Root-Controlled Fusion in Zoque: Root-Faith and Neutralization Avoidance*

Shigeto Kawahara
University of Massachusetts, Amherst
kawahara@linguist.umass.edu

(Draft version, April 2003)

Abstract

A growing body of work in Optimality Theory reveals the privileged status of roots compared to affixes in natural languages. This has lead to the postulation of distinct faithfulness constraints for roots and affixes, and most researchers agree that the ranking $\text{F}{\scriptsize\text{AITH}}_{\text{ROOT}}$ >> $\text{F}{\scriptsize\text{AITH}}_{\text{AFFIX}}$ universally holds. In this paper, I argue that this approach is further supported by the behavior of fusion found in Zoque where features from roots always take precedence over features from affixes. Further, I show that root-controlledness of fusion interacts interestingly with a constraint against contrast neutralization within a paradigm.

1. Introduction

In recent work of Optimality Theory (Prince and Smolensky 1993), much evidence has been adduced that languages make greater effort to preserve features occurring in certain phonetically or semantically prominent positions e.g., word-initial syllables, stressed syllables, onset (or released) consonants and roots (Beckman 1998 for an overview). For instance, in many vowel harmony systems, it is usually the sounds in roots that trigger harmony i.e., features from stems usually override features from affixes. The following is the list of phenomena that indicate such a privileged status of roots in natural languages:

(1)	Vowel Harmony:	Features from roots usually take precedence over features from affixes in harmony (Bakovic 2000).
	Dissimilation:	In dissimilation, it is often segments in affix that undergo structural change (Suzuki 1998).
	Accent Conflict:	When an accented root is concatenated with an accented affix, it is the accent from the affix that is usually deleted (Alderete 1999, 2001).
	Hiatus Resolution:	In resolving hiatus in a configuration like $V_1]_{\text{Stem}}$ + $_{\text{Affix}}[V_2$, it is usually V_2 that elides, although the deletion of V_1 is universally favored in a neutral context (Casali 1996).
	Sound Inventory:	The sound inventory found in affixes is often more restricted than that in roots (McCarthy and Prince 1995[1]).

* I am very grateful to Jaye Padgett, Joe Pater and John McCarthy for discussing related topics, reading a version of this paper, and providing feedback which lead to its much improvement. None of them, however, should be assumed to agree with anything I claim in this paper.

Process Resistance: Roots tend to resist alternation more than affixes (Beckman 1998)

This paper points out another instance of a root-controlled phenomenon, namely, fusion found in Zoque (Wonderly 1951, 1952) in which features from roots are preserved over features from affixes. When two different sounds fuse into one segment, feature specifications from the two input sounds sometimes disagree, the situation I dub here “featural conflict”. What we witness in Zoque is that in case of featural conflict, features from roots win by default. In other words, fusion in Zoque is root-controlled. This is schematically illustrated below:

(2)	$C_i]_{Root}$	+	$_{Affix}[C_j$	=>	C_{ij}
	|		|		|
	[αF]		[βF]		[αF]

This point is clearly seen in a near minimal pair like (3) (roots are underlined). As seen, both (a) and (b) involve the fusion of a nasal and a glide, but depending upon which segment belongs to a root, the outcome differs. That is, if a glide comes from a root, the result of fusion is also a glide, while if a nasal comes from a root, the result is a nasal.

(3)	a.	/**N** + <u>**j**ohs</u> + u/	=>	[**ǰ**ohsu]	‘my working’
	b.	/<u>mi**n**</u> + **j**ah + u/	=>	[mi**ɲ**ahu]	‘they came’

This contrast was observed as early as by Dell (1973), but I argue below that a satisfactory explanation can be provided only within Optimality Theory (Prince and Smolensky 1993) that explicitly recognizes the role of faithfulness in linguistic theory. More concretely, the contrast above naturally derives from the privileged status of roots compared to affixes, reflected in the universal ranking $\text{FAITH}_{\text{ROOT}}$ >> $\text{FAITH}_{\text{AFFIX}}$. Zoque thus provides another evidence for the privileged status of roots in natural languages.

Not only does it embody a novel instance of root-controlled phenomenon, there is one interesting twist in the fusion in Zoque. Root-controlledness fails in one particular environment where nasality of an affix takes precedence over orality of a root. I show that this follows from a constraint against contrast neutralization within a paradigm, drawing on a series of work by Padgett (2003a,b, to appear).

The rest of this paper proceeds as follows. In the next section, I lay out the theoretical and linguistic background necessary for the analysis of fusion in Zoque. Section 3 examines the first instance of root-controlled fusion, in which the thesis of root-controlledness is perfectly obeyed. In section 4, I examine the second instance of root-controlled fusion and show that it interestingly interacts with a constraint against contrast neutralization. Section 5 considers alternatives to the contrast illustrated in (3). The final section briefly concludes the paper.

---

[1] The observation itself is found in pre-OT work. For example, Yip (1987) observes that Level I suffixes in English usually begin with an unmarked vowel [i] as in *-ity*, *-ition* and *-ify*.

2. Background

2.1. Root and affix faithfulness

As laid out in the introductory section above, roots seem to be granted more privilege than affixes. Much recent work in Optimality Theory (Prince and Smolensky 1993) has argued to split faithfulness constraints for roots and affixes. Moreover, it has been convincingly argued that any faithfulness constraint for roots universally outranks the corresponding constraint for affixes. This was first explicitly argued by McCarthy and Prince (1995), and later additional evidence was adduced by various authors including Urbanczyk (1996), Casali (1996), Pulleyblank (1997), Beckman (1998), Suzuki (1998), Zoll (1998), Walker (1999), Pater (1999), Alderete (1999, 2001), Bakovic (2000), Gouskova (2001), Padgett (2002) among others. To express this universal tendency, the following meta- ranking has been claimed to hold universally.

