TROCHEE dominates IAMB.



This observation accounts for the lack of surface contrast in LH or HL roots. I follow Crowhurst 1994 in assuming that only long vowels support bimoraic structure within the syllable, and hence only CVV(C), not CV(C), syllables constitute heavy syllables in Hyman's 1985 theory of syllable weight. Now, the fact that heavy syllables are always stressed receives a straightforward interpretation if Prince's 1990 Weight-to-Stress (WSP) is ranked above prosodic faithfulness. Given this constraint ranking, *any* input containing a long vowel will be paired with an output in which a long vowel is stressed.

(16) WSP suppresses input prosody

input: tónxəə-qa	WSP	HEAD-MAX
a. (tónxəə-qa)	*!	
b. (təvxəə-qa)		*

A most interesting case is one in which the input bears stress on an initial light syllable which is directly followed by a heavy syllable. As justified in the above tableau, heavy syllable stress is predicted, as this ranking cancels out lexical prosodic analyses which do not satisfy WSP. The same result is obtained in cases with an initial heavy syllable: the input /H l/ will undergo a stress shift to the initial heavy in order to avoid a violation of WSP, exactly on a par with the above case. As a final note, WSP necessarily dominates the RHYTHMTYPE constraints mentioned above, for the presence of long vowels in a root negates any requirements on rhythmic patterning. This simply follows from the transitivity of constraint rankings already developed: WSP dominates HEAD-MAX, effectively suppressing input prosody; which in turn, dominates RHYTHMTYPE, making the distribution of long vowels the sole determinant of the position of stress in these forms.

An interesting question, which will require a brief excursion into the phonology of vowel length, is how stress will be rendered when given an input with two heavy syllables. Which constraints are decisive in determining stress placement in this case? As noted in Munro 1990, long vowel length was lost in unstressed syllables in Cupeño. This observation requires an independent account, which, when fully fleshed out, will provide a clear answer to the question at hand.

The constraints operative in sanctioning and suppressing the weight contrast are given below.

(17) WT-IDENT (McCarthy 1995)

If  $\alpha\beta$

- and  $\alpha$  is monomoraic, then  $\beta$  is monomoraic. (No lengthening.)
- and  $\alpha$  is bimoraic, then  $\beta$  is bimoraic. (No shortening.)

NOLONGVOWEL (Rosenthal 1994)

Avoid vowels dominated by more than one mora.

NOLONGVOWEL assumes that long vowels are marked cross-linguistically, and the ranking of this constraint relative to faithfulness to underlying vowel length (WT-IDENT) will either license, or suppress a length contrast. In accordance with the usual ranking logic, if WT-IDENT is high ranked, long vowels are included in the sound inventory of the language. In contrast, if the markedness constraint NOLONGVOWEL is dominant, all vowels will be short.

The observation that stressed syllables pattern differently than unstressed syllables is taken as motivation for an independent set of faithfulness constraints which specifically target the segments of the stressed syllable (McCarthy 1995, Beckman 1995, Alderete 1995).

## (18) HEAD WT-IDENT

If  $\beta$  is contained in a head and  $\alpha R\beta$ ,  
and  $\alpha$  is monomoraic, then  $\beta$  is monomoraic. (No lengthening.)  
and  $\alpha$  is bimoraic, then  $\beta$  is bimoraic. (No shortening.)

The analysis of the stressed syllable length contrast may be located in a larger framework of Positional Faithfulness (Selkirk 1995, Beckman 1995). The empirical basis for this theory is that certain privileged positions in the word, e.g. edge syllables or stressed syllables, quite often license a wider range of contrasts than the complement set of positions in the word (see also Steriade 1994 on this class of observations under the rubric of Positional Neutralization). By giving positional faithfulness high rank in the constraint hierarchy, these authors derive the non-uniform inventory patterns characteristic of many systems. Hence, by putting the above constraints together in the general schema, Positional Faith >> Markedness Constraint >> Faith, the same non-uniformity result will be obtained in Cupeño.

## (19) Positional faithfulness for vowel length

Input: təvxsə	HEAD WT-IDENT	NOLONGVOWEL	WT-IDENT
a. təvxə	*!		**
b. təvxsə		**!	
c. <del>ts</del> təvxsə		*	

The result derived here is a length contrast only in accented syllables, with short vowels surfacing in all unaccented syllables. Given an input containing two long vowels, only one vowel may surface with stress because prosodic words must have a unique head (to be elaborated on directly below). In general, the analysis yields length preservation in a single syllable because of the monoheadedness constraint and high ranking faithfulness to the stressed syllable. Also, the loss of input bimoraic vowels in unstressed positions is due to the markedness of long vowels: NOLONGVOWEL dominates WT-IDENT, and so in syllables which do not have the privileged property of being a head, only monomoraic vowels are licensed.

The up-shot is that this component of the constraint system provides a basis for answering the question regarding stress placement in forms with more than one underlying long vowel. Such forms may only surface with a single long vowel; since long vowels are tropic to stress, and there is only one stress per word, there can only be one long vowel per word. Concretely, if an input contains more than one long vowel, only one can surface because of the monoheadedness constraint and the Positional Faithfulness ranking given above, e.g. /H H/ → [L H], or /H H/ → [H L]. And so the problem of deciding which input long vowel to stress will never arise. (A full range of input-output pairings are considered in the summary of this section in justifying this claim.)