(4) Root/affix asymmetry in faithfulness

$\text{FAITH}_{\text{ROOT}} >> \text{FAITH}_{\text{AFFIX}}$

This privileged status of faithfulness constraints for roots plays a central role in the analysis of fusion below.

To illustrate how this ranking schema actually works, here I analyze one phenomenon (other than fusion we will see below) from Zoque that requires (4). This section is also intended to provide some background for the analysis of Zoque fusion as well. The privileged status of root faithfulness constraints manifests itself in the context of nasal place assimilation in Zoque, as Pulleyblank (1997) observes. In this language, stem-final nasals do not undergo nasal place assimilation while affix-final nasals are subject to this process. Some relevant data that illustrate this contrast are provided below as (5) [2]. Here and throughout this paper, I underline stem segments for the sake of exposition. The data is based upon Wonderly (1951, 1952) unless otherwise noted. I follow Sagey (1986) in transcribing the sounds in IPA.

(5)

a. Stem nasals resisting NPA

/maŋ + ba/	[ma**ŋba**]	‘he goes’
/maŋ + jah+ u/	[ma**ŋj**ahu]	‘they went’
/maŋ + tɯʔ+u/	[ma**ŋd**ɯʔu]	‘he intended to go’
/tsɯm+ geʔt+u/	[tsɯ**mg**eʔtu]	‘he carried also’
/tsɯm + jah +u/	[tsɯ**mj**ahu]	‘they carried’
/tsɯm + tɯʔ+u/	[tsɯ**md**ɯʔu]	‘he intended to carry’

[2] The voicing of post-nasal consonants is an independent process, which I ignore here. See Kenstowicz and Kisseberth (1979); Sagey (1986); Pullyblank (1997) for related discussion in Zoque. See also Pater (1999) for more general discussion.

b. Affixal nasals undergoing nasal place assimilation

1. Present Participle /N-/

/N + <u>puht</u> + u/	[**mb**<u>uhtu</u>]	'my emerging'
/N + <u>kaʔ</u> + u/	[**ŋg**<u>aʔ</u>u]	'my dying'

2. Agreement Suffix /-tam/

/<u>tih</u> + tam + u/	[<u>tih</u>ta**m**u]	'we/you arrived'
/<u>tih</u> + tam + pa/	[<u>tih</u>ta**mb**a]	'we/you arrive'
/<u>tih</u> + tam + tɯʔ+u/	[<u>tih</u>ta**nd**ɯʔu]	'we/you were about to arrive'
/<u>tih</u> + tam + keʔt + u/	[<u>tih</u>ta**ŋg**eʔtu]	'we/you arrived also'

As seen, nasals in stems retain their underlying place specification even when they are followed by an obstruent. On the other hand, affixal nasals place-assimilate to the immediately following obstruent.

This contrast receives a straightforward explanation if we use the universal ranking (4). I assume that the trigger constraint for nasal place assimilation is AGREE(PLACE), which requires two consecutive consonants to share the same place specification (Lombardi 1995, 1999; Padgett 1995b, 2002; Bakovic 2000). As noted above, the constraints governing the faithfulness properties of roots are distinct from those governing affixes. For the sake of present discussion, let them be FAITH(PLACE)$_{ROOT}$ and FAITH(PLACE)$_{AFFIX}$.

(6) AGREE(PLACE): Two adjacent segments agree in place specification
FAITH(PLACE)$_{Root}$: Input place specifications of roots are faithfully mapped to output
FAITH(PLACE)$_{Affix}$: Input place specifications of affixes are faithfully mapped to output

Since nasal place assimilation takes effect only in affixes, we motivate the ranking FAITH(PLACE)$_{ROOT}$ >> AGREE >> FAITH(PLACE)$_{AFFIX}$. This ranking is confirmed by the following tableaux[3]:

(7) /<u>maŋ</u>+ba/ => [maŋba]

/<u>maŋ</u>+ba/	FAITH(PLACE)$_{ROOT}$	AGREE(PLACE)	FAITH(PLACE)$_{AFFIX}$
a. ☞[ma**ŋb**a]		*	
b. [ma**mb**a]	*!		

(8) /<u>tih</u> + tam + keʔt +u/ => [tihtaŋgeʔtu]

/<u>tih</u> + tam + keʔt +u/	FAITH(PLACE)$_{ROOT}$	AGREE(PLACE)	FAITH(PLACE)$_{AFFIX}$
a. [tihta**mg**eʔtu]		*!	
b. ☞[tihta**ŋg**eʔtu]			*

[3] To avoid complication, I ignore the possibility of changing obstruents' place of articulation. See Padgett (1995b) for a decomposition of faithfulness such that faithfulness to a nasal place is intrinsically lower than faithfulness to an obstruent place.

It is clear that roots and affixes must be governed by a different faithfulness constraint because they react differently with respect to the same markedness constraint AGREE(PLACE). So, splitting of faithfulness constraints for roots and affixes is independently motivated in Zoque phonology.