One final question that should be addressed briefly is how to rule out input-output mapping for words with heavy syllables in which both WSP and HEAD-MAX are satisfied, e.g. /L H / → [(L)(H)]. One obvious way of ruling out this result is to appeal to a Clash

Avoidance constraint (dating back to Prince 1983), yet this approach fails to generalize to roots longer than two syllables. Rather than rely on a specific requirement on the rhythmic patterning of prominent syllables, this case, and others like it, can be simply ruled out by invoking a basic structural property of prosodic layering, namely that prosodic units always have unique heads at the immediately subordinate level of analysis (e.g., prosodic words have a unique foot head, and feet only have one head syllable). The problem with an output like [(L)(f)] is evident from its analysis of both syllables as foot heads of the prosodic word. Similar cases with nonadjacent underlyingly stressed syllables and heavy syllables may be treated in an analogous fashion. To close, once the constraint deriving monoheadedness is properly defined and incorporated into the larger constraint system, this case can be ruled out rather straightforwardly.

### 2.3 Summary and Implications

Returning to the major theme of this section, recall that inventory results are derivable from the constraint hierarchy in Optimality Theory, and not from assumed restrictions on underlying representations. The root stress inventory obtained in this section is fully consistent with this approach, and in this way the analysis differs from the one offered in Crowhurst 1994 where surface accentual patterns are characterized as various instantiations of an underlying iambic foot. The analysis of lexical stress I have presented makes no assumptions regarding the character of the input, and derives the semi-predictable distribution of stress with the constraint ranking below.

#### (20) Semi-predictable root stress in Cupeño

WSP >> HEAD-MAX >> RHYTHMTYPE (TROCHEE >> IAMB)

Predictable stress in forms with long vowels follows from the constraint ranking where WSP dominates faithfulness to lexical prosody, while the ranking of HEAD-MAX above RHYTHMTYPE makes it possible for lexical distinctions to surface in outputs with no long vowels. Further, initial stress in forms with no underlying accent granted a complete ranking of the RHYTHMTYPE constraints, i.e. where TROCHEE >> IAMB, as an account of default word-initial stress. Finally, in completing the account of the interaction between stress and vowel length, the following constraint ranking was given in an analysis of the fact that vowel length is only contrastive in accented syllables.

#### (21) Positional faithfulness for length in tonic positions

HEAD WT-IDENT >> NOLONGVOWEL >> WT-IDENT

To illustrate how the root stress inventory is derived solely on the basis of these constraint rankings, let us run through an exhaustive set of input-output mappings, limiting the discussion to disyllabic roots. The first subset involves roots with uneven quantity. In the cases shown below, regardless of underlying prosodic analysis, the system correctly predicts long vowel stress because of the dominant role of WSP in the analysis.

#### (22) Inputs yielding f̂L

Input	→	Output	WSP	HEAD-MAX
a. /HL/	→	f̂L	Okay	Irrelevant
b. /f̂L/	→	f̂L	Okay	Okay
c. /HĬ/	→	f̂L	Okay	Irrelevant violation

When no underlying syllable is stressed, prosodic faithfulness is irrelevant, and WSP yields long vowel stress (22a). Moreover, because WSP dominates HEAD-MAX, any prosodic analysis of an underlying /H L/ will converge on the output [f̄ L], whether this will lead to a violation of prosodic faithfulness (22c), or not (22b).

Two additional inputs yield the same accentual pattern, both of which contain two underlying heavy syllables. The first has no underlying prosody, but receives default initial stress (23a). This has the consequence of preserving length on the initial syllable, but not on the second syllable because of the Positional Faithfulness ranking given above. The second input-output pairing differs from the previous one only in bearing underlying stress on the initial heavy syllable (23b). This receives trochaic stress as a means of satisfying HEAD-MAX, and also leads to reduction of the second unstressed syllable.

## (23) Additional inputs yielding f̄ L

Input	→	Output	WSP	HEAD-MAX
a. /HH/	→	f̄ L	Okay	Irrelevant
b. /f̄H/	→	f̄ L	Okay	Okay

The three inputs in (24) are paired with an output [L f̄] by the same constraint ranking. If prosodic faithfulness is not relevant, WSP prevails in effecting a peninitial stress pattern (24a). Further, when prosodic faithfulness is relevant, the high ranking WSP ensures that the inputs in (24b) and (24c), representing both possible stressings for a LH root, are mapped to outputs in which stress falls on a heavy syllable.

## (24) Inputs yielding L f̄

Input	→	Output	WSP	HEAD-MAX
a. /LH/	→	L f̄	Okay	Irrelevant
b. /L f̄/	→	L f̄	Okay	Okay
c. /L̄H/	→	L f̄	Okay	Irrelevant violation

Lastly, a root with two underlying heavy syllables and stress on the peninitial syllable will surface as [L f̄] as a means of obeying HEAD-MAX and the markedness constraint against long vowels (NOLONGVOWEL).

## (25) Additional input yielding L f̄

Input	→	Output	WSP	HEAD-MAX
/H f̄/	→	L f̄	Okay	Okay

This concludes the discussion of the set of input-output pairings which characterize the predictable component of the stress inventory. In most of these cases, WSP played an important role in restricting the set of potential output structures, and the prosodic faithfulness constraint, HEAD-MAX, had a more limited role in carving up the inventory. Next, we consider cases with no underlying vowel length, which are cases where HEAD-MAX will be responsible for yielding a lexical contrast. The stress contrast is derived by the ranking of HEAD-MAX above the RHYTHMTYPE constraints: (i) because prosodic faithfulness dominates the iambic requirement, underlying trochees surface as trochees (26a), and (ii) because prosodic faithfulness is ranked above the trochaic requirement, inputs with iambic rhythm will also surface unchanged in output forms (26b).

## (26) Emergent lexical stress

Input	→	Output	HEAD-MAX	RHYTHMTYPE
a. / <u>l</u> l/	→	l <u>l</u>	Okay	Violation of IAMB
b. /L <u>l</u> /	→	L <u>l</u>	Okay	Violation of TROCHEE

The lexical contrast is thus derived by high ranking faithfulness, relative to the markedness constraints on rhythm type.

Finally, when prosodic faithfulness is not relevant in the LL roots, default trochaic stress emerges because TROCHEE dominates IAMB in the family of RHYTHMTYPE constraints.

## (27) Default initial stress

Input	→	Output	TROCHEE	IAMB
/LL/	→	lL	Okay	Irrelevant violation

In summary, the system of constraints as proposed above is sufficient to derive the root stress inventory of Cupeño without any language particular constraints on the input. Only and all the observed surface patterns are predicted to emerge with the system of constraints as they are ranked above.

Considered more generally however, the analysis provides a framework for approaching both lexical stress systems and systems where the distribution of stress is more systematic. Predictable stress is derived from a constraint ranking in which HEAD-MAX is dominated by the set of constraints responsible for deriving a regular stress pattern, generally referred to here as 'Stress'. Conversely, lexical stress is accounted for with the opposite ranking, allowing the unconstrained underlying metrical structures to emerge in output forms.

- (28) a. Stress >> HEAD-MAX: Predictable Stress  
 b. HEAD-MAX >> Stress: Lexical Stress

In a language with predictable stress, underlying forms may be endowed with prosodic specifications, yet the stress restricting constraints will ensure that only certain prosodic structures may surface. Lexical stress systems are characterized by greater emergence of input prosody, licensed by high ranking HEAD-MAX. In sum, both systems may have inputs specified for prosodic analysis, and the (non)systematic surface patterns result from language particular constraint rankings. Furthermore, in both types of languages, no language particular restrictions are made on the input, and so, consistent with one of the main results of OT, both types of languages share the same, potentially infinite, set of input structures.

The analysis of root stress in Cupeño presented in this section has been shown to be consistent with the optimality theoretic treatment of phonemic contrast and inventories in general. This was achieved by permitting lexical forms to bear prosodic specifications, and defining an adequate notion of faithfulness to this underlying structure. What remains to be shown, however, is that the representational approach, employing prosodic faithfulness, is the *correct* account of exceptional stress. For example, it is possible to derive the root stress contrast, without a notion of prosodic faithfulness, in a framework which postulates a core-periphery structure to the lexicon (as defined in Itó and Mester 1995) by allowing

constraint rerankings of the RHYTHMTYPE constraints. To be more concrete, suppose there was a section of the Cupeño root list in which the iambic requirement dominates the trochaic requirement, and further, that there was an independent component in which TROCHEE is dominant. Both the constraint reranking approach, and the representational faithfulness-based approach developed above derive surface contrast without stipulating restrictions on underlying forms. On what basis, therefore, can one choose between these two different approaches to lexical stress? The subsequent section develops argumentation supporting the faithfulness-based representational approach.

### 3. Dominant root stress

The discussion so far has focused mainly on the accentual patterns observed in bare roots, but the lexical stress system of Cupeño is more complicated than this. The observations presented below extend the empirical scope of the investigation in two ways: (i) by establishing the distinction between accented and unaccented roots, and (ii) by discussing the behavior of accented roots when they combine with inherently stressed prefixes and suffixes. After the main observations to be discussed are presented (§3.1), a recent development involving the segregation of root and affix faithfulness is applied to the prosodic faithfulness constraint employed above, which will provide a clear line of analysis for dominant root accent (§3.2). Some alternatives to the analysis are then developed, and justification for choosing the faithfulness-based approach is given (§3.3).

#### 3.1 *Data and Observations*

Root stress is dominant to affix stress (Hill & Hill 1968). This is shown by the behavior of accented affixes when they combine with different classes of roots. Prefixal accent surfaces on subject person prefixes with unaccented verbs (29a), and suffixal accent surfaces when inherently stressed suffixes (-qál 'past durative', -qá 'present singular' or -í 'object marker') combine with an unaccented root (29b).

## (29) Affix stress with unaccented root

## .1 Unaccented root yax 'to say'

a.	nó-yax	I said JH	b.	nə?ep ne-ya-qál	I was saying JH
	pó-yax	He says 1.15		nə?ən ya-qá?	I say JH
	čém-yax	We say 21.6		pə-ya-qál	He was saying 1.9
	pám-yax-wən	They said 42.28		mi-ya-qá?	He tells them 38.49
	pó-yax-?ə	What he says JH		yəx-qəl-í	While...was saying HH 236
	nó-yax-pi	(We) to say JH		?ə-ya-qal-í	...what you said JH
				čəm-yax-wən-í	...what we said JH

.2 Unaccented root kuš 'take'<sup>6</sup>

a.	nú-kuš	I took JH	b.	nə?nə kuš-qá?	I am taking JH
	?ú-kuš	You took JH		nə-kuš-qál	I was taking JH
	pú-kuš	He, she, it took JH		?ə-kuš-qal-í	...you were taking (obj.) JH
	pi-pú-kuš	He...took it JH		pum-kuš-qal-í	...them picking it up (obj.) JH
	čúm-kuš	We took JH			
	púm-kuš	They took JH			
	man nú-kušə-pi	Let me get it JH			
	man čúm-kušə-pi	Let us get it JH			
	man púm-kušə-pi	Let them get it JH			

## .3 Unaccented root max 'to give'

a.	nó-max-?ə	(I) to give ... JH	b.	max-qá?	... giving ... JH
	čə?max-?ə	(We) to give ... JH		?i-nə-max-qál	I was giving you JH
	mi-pó?-max-wən	They were giving ... JH		čim-pə-max-qál	He was giving us JH
	mi-nó-max-en-pi	(I) to give them ... JH			
	?i-pó?-max	They gave you ... JH			

## .4 Unaccented root wən 'to put'

a.	nó-wən	I put JH	b.	nə-wən-qál	I was putting JH
	pi-pó-wən	He put it JH		wən-qá?	... put (it) ... JH
	čém-wən	We put JH			
	nó-wənə-pi	(I) to put it in JH			
	čém-wənə-pi	(We) to put it in JH			

Affix stress only surfaces, however, in forms with unaccented roots. Stress on prefixes and suffixes, as exhibited in the above forms, is suppressed when these affixes combine with an inherently stressed root. In the examples below, root stress overrides prefixal stress (30a) and suffixal stress (30b).