2.2. Zoque sound inventory

Below is the list of Zoque sound inventory, which becomes relevant when we discuss the properties of fusion (Wonderly 1951, 1952):

(9) Zoque Consonant Inventory

	Labial	Alveolar	Palatal	Velar	Glottal
Stops	p b	t d	c ɟ	k g	ʔ
Affricates		ts dz	tʃ dʒ		
Fricatives	f	s	ʃ		h
Nasals	m	n	ɲ	ŋ	
Liquids		l ɾ	r		
Glides	w		ɥ j		

There is one more point to be made explicit before we delve into the actual analysis of Zoque fusion. I assume, following the standard assumption in Optimality Theory, that the sound inventory of a language is derived from constraint interaction, rather than a restriction in the input level. Thus, the lack of palatalized labials [m^j] or [b^j] in Zoque, for example, derives from a markedness constrains against these sounds over a faithfulness constraint. We do not rule out these sounds from the input, but constraint interaction renders them into something else ("Richness of the Base"; Prince and Smolensky 1993; Smolensky 1996). In the following discussion, I will collectively refer to a set of markedness constraints that shape Zoque sound inventory as "INV(ENTORY)".

(10)

/m^j/	*Cj | (∈ INV) Lab	FAITH
a. [m^j]	*!	
b. ☞ [m]		*

3. Root-controlled Fusion I

As discussed above, faithfulness constraints for roots are universally ranked higher than faithfulness constraints for affixes. Then, one prediction is that in case of featural conflict, features from roots take precedence over affixes. In this paper, I call this "the thesis of root-controlledness."

(11) The thesis of root-controlledness in fusion

In case of featural conflict, features of roots take precedence.

I argue that this prediction is in fact borne out by the data from Zoque.

3.1. Data

Some data that instantiate root-controlled fusion are laid out below in (12) (Wonderly 1951, 1952; Dell 1973; Sagey 1986). Fusion takes place when coronal and glide labial consonants are placed next to [j], the result of which is palato-alveolar sounds. Labials, dorsals, and glottals fail to fuse, as data in (13) shows. Hall (2000) argues that in case of (13) also, what is involved is fusion. However, as Dell (1973: 90-91) points out, there is independent evidence that (12) and (13) are distinct cases. Zoque deletes a coda [h] to avoid a complex coda: this [h] surfaces in the context of (12), but not in (13), as in /wiht+jah+u/ => [wi**h**cahu] 'they walked' and /kihp+jah+u/ => [kipjahu] 'they fought' (Wonderly 1951: 119)[4]. This contrast is naturally explained if (13) has one more extra consonant compared to (12). Further, Zoque exhibits a general process that deletes [j] before [i]. However, [j] that is fused with coronal sounds does not delete by this process as in /j+tih+u/ => [cihu] 'it's progressing', whereas [j] that follows other sounds actually deletes, as in /j+kihp+u/ => [kihpu] ([j] metathesizes with [k]) (Dell 1973: 105). Again this contrast in inexplicable if (13) also involves fusion parallel to (12). From these considerations, I conclude that only in (12) does fusion take effect (see also Sagey 1986 for the same conclusion).

(12) Coronals and Labial Glide

a.	/mi**n** + jah + u/	[mi**ɲ**ahu]	'they came'
	/pu**t** + jah + u/	[pu**c**ahu]	'they emerged'
	/Nj + **t**ih + u/	[ɲ**ɟ**ihu]	'your arriving'
	/ʔe**ts** + jah + u/	[ʔe**tʃ**ahu]	'they danced'
	/soh**s** + jah + u/	[soh**ʃ**ahu]	'they cooked'
b.	/haj + **w**it+ u/	[ha**ɥ**itu]	'he didn't walk'

4 There are some vocalic suffixes that induce the deletion of [h] even though the concatenation does not result in a complex coda. An example of such affixes is an imperative marker /-ʌ/, as seen in /puht+ʌ/ => [putʌ] 'go out!' or a nominalizer /i/, as in /napahʃ+i/ => [napaʃi' 'dream' (Wonderly 1951: 120).

(13) Labials, Dorsals, and Glottals

a.	LABIAL		
	/<u>tsɯ**m**</u> + jah + u/	[tsɯ**mj**ahu]	'they carried'
	/<u>ki**p**</u> + jah + u/	[ki**pj**ahu]	'they fought'
b.	DORSAL		
	/<u>ma**ŋ**</u> + jah + u/	[ma**ŋj**ahu]	'they went'
	/<u>ha**k**</u> + jah +u/	[ha**kj**ahu]	'they crossed'
c.	Glottal		
	/haj + <u>**ʔ**ets</u> + ɯ/[5]	[ha**ʔj**etsa]	'he did not dance'
	/j + <u>**h**ajah</u>/	[**hj**ajah]	'her husband'

Concentrating now on the case in which fusion indeed takes place, what is most important is the fact that the all non-place features ([son], [cons], [approx], [voi], [nas], [cont], [strid]…) of the resulting forms agree with the feature specifications of stem consonants in the input. In other words, most of the features of affixal [j] are lost in favor of the features from stem consonants in case of featural conflict. This generalization seems to be very robust with only one exception, namely, place features: it seems that the thesis of root-controlledness is violated in terms of place features, since the results of fusion and input root segments do not perfectly agree in place specifications. However, I argue below that the thesis of root-controlledness is in fact observed for place features too.