<sup>6</sup>The observed raising and backing of the prefixal vowels in (29.2a) is due to a consistent pattern whereby stressed vowels assimilate to a following high back vowel (Hill & Nolasquez 1973).

## (30) Root stress overrides affix stress

a.	pə-ŋjy-pi	He would go away 1.15	b.	píq-pə-qal	... touched him 43.31
	pə-ŋsya-yax	It shakes 1.17		mi-k <sup>w</sup> áw-pə-qal	He was calling them 44.1
	pə-míʔaw-lu	He came 9.1		nánva-ya-qa	... is done 44.9
	čəm-náačin	We passed on 21.9		ʔáyu-qa	... wants 23.31
	pəm-ŋjy-wən	They went out 29.2			
	pəm-čáŋnu	They got angry 1.15			
	pəm-číʔ-íʔu-wən	They went gathering 29.1			
	mi-pəm-čix-in-wən	They killed them 9.3			

Root stress dominance is further exemplified in the following set of forms in which an accented root combines with both an inherently stressed prefix and one of the accented suffixes.

## (31) Root stress overrides affix stress

pə-ʔáyu-qal	He was wanting 1.14
pə-túl-qa	He finished 42.22
pə-háw-pə-qal	He sang 42.22
pə-pulín-qal	She gave birth 43.5
nə-ŋjy-qal-i-pə	When I go away 1.16

To summarize the above facts, dominant root stress is quite general in Cupeño phonology, as shown in the following schematic diagrams for the above data.

## (32) Dominant root stress

a.	/áf-řt ... /	→ [af-řt ... ]	(30a)
	pś-ŋjy-pi	→ pə-ŋjy-pi	
b.	/řt-áf/	→ [řt-af]	(30b)
	/ʔáyu-qá/	→ ʔáyu-qa	
c.	/áf-řt-áf/	→ [af-řt-af]	(31)
	/pś-túl-qá/	→ pə-túl-qa	

Any analysis of the accentual system of Cupeño will therefore have to reckon with this robust linguistic observation.

## 3.2 Analysis

Before turning to the analysis of dominant root stress, I will first provide the necessary theoretical background for understanding the hypothesis developed below. In establishing this background, it will be helpful to distinguish between two classes of constraints: (i) constraints on faithfulness of input-to-output, and (ii) constraints on phonological markedness. The latter type of constraints bans marked structural configurations, for example, syllable-final obstruents or unfooted syllables in word-medial contexts. The faithfulness constraints, generally speaking, encourage input-output pairings in which no segments are deleted, inserted, or changed in any way. Because of this, faithfulness can be



seen as supporting lexical contrast, as distinctions present in underlying forms will surface in the output if faithfulness is not to be violated. Within this view, inventory patterns are solely derived by the interaction between faithfulness and markedness constraints (see especially P & S 1993 §9).

Based on what appears to be a fundamental asymmetry in root versus affix inventories, recent work has proposed a bifurcation of faithfulness such that distinct morphological domains are targeted in the application of these constraints (McCarthy & Prince 1994, 1995, Selkirk 1995, and Urbanczyk 1995). The basic observation, as it has been established so far, is that affixes may exhibit a reduced structural inventory, relative to the root inventory, and furthermore, that the reverse case is not attested. For example, root vowels are distinctive for front/backness in Turkish, but the same is not true of the affix vowels. McCarthy & Prince 1995 note a second asymmetry in the set of syllable patterns observed in Sanskrit: roots may contain onset clusters, while affixes tend not to. To account for this basic asymmetry, McCarthy & Prince segregate root and affix faithfulness, and give root faithfulness top rank in the following universal constraint ranking.

(33) Meta-constraint on constraint ranking (McCarthy & Prince 1995)

Root Faith >> Affix Faith

With Root Faith ranked higher than Affix Faith, the general claim is that affixes will never be more marked than roots. This meta-constraint ranking of course has consequences for the theory of the inventory: lexical contrasts present in affixes will always be observed in roots as well. If root faithfulness dominates affix faithfulness universally, the absence of contrast in roots, achieved through ranking a given markedness constraint above Root Faith, entails the same result in affixes.

All the components necessary to the analysis of dominant root stress are now in place. Recall from section §2.2 that general properties of the Prosodic Hierarchy and the layering of prosodic categories dictate that prosodic words will have a unique foot head. This is the account of the fact that there is only one accent per word in Cupeño, distinguishing primary stress (accent) from secondary stress. With this structural constraint operative in the grammar, dominant root stress may now be viewed as the result of a universal ranking promoting root faithfulness, as motivated directly above. Like all the faithfulness constraints, faithfulness to lexical prosody is segregating along morphological dimensions, and HEAD-MAX defined for roots dominates the analogous requirement targeting material in an affix.

(34) HEAD-MAX<sub>Root</sub>  
If  $\alpha \in S_1$  is a prosodic head,  $\alpha$  is in root, and  $\alpha R \beta$ , then  $\beta$  is a prosodic head.

HEAD-MAX<sub>Affix</sub>  
If  $\alpha \in S_1$  is a prosodic head,  $\alpha$  is in affix, and  $\alpha R \beta$ , then  $\beta$  is a prosodic head.

Recessive affix stress may now be interpreted simply as an effect of the espoused meta-constraint ranking: root stress is dominant because HEAD-MAX<sub>Root</sub> dominates HEAD-MAX<sub>Affix</sub>. Let's see how this result is achieved with an input containing both a stressed root (rt) and a stressed suffix (-áf).

(35) Recessive suffixal stress: /ʔt-áf/ → [ʔt-af]

input: ʔáyu-qá	HEAD-MAX <sub>Root</sub>	HEAD-MAX <sub>Affix</sub>
a. ʔayu-qá	*!	
b. ʔáyu-qa		*

In (35a), HEAD-MAX<sub>Root</sub> is violated because the input root segment /á/ stands in correspondence with the output root vowel [a], but it is not violated in (35b) where the underlying stressed root vowel finds its correspondent in a stressed vowel in the output. Conversely, HEAD-MAX<sub>Affix</sub> is only violated by (35b), where underlying affix /áf/ is in correspondence with [a]. Root stress is dominant in this example, therefore, because failure to preserve the root stress in the output incurs a fatal violation of the dominant HEAD-MAX<sub>Root</sub>. Likewise, recessive prefixal stress is derived via the same (universal) constraint ranking.

(36) Recessive prefixal stress: /áf-ʔt/ → [af-ʔt]

input: pś-ŋiy-pi	HEAD-MAX <sub>Root</sub>	HEAD-MAX <sub>Affix</sub>
a. pś-ŋiy-pi	*!	
b. pə-ŋiy-pi		*

Opting to stress the underlyingly stressed prefix instead of allowing underlying root stress to surface is also non-optimal. Moreover, root stress will override affix stress in forms with both a stressed prefix and a stress suffix, e.g. /áf-ʔt-áf/ → [af-ʔt-af], for exactly the same reason: faithfulness to stress in roots is ranked above faithfulness to stress in affixes. Finally, when a stressed affix combines with an unaccented root, affix stress will emerge. This is because in such a context, HEAD-MAX<sub>Root</sub> is not in conflict with HEAD-MAX<sub>Affix</sub>. Thus an underlying /áf-rt/ surfaces as [áf-rt], and not [af-rt], as a means of satisfying faithfulness to lexical prosody in the affixal domain.

Before exploring alternatives to the faithfulness-based approach to dominant root stress, let us take a moment to consider how the analysis just presented fits into the theory of the inventory in OT. One direct connection is that dominant root stress can be shown to be related to the cross-linguistic observation that roots are more marked relative to affixes. If it's true that affixes are unmarked relative to roots with respect to cluster avoidance and unmarked feature occurrences, then we can make sense of dominant root stress in Cupeño as an instance of a universal tendency for affixal unmarkedness relative to roots. Furthermore, the approach segregating root and affix faithfulness can be seen as part of a rather restrictive theory of lexical stress systems. The rationale here is based in the claim central to Optimality Theory, namely that language particular grammars are constructed by permuting the relative rankings of faithfulness and markedness constraints. Hence, a given markedness constraint may dominate the HEAD-MAX family altogether (37a), suppressing a stress contrast in both the root and affixal domain. Or the markedness constraint may assume intermediate rank between the HEAD-MAX constraints (37b), licensing the stress contrast in roots, but not in affixes. Finally, the markedness constraint may be bottom-ranked (37c), permitting lexical distinctions in any position in the morphological word.

- (37) a. Markedness Constraint >> HEAD-MAX<sub>Root</sub> >> HEAD-MAX<sub>Affix</sub>  
 b. HEAD-MAX<sub>Root</sub> >> Markedness Constraint >> HEAD-MAX<sub>Affix</sub>  
 c. HEAD-MAX<sub>Root</sub> >> HEAD-MAX<sub>Affix</sub> >> Markedness Constraint

To flesh this out in the context of a particular example, let us examine a scenario in which WSP is the markedness constraint, and consider the consequences for its ranking relative to the two distinct faithfulness constraints. Thus, as in the case of root stress in Cupeño, WSP can have the effect of neutralizing a stress contrast in disyllabic roots with long vowels: with WSP dominant, underlying forms such as /L H/ will uniformly surface as L H, effectively ruling out an initial—peninitial stress contrast. The situation in Cupeño is characterized in the schematic ranking in (37a); WSP is dominant over prosodic faithfulness generally, and so stress is not contrastive in roots or affixes with uneven quantity. A different state of affairs obtains when WSP assumes intermediate rank between the two prosodic faithfulness constraints, as in (37b). In this case, stress can be contrastive in roots with long vowels, but not in an analogous set of affixes. Lastly, if WSP is lower ranked than both HEAD-MAX<sub>Root</sub> and HEAD-MAX<sub>Affix</sub>, then the stress contrast may surface anywhere in the morphological word.

The important point here is that the factorial ranking of these constraints fleshed out above will never yield a stress contrast only in affixal domains: if a stress is contrastive in affixes, it is contrastive in roots. No ranking of the markedness constraint with respect to the universally ranking of the HEAD-MAX constraints will yield this result. In this way, the faithfulness-based approach which bifurcates prosodic faithfulness along morphological dimensions can be distinguished from the alternatives to be discussed in the next subsection.

### 3.3 Alternatives

I will now consider two proposals as alternatives to the faithfulness-based analysis developed above, first considering an analysis which describes lexical stress as effect of constraint reranking, and then an alternative account which describes idiosyncratic stress as a set of output constraints requiring a special stressing of individual morphemes. Both accounts have their failings, which will be apparent in the discussion of the particular proposals.

As mentioned above at the end section §2.3, a different approach to the observed stress contrast might be achieved by permitting rerankings of the RHYTHM<sub>TYPE</sub> constraints (see e.g. Pater 1994). Suppose that for one class of roots, TROCHEE dominates IAMB, yielding a trochaic analysis for these forms, while for another set of roots the reverse ranking holds. The surface initial-peninitial stress contrast would thus be achieved through this restricted operation of constraint reranking. The constraint reranking approach would therefore yield the right results in forms with accented roots, but the root-affix interaction proves more difficult for this approach. How will the fundamental distinction between accented and unaccented roots be achieved? Clearly, alignment-based approaches (à la McCarthy & Prince 1993b) to yielding stress on the inherently stressed affixes will not be sufficient. Alignment of the edges of prosodic and morphological categories will achieve results effecting a left/right edge bias. But the observation fundamental to Cupeño accent is not for a left/right bias; rather, the system exhibits a bias for root stress.