Before claiming that the data above instantiates root-controlled fusion, it is imperative to justify that these examples indeed involve fusion rather than assimilation of stem sounds to [j] followed by deletion of [j]. Part of this motivation for this decision is theory-internal: a fusion analysis allows the phenomenon above to be treated as one step input-output mapping, obviating opaque counterbleeding interaction (Kiparsky 1973; see also Pater 1999). Moreover, as we saw in section 2 above, stem-final nasals resist undergoing nasal place assimilation; therefore, it is not clear at all why [j] can trigger nasal place assimilation in /<u>mi**n**</u>+jah+u/=>[mi**ɲ**ahu]. Finally, in palatalization, [i] and [j] usually act together as a trigger (Lahiri and Evers 1991), but Zoque [i] does not trigger palatalization, as in *minu* 'he came'. Thus, I will take it that (12) instantiates fusion rather than mere assimilation plus concomitant deletion of the trigger.

3.2. Analysis

Building upon the data presented above, this section analyzes the phenomenon in the framework of Optimality Theory (Prince and Smolensky 1993). First of all, the motivation behind fusion is presumably to reduce the number of coda consonants i.e., the effect of the well-known NoCoda constraint. Assuming that fusion violates Uniformity (McCarthy and Prince 1995; also Lamontangne and Rice 1995), we need to posit NoCoda >> Uniformity to trigger fusion. This is given in the tableau below:

---

[5] This involves a fairly well-known metathesis operation which flips jC into Cj (Wonderly 1951, 1952; Dell 1973). See Sagey (1986: 74-77) for a different interpretation of this datum.

(14)

/min+jah+u/	NOCODA	UNIFORMITY
a. [min$_1$.j$_2$ahu]	*!	
b. ☞ [mi.ɲ$_{12}$ahu]		*

Next, the root-controlledness naturally derives from the universal ranking FAITH$_{Root}$>> FAITH$_{Affix}$. No additional ranking needs to be stipulated. I follow McCarthy and Prince (1995) that featural identity is governed by IDENT family of constraints.

(15) IDENT(F): Input and output correspondents agree in the specification of F.

Three illustrative tableaux are given below, taking [son], [nas] and [voi] as examples.

(16)

/put+jah+u/	IDENT(SON)$_{ROOT}$	IDENT(SON)$_{AFFIX}$
a. [pu.ja.hu]	*!	
b. ☞ [pu.ca.hu]		*

(17)

/min+jah+u/	IDENT(NAS)$_{ROOT}$	IDENT(NAS)$_{AFFIX}$
a. [mi.ja.hu]	*!	
b. ☞ [mi.ɲa.hu]		*

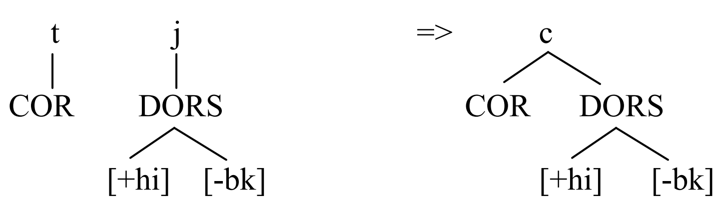
(18)

/sohs+jah+u/	IDENT(VOI)$_{ROOT}$	IDENT(VOI)$_{AFFIX}$
a. [soh.ʒa.hu]	*!	
b. ☞ [soh.ʃa.hu]		*

As seen in the three tableaux above, given FAITH$_{Root}$ >> FAITH$_{Affix}$, in case of featural conflict preserving the features from root segments is always more important than preserving the features from affixes, hence resulting in the root-controlled fusion.

Now let us move on to the discussion of place features. The question is, in mapping like (19), whether IDENT constraints for place features are violated or not.

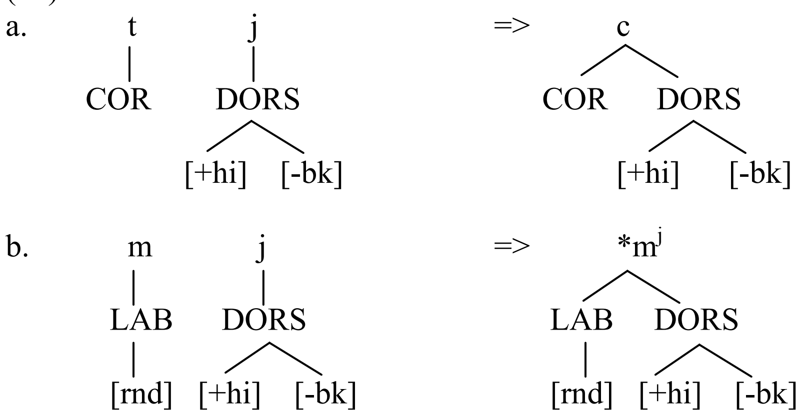
(19)



I argue that such a mapping does not constitute a violation of IDENT. Take IDENT(COR)$_{ROOT}$ for example. Both the input segment and the output segment are specified as [cor], hence it seems natural to conjecture that this constraint is satisfied. The same logic applies to IDENT(DORS)$_{AFFIX}$:

since both the input [j] and output are specified as [dors], it seems safe to assume that the constraint is observed. So, in (20), both of the faithfulness constraints for place features are satisfied. In fact, fusion takes place if and only if both of the two input features can be preserved. Let us consider again (13). In (13), preserving both of the input place features would result in impermissible sounds i.e., palatalized complex sounds, are not licensed in this language (cf. Zoll 1997 for a similar case in palatalization in Japanese mimetics).

(21)



In such cases, Zoque does not disregard the place feature of [j] to attain fusion: fusion simply fails. As disregarding the place feature of affixal [j] is not allowed, IDENT(DORS)$_{AFFIX}$ must be ranked higher than NOCODA. INV, a set of markedness constraint that derives the sound inventory of Zoque, must also dominate NOCODA. These constraint interactions are illustrated by the following tableaux below.