One potential means of deriving the root stress bias, without invoking any notion of faithfulness to lexical prosody, is to encode the root bias in the markedness constraints. Suppose, for example, that stressing material in an affix was marked in the sense that doing so would incur violations of the constraint \*AFFIXSTRESS. Suppose further that \*AFFIXSTRESS dominates the analogous markedness constraint for roots, \*ROOTSTRESS. Dominant root stress is then the result of a root-affix asymmetry encoded directly in the markedness constraints.

## (38) Recessive affix stress

input: áf, ft	*AFFIXSTRESS	*ROOTSTRESS
a. áf, rt	*!	
b. af, ft		*

While this approach, when coupled with the assumptions necessary in the constraint reranking analysis of distinctive stress, will derive the right results for Cupeño, it is flawed on two counts. First, dividing the markedness constraints with respect to morphological environment causes serious problems for constructing factorial typologies. This is because the total number of markedness constraints employed in all versions of OT greatly outnumber the total number of faithfulness constraints. Given a choice between doubling one class of constraints over the other, it is clearly preferable to divide up the faithfulness constraints because of the greater computational efficiency this would lead to when permuting constraint rankings for the purpose of constructing language particular grammars.

A second point is that this approach to dominant root stress in Cupeño will not provide the necessary materials for constructing a restrictive theory of lexical stress, as shown above for the faithfulness-based approach. By separating HEAD-MAX into two position sensitive constraints, it was possible to derive the entailment of a root stress contrast if the same contrast is observed in affixes. In choosing to divide up the markedness constraints, this entailment relation no longer holds. The ranking of other kinds of markedness constraints relative to the \*AFFIXSTRESS and \*ROOTSTRESS will not have the desired effect. This is because it is constraint interaction among markedness and faithfulness constraints which yields phonemic contrast in this framework; therefore some notion of prosodic faithfulness is necessary in deriving the entailed root stress contrast. To conclude, while the constraint reranking approach to Cupeño lexical stress can be augmented to account for dominant root stress with an enrichment in the set of markedness constraints, this leads to complications in calculating language particular grammars and a loss of restrictiveness in the theory of lexical stress.

A second alternative to the representational approach is to locate the stress idiosyncrasies in the output constraints themselves. Thus, along the lines of Hammond 1995, suppose that instead of specifying underlying prosodic structure, one was to stipulate output constraints which set a specific prosodic analysis as the target representation for individual morphemes. For example, instead of specifying -qál as the underlying structure of the past tense durative suffix, an output constraint may assert stress on the durative marker. Further, every accented root morpheme will have a morpheme specific constraint characterizing its accentual properties. To summarize this approach, the morpheme specific constraint approach avoids positing underlying prosodic structure by encoding the nonsystematic elements of the stress system in rankable output constraints. While this distinction may seem rather artificial—both accounts stipulate idiosyncratic stress somewhere in the grammar—the distinction is actually clear enough to differentiate it from the faithfulness-based representational analysis.

To begin, morpheme specific constraints, excluding their limited use when targeting specific paradigms, undermine one of the central claims of Optimality Theory, namely that cross-linguistic variation arises from factorial rankings of universal well-formedness constraints. While it may be possible to show that certain morpheme specific constraints are ranked with respect to each other in a given language, morpheme specific constraints

are clearly not universal constraints, and therefore, permuting the ranking of said constraints will have no implications for other languages. Thus, on theory-internal grounds, the morpheme specific constraint approach may be rejected because it confounds the project of creating factorial typologies.

A second problem with this approach is that it fails to insightfully characterize dominant root stress. The reason for this is because the bias towards stressing a root will result from ranking exactly all the constraints asserting root stress above the set of constraints requiring affix stress. For example, in order to derive root stress in the embedded sentence *piq-pə-qał*, the morpheme specific constraint yielding stress on *piq* must outrank the analogous constraint for *-qał*.

(39) Dominant root stress, derived for two morphemes

input: <i>piq-pə-qał</i>	STRESS <i>piq</i>	STRESS <i>-qał</i>
a. <i>piq-pə-qał</i>	*!	
b. <i>piq-pə-qał</i>		*

Extending this approach in order to obtain the same result for all accented roots and affixes will lead to loss of generalization: the observation that root stress overrides affix stress is stated as many times as the number of accented roots there are in the Cupeño lexicon, multiplied by the number of accented affixes. Compared with the faithfulness-based approach, which ascribes accentual prominence to underlying representations, it is clear which approach fares better concerning the simplicity of the grammar. To summarize the two problems presented above, an account of dominant root stress in terms of morpheme specific constraints confounds the project of creating factorial typologies and leads to serious loss of generalization.

#### 4. Unbounded Stress in an Accent System

The above argument was developed in the context of a study of the interaction between underlying root and affix stress. A different kind of argument may be constructed in favor of the prosodic faithfulness approach in cases where underlyingly forms do not have a root accent. In such cases, an unbounded stress pattern is observed, which is the topic of this section.

There are several analyses unbounded stress systems in constraint-based phonology (Prince & Smolensky 1993, Kenstowicz 1994a, Walker 1995, Hewitt & Crowhurst 1995), but none of these have provided a sufficiently rich theoretical framework for describing unbounded stress in accent systems (as successfully accomplished, for example, in Halle and Vergnaud 1987). This section will begin by presenting a set of examples that have justified describing affix stress as a default to opposite edge accent system (§4.1), and subsequently it will be shown how prosodic faithfulness may be employed in extending the theory of unbounded stress to account for this pattern in an accent system (§4.2).

##### 4.1 Data and Observations

Recall from above discussion that unaccented roots are characterized by the fact that when they combine with inherently accented affixes, stress falls on an affix. Thus, *yax* is an unaccented root because conjugated forms receive stress on a prefix, as shown by the examples below.

- (40) /áf-rt/ → áf-rt  
 /nə-yax/ → nə-yax I say  
 /pə-yax/ → pə-yax S/he, it says

Further, Hill & Hill (1968: 236) observe that in forms containing more than one inherently stressed affix only the rightmost affix surfaces with stress. Hence, when yax combines with both a stressed prefix and a stressed suffix, the suffix surfaces with stress.

- (41) /áf-rt-áf/ → af-rt-áf  
 /pə-ya-qál/ → pə-ya-qál He was saying  
 /nə-ya-qál/ → nə-ya-qál I was saying

Additional examples supporting the rightmost affix stress observation are given below. These examples show how a stressed suffix like -í or -qál wins out over a person prefix for stress (42a), and also, how the competition is resolved between two inherently stressed suffixes (42b).

(42) Rightmost affix stress wins

.1 Unaccented root yax

- a. nə-ya-qál I said to myself 51.4  
 pə-ya-qál he was saying 1.9  
 čəm-yax-wən-í ...what we said JH
- b. yax-qəl-í while...was saying HH 236  
 ?ə-ya-qal-í ...what you said JH

.2 Unaccented root kuš

- a. pə-kuš-í he picked it up 62.30  
 nə-kuš-qál I was taking JH
- b. ?ə-kuš-qəl-í while...taking JH  
 pum-kuš-qal-í them picking it up JH

.3 Unaccented root max

- a. čimi-pə-max-qál she gave us ... 53.71  
 ?i-nə-max-qál I was giving you JH  
 čim-pə-max-qál He was giving us JH

The final observation, again from Hill & Hill (p. 236), is that in the absence of any inherently stressed morphemes, stress falls on the word-initial syllable.

## (43) Default to initial

- |    |  |   |
|----|--|---|
| .1 | yáxəm<br>čəmčəmə yáxwə<br>nəʔqʷən yáʔa | (You pl.) say! JH<br>We say JH<br>I can say JH                            |
| .2 | kúšəm<br>kúšu<br>kúšat                 | Take it! (pl) JH<br>Take it! (sing)<br>female initiate from outside C 186 |
| .3 | máxəm<br>máxan<br>máxaʔəš              | Give! (pl) C 186<br>Give it to me JH<br>Give it to us JH                  |
| .4 | wónəm<br>wóna                          | Put it in (Pl subj) JH<br>Put it in (sing?) JH                            |

It is this set of observations which leads to Crowhurst's (1994: 188) comparison with unbounded, default to opposite stress systems like Eastern Cheremis (Sebeok & Ingemann 1961) and Komi Jazva (Kiparski 1973). The presence of an inherently stress morpheme may compel non-initial stress, but in the absence of such morphemes, stress falls on the initial syllable. Compare this element of the stress system with that of Eastern Cheremis, in which a rightmost heavy syllable is stressed, and in the absence of heavies, the initial syllable is stressed.

As the complete analysis of default to opposite would lead us too far from the main issues at hand, the full pattern will not be described below (but see Crowhurst 1995 for a clear line of analysis of the opposite edge effects). Rather, the focus of the ensuing discussion is on how prosodic faithfulness constitutes a theory of associating accented morphemes with intrinsic prominence, rather on a par with how heavy syllables attract a stress prominence in other unbounded stress systems.

#### 4.2 Analysis

In order to provide the necessary background for understanding how prosodic faithfulness fits into the analysis presented below, let us review briefly how unbounded stress systems have been treated in the OT literature. The first component of the analysis involves associating stress with intrinsically prominent syllables, e.g., syllables containing long vowels. As a direct account of this basic fact in unbounded stress systems, Prince & Smolensky 1993 posit Peak-Prominence (PK-PROM), which establishes a bias for stressing syllables of greater intrinsic prominence relative to the rest of the syllables of a word, e.g. heavy syllables compared to light syllables, or syllables with low vowels compared to ones with high vowels. To draw on an illustrative example, a system with heavy syllables and a rightward orientation for stress requires a ranking in which PK-PROM dominates EDGEMOST(Pk, R). This yields stress on a rightmost heavy syllable, as shown in the tableau below (drawn from P&S §4).

## (44) Right-oriented prominence system, with heavy syllables

input: L H H L	PK-PROM	EDGEMOST(Pk, R)
a. L H H <b>́</b> L	<b>́</b> !	
b. <b>☞</b> L H <b>́</b> L	<b>́</b>	$\sigma$
c. L <b>́</b> H H L	<b>́</b>	$\sigma\sigma!$
d. <b>́</b> H H L	<b>́</b> !	$\sigma\sigma\sigma$

The essential point here is that with PK-PROM dominant, the regular pattern of rightmost stress may be suppressed to promote a heavy syllable as the stress peak. Hence, rather than stressing the final rightmost light syllable (44a), the penultimate heavy syllable is stressed (44b). This is the account of default-to-same unbounded stress, as the rightmost heavy syllable is stressed here, and in the absence of a quantitative contrast across the word, stress will default to the final syllable.

The same constraint ranking may be employed in the analysis of Cupeño accent, except HEAD-MAX is the constraint which effectively negates the regular pattern of rightmost stress. Affix stress is rightward-oriented, as shown by forms like *pə-yəx-qál*, yet inherently stressed prefixes surface with stress, e.g., *pó-yax*. If input-output prosodic faithfulness dominates EDGEMOST(Pk, R), an input with only one inherently stressed morpheme, e.g. a person prefix, may surface with nonfinal stress.