(22) Coronal fusion

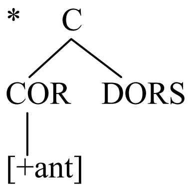
/put+jah+u/	INV	IDENT(COR)$_{ROOT}$	IDENT(DORS)$_{AFFIX}$	NOCODA
a. ☞ [pu.ca.hu]				
b. [put.ja.hu]				*!

(23) Labial no fusion

/tsɯm+jah+u/	INV	IDENT(LAB)$_{ROOT}$	IDENT(DORS)$_{AFFIX}$	NOCODA
a. [tsɯ.m^ja.hu]	*!			
b. [tsɯ.ɲa.hu]		*!		
c. [tsɯ.ma.hu]			*!	
d.☞ [tsɯm.ja.hu]				*

Finally, there is one more interesting twist that should be discussed in this context. As Sagey (1986: 78) points out, in (12), the resulting place features are not exactly the composition of two input sounds i.e., [t] plus [j] predicts [t^j] rather than [c]. I follow Sagey that [-anterior] is added to change from [t^j] to [c]. Since Zoque does not allow [+anterior] palatal sounds, this should be attributed to an undominated markedness constraint, which is a part of INV that regulates the sound inventory of Zoque. I posit a constraint that bans co-occurrence [+anterior] with DORS node as a member of INV, which is well-motivated for an articulatory reason. If a dorsum is used for articulation, tongue body is retracted to backwards, hence it is more compatible with [-anterior] articulation. This constraint dominates IDENT[ANT]$_{\text{ROOT}}$ since the input root segment [t] (which is [+ant]) and the output segment [c] ([-ant]) do not agree in [ant] specification.

(24) *



: If C has a dorsal node, it must not have [+ant] specification.

To recapitulate what we have seen in this section, I show that in case of fusion, root feature specifications are never changed. Zoque fusion thus provides a typical instance of root-controlled phenomenon. The next section discusses a similar case, which involves a slight complication.

4. Root-controlled Fusion II

The second type of fusion coalesces a prefixal nasal with the stem-initial [j], [w], [ɥ] and [h]. The resulting structure is the nasalized counterpart of stem initial sounds: i.e., [j̃], [w̃], [ɥ̃] and [h̃]. At first blush, this seems to constitute a counterexample to the thesis of root-controlledness of fusion. Nasality of a prefix takes precedence over the non-nasality (or orality) of the stem consonant. I argue that this derives from a constraint against contrast neutralization within a paradigm overriding the effect of FAITH$_{\text{ROOT}}$. In particular, I employ a slightly modified version of *MERGE constraint developed by Padgett (2003a,b, to appear), which is formalized within Dispersion Theory (Flemming 1995; Padgett 1997, 2003a, b, to appear; Padgett and Ní chiosáin 1997, 2001; Sanders 2002).

4.1. Data

The second instance of root-controlled fusion in Zoque is a fairly famous phenomenon, and it has attracted the attention of a number of researchers, including Dell (1973), Sagey (1986), Steriade (1993) and Padgett (1994, 1995a). The relevant data is as follows:

(25) Root-Controlled Fusion II

a.	/N + johs + u/	[j̃ohsu]	'my working'
	/N + hahk +u/	[h̃ahku]	'my crossing'
	/N + wiht +u/	[w̃ihtu]	'my walking'
	/Nj + wen +u/	[ɥ̃enu]	'your breaking'
b.	/N+sohs+u/	[sohsu]	'my cooking'
	/N+ʔehts+u/	[ʔehtsu]	'my dancing'

c. /N+puht+u/ [mbuhtu] 'my emerging'
/N+tih+u/ [ndihu] 'my arriving'
/N+kayu/ [ŋgayu] 'my rooster'

As in (c), when the prefixal nasal is followed by a stop, it regressively place-assimilates with concomitant postnasal voicing. When the prefixal nasal attaches to glides and [h], fusion takes place. Finally, when this prefix is attached to non-glide continuants, the prefix receives no phonological exponence.

I assume here too that the behavior of the prefix nasal is fusion rather than nasalization followed by deletion of the nasal consonant. The similar arguments that I made in the first type of fusion above apply. The fusion approach obviates opaque counterbleeding interaction. Also, if Zoque had a regressive nasalization process, it would predict that [h], [w], [ɥ] and [ʔ] after nasal would be exceptionlessly nasalized. This prediction is not borne out, as there are many non-nasalized glides after a nasal: [tsɯmjahu] 'they carried,' [maŋjahu] 'they went.'

4.2. Analysis

Let us start our analysis with a trigger constraint. The fusion in (a) and deletion in (b) seems to derive from dispreference of juxtaposing a nasal after [+continuant] segments (see Padgett 1994, 1995a for some related discussion). Thus, I assume that a markedness constraint that prohibits this configuration, *NAS-[+CONT], and this is ranked above UNIFORMITY in this language to induce alternations in (25). There is one caveat, however: this alternation does not take place for root segments[6], as in /tsɯm+jah+u/ => [tsɯmjahu] 'they carried.' Thus, we need to posit UNIFORMITY$_{ROOT}$ and UNIFORMITY$_{AFFIX}$ and sandwich the markedness constraint, as in UNIFORMITY$_{ROOT}$ >> *NAS-[+CONT] >> UNIFORMITY$_{AFFIX}$ (see Pater 1999 for a parallel case in Indonesian).

The most interesting case for our current discussion is (25a). Let us ignore nasality for the moment. Then, every feature of the resulting sound coincides with that of stem consonants. This, as in the case above, follows from the universal ranking (4), as illustrated by the two illustrative tableaux below:

(26)

/N+johs+u/	IDENT(APPROX)$_{ROOT}$	IDENT (APPROX)$_{AFFIX}$
a. [ɲoh.su]	*!	
b. ☞ [j̃oh.su]		*

[6] Another affix /tam/, which is discussed in section 2 in the context of nasal place assimilation, does not exhibit fusion before the glide w. Unfortunately, this morpheme does not occur in morphemic distribution before y, h or any of the fricatives (Padgett 1995a: 65). Due to this crucial deficiency of distribution of this morpheme, I set aside its analysis.

(27)

/N+<u>johs</u>+u/	IDENT(CONT)$_{ROOT}$	IDENT(CONT)$_{AFFIX}$
a. [ɲoh.su]	*!	
b. ☞[ʝoh.su]		*

Thus, except in nasality, (25a) is a perfect instance of root-controlled fusion. Then, an obvious question is why nasality of the affix takes precedence over the feature specification (i.e., non-nasality) of stems. If IDENT(NAS)$_{ROOT}$ >> IDENT(NAS)$_{AFFIX}$ is universal, how is it possible that feature specification of affixes takes precedence over that of roots?

I propose that nasality of affix takes precedence over root's specification because of the requirement that every distinct word within a paradigm assume a distinct phonological shape. The total root-controlledness would wind up making affix receive no phonological exponence at all, and this is what is avoided here. A number of researchers have proposed a constraint to this effect, which requires assigning some phonological exponence to each morpheme (see particularly Gnanadesikan 1997 for such a constraint in context of fusion; see also Samek-Lodovici 1993; McCarthy and Prince 1995; Akinlabi 1996; Walker 1998; Urabanczyk 1998; Kurisu 2001 among others). However, such a formulation of the constraint runs afoul in accounting for the behavior of Zoque. One recalcitrant problem with this approach emerges with 2nd person possessive, which is given below:

(28) /Nj + <u>wen</u> +u/ [w̃ʲenu] 'your breaking'

The prefix, by way of fusion discussed in section 3, receives phonological exponence already, so nasalization is superfluous, according to a constraint developed by the above mentioned authors. This is a very general problem of double morphemic exponence where one morpheme is expressed by two pieces of exponence. The approach that posits a constraint that requires every morpheme to *some* phonological exponence cannot explain why double exponence must be assigned[7]. Some might quibble that /Nj/ in fact consists of two morphemes /N/ and /j/. However, the first morpheme /N/ makes first person participle and the second /j/ the third person participle. It is not at all clear why the combination of these two morphemes can produce the meaning of second person participle.

Therefore, I employ a slightly different conception of contrast preservation, which is developed by Padgett (2003a, b, to appear) within Dispersion Theory (Flemming 1995; Padgett 1997, 2003a,b, to appear; Ní Chiosáin and Padgett 1997, 2001; Sanders 2002). In this approach, wellformedness must be evaluated not over isolated forms, but with respect to the larger system of contrast that a particular item enters into. "The larger system" is an entire language in

[7] Kurisu (2001) developed a mechanism to explain double morphemic exponence phenomena making crucial use of Sympathy Theory (McCarthy 1999 and reference cited therein). However, this theory can assign one additional non-concatenative phonological exponence plus affixation (as in German Umlaut), but it is unable to assign one additional exponence plus fusion (and in fact the theory fails to assign two kinds of non-concatenative exponence for one morpheme). Readers are referred to Chapter 5 in his dissertation for details of this mechanism.

Dispersion Theory, but for the case at hand, it is only necessary to evaluate an entire paradigm under consideration (see also Kenstowicz 1996, 1997; McCarthy 1998, 2002; Raffelsiefen 1995, 1999 for the necessity to evaluate an entire paradigm as one candidate). The following paradigm is particularly important:

(29)

a.	/wen+u/	[wenu]	'it broke (3rd person perfective)'
b.	/N + wenu/	[w̃enu]	'my breaking (1st person progressive)'
c.	/j + wenu/	[ɥenu]	'its breaking (3rd person progressive)'
d.	/Nj + wenu/	[ɥ̃enu]	'your breaking (2nd person progressive)'

Each of the forms, as seen, receives a distinct phonological exponence. Padgett's *MERGE constraint, a constraint against neutralization, is extremely suitable for this situation. For the reason that becomes clear later, I employ a relativized version of *MERGE, namely, the one that prohibits merger of two words *within* a paradigm. That is, the constraint forbids the situation in which more than one items receive the same phonological exponence within the same paradigm.

(30) *MERGE: Underlyingly distinct forms within a paradigm must receive different phonological exponence.

Whether there is a more general *MERGE constraint that penalizes against merger of two lexical items regardless of their paradigm affiliation, as Padgett argues, or this relativized *MERGE suffices is an interesting research topic, but it is well above the scope of this paper.

Given a relativized *MERGE constraint, if (29b) underwent pure root-controlled fusion, this would result in [wenu]. Then the surface form [wenu] would end up having two underlying correspondents. This is exactly what is prohibited by *MERGE, which is ranked above $\text{IDENT(NAS)}_{\text{ROOT}}$. This is illustrated by the following tableau. As noted above, the evaluation should be operated over the entire paradigm, but for the simplicity's sake, I first posit only (29a) and (29b) in the tableau.