## (45) Emergent prefixal stress (exemplification given in 29a)

input: <b>́</b> af-rt-af	HEAD-MAX <sub>Affix</sub>	EDGEMOST(Pk, R)
a. af-rt- <b>́</b> af	*!	
b. <b>☞</b> <b>́</b> af-rt-af		rt-af

Failing to stress the inherently stressed prefix is fatal in the first case, rendering the second output the optimal one, despite its poor rightward alignment. EDGEMOST(Pk, R) will play a role in determining affixal stress patterns, however, which is apparent from considering forms with more than one inherently stressed affix. In such a context, HEAD-MAX will not be decisive, as both accentual patterns result in failure to accent an underlyingly stress affix, and hence, satisfaction of EDGEMOST(Pk, R) becomes important. Given a choice between stressing the prefix or the suffix in this schematic example, the latter is chosen because it fares best with respect to the rightward orientation constraint.

## (46) Rightmost affix stress (exemplification given in 42)

input: <b>́</b> af-rt- <b>́</b> af	HEAD-MAX <sub>Affix</sub>	EDGEMOST(Pk, R)
a. <b>́</b> af-rt-af	*	rt-af!
b. <b>☞</b> af-rt- <b>́</b> af	*	

This ranking will also have the consequence of promoting a rightmost stressed suffix in prominence. For example, /rt-**́**af-**́**af/ will be paired with [rt-af-**́**af] because it best aligns the syllable peak with the right edge of the prosodic word. To foreground the main theme here before moving on, the role of prosodic faithfulness in deriving unbounded stress in Cupeño is an important one, analogous to other researcher's use of WSP or PK-PROM in systems with stress-weight tropism: it establishes an intrinsic prominence for underlying



accent necessary in the suppression of the edge orientation constraints. Thus, in addition to providing a basis for describing lexical stress contrasts and dominant root stress, faithfulness to underlying prosody proves most useful in the context of unbounded stress in accent systems.

Let's consider how this kind of observation would be accounted for without prosodic faithfulness, as a way of contrasting the approach taken here with the two alternatives given in section 3. How will prefixal stress in *pé-yax* be derived via constraint reranking in the same system assigning final stress to *pə-ya-qál*? Presumably the constraint reranking approach could posit various levels of morphological analysis, which would in turn provide the means for reranking the relevant alignment constraints. Yet the multi-stratal framework necessary for developing this analysis is both controversial in theoretical arenas (Benua 1995, McCarthy 1995, cf. Kenstowicz 1994a), and as yet unmotivated for Cupeño. Since more than one morphological levels are not needed in the prosodic faithfulness analysis, this may be taken as evidence in its favor.

In considering how rightmost stress would be accomplished with morpheme specific constraints, an argument can be formulated against this treatment which is in a similar vein to the one given at the closure of section 3. If rightmost affix stress is to be accounted for in the morpheme specific constraint approach, the stress-asserting constraints will necessarily reproduce the sequence of morphemes (in an inverted order of course) in the constraint hierarchy. The fact that the object marker *-í*, for example, is stressed over the durative suffix *-qál* in a form like *yəx-qəl-í*, shows that STRESS *-i* dominates STRESS *-qal* within this framework. But it is clearly possible, and desirable, to derive this fact from the sequencing of these morphemes. One of the advantages, therefore, of the prosodic faithfulness approach is that, by employing a notion of faithfulness to underlying prosody, the rightward orientation of affix stress may be shown to follow simply from the independently motivated ordering of morphemes.<sup>7</sup>

## 5. Conclusion

This paper has developed a complete analysis of diverse aspects of the accent system of Cupeño. At every stage in the analysis, the notion of faithfulness to underlying prosody was employed successfully—but more importantly, it was shown that attempting to do without prosodic faithfulness leads either to descriptive failures or loss of generalization.

The initial motivation for introducing prosodic faithfulness was as an account of the restricted set of stress contrasts among roots. By ranking the prosodic faithfulness constraint, HEAD-MAX, relative to the RHYTHMTYPE constraints and WSP, the semi-predictable patterns of lexical stress were derived purely on the basis of a language particular constraint system. That is, the restrictions on the root stress inventory were the result of ranking the markedness constraint WSP above prosodic faithfulness. Further, faithfulness to lexical prosodic structure provided a framework for describing Cupeño lexical stress in a way which is consistent with the one of the central results of Optimality Theory, namely that there are no language particular restrictions on the input.

<sup>7</sup>One might ask in why the morpheme specific constraint approach cannot negotiate stress in sequences of affixes by employing edge alignment constraints on a par with standard treatments of this problem. This strategy is only viable if the various affix specific constraints are unranked with respect to each other, violating an important OT maxim that the constraint hierarchy is a total ordering of constraints (see P&S 1993 and McCarthy 1996 for justification of this assumption).

The necessity for prosodic faithfulness was further justified in the analysis of a fundamental observation in Cupeño accent, namely that root stress overrides accent stress. This observation received a very general account in the faithfulness-based approach: by segregating prosodic faithfulness along root and affix domains, the analysis of dominant root stress was interpreted on a par with a cross-linguistic tendency for the root inventory to be more marked relative to affixes. It was also shown that this explanation was not available to alternative accounts of idiosyncratic stress, as the implementational decisions necessary to account for this observation led either to serious loss of generalization or formal problems in computing factorial typologies. That these problems did not arise in the representational faithfulness-based approach showed that prosodic faithfulness was indeed necessary in the explanation of dominant root stress.

Lastly, faithfulness to lexical prosody was called for in the analysis of unbounded stress in Cupeño, effectively enlarging the range of the theory of unbounded stress to encompass accent systems.

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