(31)

$/\text{N+wen+u}/_1$ $/\text{wen+u}/_2$	*MERGE	$\text{IDENT(NAS)}_{\text{ROOT}}$	$\text{IDENT(NAS)}_{\text{AFFIX}}$
a. $[\text{wenu}]_{1,2}$	*!		*
b. ☞ $[\tilde{\text{w}}\text{enu}]_1$ $[\text{wenu}]_2$		*	

The candidate (a) violates *MERGE because the surface form [wenu] corresponds to two distinct input forms. It is important to stress here that candidate (a) does not involve deletion of a word. Assigning the same output form [wenu] for /N+wen+u/ with /wen+u/ does not mean that the former word is deleted. It just means that the output forms of these two words coincide.

The biggest virtue of this theory is that this approach solves the double morphemic exponence problem of (29d). Unless the third person participle form receives two exponence, it would result in a violation of *MERGE constraint. The evaluation of entire paradigm in (29) is illustrated below:

(32)

/N+wen+u/$_1$ /wen+u/$_2$ /j+wenu/$_3$ /Nj+wen+u/$_4$	*MERGE	IDENT(NAS)$_{ROOT}$	IDENT(NAS)$_{AFFIX}$
a. [wenu]$_{1,2}$ [ɥenu]$_{3,4}$	*!*		**
b. [w̃enu]$_1$ [wenu]$_2$ [ɥenu]$_{3,4}$	*!	*	*
c. [w̃enu]$_{1,2}$ [ɥenu]$_3$ [ɥ̃enu]$_4$	*!	*	*
d. [w̃enu]$_1$ [wenu]$_2$ ☞ [ɥenu]$_3$ [ɥ̃enu]$_4$		**	

To complete our discussion, we need to account for the fact that the prefix receives no phonological exponence when the stem begins with a fricative and a glottal stop. This is straightforward: a constraint against nasalized fricative (see Cohn 1993; Walker 1998) and a constraint against nasal glottal (see Pullum and Walker 1999) are ranked higher than *MERGE so that they prevent nasalization of stem-initial consonants, even at the cost of resulting in contrast neutralization.

In sum, I have argued in this section that fusion of the nasal prefix and stem-initial consonants again instantiates a root-controlled phenomenon. Further, the exceptional behavior of [nas] is accounted for by *MERGE constraint, which prohibits contrast neutralization within a paradigm.

4.3. Alternative to *MERGE

This section discusses one alternative approach for the exceptional behavior of [nas] in terms of root-controlledness. The basic idea of this alternative is to claim that what is conflicting in (25a) is not actually symmetrical: for roots, identity prohibits a change *from oral to nasal*, but for affixes, identity inhibits a change *from nasal to oral*. Hence, one might argue that there is no direct conflict here. There are several ways to implement this idea; here to illustrate this alternative approach, I use MAX/DEP[FEATURE] constraints[8] proposed by Pulleyblank (1996), Causley (1997), Lombardi (1998, 2001), Walker (1999) and Zhang (2000).

In this approach, MAX prohibits the change from nasal to oral while DEP prohibits the change from oral to nasal, as MAX penalizes against deletion of [nas][9] feature and DEP prohibits addition of the same feature.

(33) MAX(NAS): underlying [nas] feature must surface.
DEP(NAS): surface [nas] feature must be also underlying.

[8] Another possible implementation of this idea is directional IDENT constraints developed by Pater (1999) (see also Walker 2001).

[9] Following Steriade (1993), I assume that [nas] is a privative feature. This is merely for the sake of simplicity.

Given this formulation of faithfulness constraints, the change in a root from oral to nasal is prohibited by DEP(NAS)$_{ROOT}$ while the change in an affix from nasal to oral violates MAX(NAS)$_{AFFIX}$. These constraints must be ranked as MAX(NAS)$_{AFFIX}$ >> DEP(NAS)$_{ROOT}$ to guarantee the appearance of [nas] from the affix, as the tableau below illustrates.

(34)

/N+johs+u/	MAX(NAS)$_{AFFIX}$	DEP(NAS)$_{ROOT}$
a. [joh.su]	*!	
b. ☞ [j̃oh.su]		*

Though this approach can account for the nasalization of a root segment by an affix segment, I argue that this approach is not viable both empirically and theoretically. Starting with the empirical problem, since nasalized glides arise under the duress of MAX(NAS)$_{AFFIX}$, this faithfulness constraint must dominate *NASGLIDE, which penalizes against nasalized glides. This is illustrated by the tableau below:

(35)

/N+johs+u/	MAX(NAS)$_{AFFIX}$	*NASGLIDE
a. [joh.su]	*!	
b. ☞ [j̃oh.su]		*

However, as Steriade (1993) points out, the creation of nasalized glides is not structure preserving (see e.g., Kiparsky 1985); i.e., nasalized glides do not exist in Zoque independently of the effects of the fusion discussed in this section. Crucially, however, the ranking motivated in (35) fails to account for this absence of nasalized glides outside of the fusion: an affix that has an underlying nasalized glide is predicted to surface faithfully because MAX(NAS) dominates the markedness constraint against this structure. So, for example, given the Richness of the Base hypothesis (Prince and Smolensky 1996; Smolensky 1996), we must entertain the possibility that Zoque has an affix like /j̃a-/ in the input. This must surface as [ja] because nasalized glides are prohibited outside of the context of the fusion. However, the ranking in (35) fails to account for this:

(36)

/j̃a-/	MAX(NAS)$_{AFFIX}$	*NASGLIDE
a. [ja]	*!	
b. 💣 [j̃a-]		*

The approach that relies on *MERGE constraint does not face this problem, as nasalization is forced by *MERGE, not by featural faithfulness constraints. *MERGE dominates *NASGLIDE because nasalized glides are forced to appear under the duress of avoidance of homophony within a paradigm. *NASGLIDE dominates IDENT(NAS)$_{ROOT}$ (and thus IDENT(NAS)$_{AFFIX}$) on the other hand, as nasalized glides are prohibited outside of the fusion. The results of these rankings are illustrated by the two tableaux below. Importantly, *MERGE is not violated by denasalization of /j̃a/ into [ja], even if we assume the presence of another hypothetical form [ja]. This is because *Merge constraint employed here is relativized within a paradigm, so homophony avoidance is forced iff the two forms belong to a separate paradigm.

(37)

/N+wen+u/$_1$ /wen+u/$_2$	*MERGE	*NASGLIDE	IDENT(NAS)$_{ROOT}$	IDENT(NAS)$_{AFFIX}$
a. [wenu]$_{1,2}$	*!			*
b. ☞ [w̃enu]$_1$ [wenu]$_2$		*	*	

(38)

/j̃a- / /ja-/	*MERGE	*NASGLIDE	IDENT(NAS)$_{ROOT}$	IDENT(NAS)$_{AFFIX}$
a. ☞ [ja]$_{1,2}$				*
b. [ja]$_1$, [j̃a]$_2$		*!		

As shown, this approach successfully accounts for both (i) nasalization of root segments in the context of fusion and (ii) the lack of nasalized glides elsewhere.

The approach that utilizes MAX(NAS)$_{AFFIX}$ >> DEP(NAS)$_{ROOT}$ to derive nasalization of a root segment by an affix segment faces a theoretical problem as well. This approach relies on the assumption that the universal meta-ranking (4), repeated below as (39), is loosely interpreted as (40).

(39) meta-ranking

FAITH$_{ROOT}$ >> FAITH$_{AFFIX}$

(40) Loose interpretation of (39)

FAITH-X$_{ROOT}$ >> FAITH-Y$_{AFFIX}$ iff FAITH-X and FAITH-Y are the very same constraint.

In (40), the universal meta-constraint ranking (39) is granted only for the very same faithfulness subconstraints. Allowing such an interpretation together with directional faithfulness constraints, however, weakens the explanatory success of positional faithfulness theory in general. Here I illustrate the serious flaw of this weakening in terms of the analysis of intersyllabic voicing assimilation within Optimality Theory. As argued by Lombardi (1995, 1999), intersyllabic voicing assimilation is by default regressive i.e., from onset to coda. Lombardi argues that this automatically follows from the meta-ranking over FAITH$_{ONSET}$ >> FAITH$_{CODA}$ (or general FAITH). Since preserving featural specification of onset is universally favored over the featural preservation of coda segments, the spreading from onsets to codas is automatically guaranteed. However, if we allow the possibility of (40), this does not hold any longer. The change from voiceless to voiced violates MAX(VOI) and the change from voiced to voiceless violates DEP(VOI). Then, since (40) would allow for the ranking MAX(VOI)$_{CODA}$ >> DEP(VOI)$_{ONSET,}$ this predicts a hypothetical language that has regressive assimilation of [+voi] segments.

(41)

/…d.t…/	MAX(VOI)$_{\text{CODA}}$	DEP(VOI)$_{\text{ONSET}}$
a. […t.t…]	*!	
b. ☞ […d.d…]		*

As Lombardi emphasizes, however, this pattern is not attested.

Even if we employ stringency relationship (see de Lacy 2002) between a strong position and a weak position (i.e., FAITH$_{\text{STRONG}}$ vs., FAITH$_{\text{GENERAL}}$), allowing (40) together with directional faithfulness constraints would make an undesirable prediction. To take the similar example as above, if we allow the ranking MAX(VOI) >> DEP(VOI)$_{\text{ONSET}}$, the result is the language in which consonants clusters agree in voicing, no matter where [+voi] originates underlyingly.

(42)

/…dt…/	MAX(VOI)	DEP(VOI)$_{\text{ONSET}}$
a. […t.t…]	*!	
b. ☞ […d.d…]		*

(43)

/…td…/	MAX(VOI)	DEP(VOI)$_{\text{ONSET}}$
a. […t.t…]	*!	
b. ☞ […d.d…]		

In a nutshell, allowing FAITHY$_{\text{WEAK}}$ >> FAITHX$_{\text{STRONG}}$ or FAITHX$_{\text{GENERAL}}$ >> FAITHY$_{\text{STRONG}}$ as well as directional faithfulness constraints predicts the existence of languages that do not seem to exist. Now it should be emphasized that it is only when both (40) and directional faithfulness constraints are allowed, do the undesirable consequences arise. Thus, it is possible that one of these theories is necessary for phonological theorizing (see de Lacy 2002 for the necessity of ranking FAITHX$_{\text{GENERAL}}$ >> FAITHY$_{\text{STRONG}}$; see references cited above for the necessity of directional faithfulness constraints[10]).

---

[10] Prince (1997) shows that positing directional faithfulness constraints alone is dangerous in terms of factorial typology. Schematically,

- Let x be less marked than y context-freely (i.e., *y (>> *x)).
- Suppose y is less marked than x in environment z (i.e., *x/z)
- Let there be two faithfulness constraints F(y ≠>x) and F(x ≠>y)

Then, the ranking F(x ≠>y) >> *x/z >> *y >> F(y ≠>x) produces a language that preserves contrast only in z, the environment favoring neutralization. e.g., Languages that have nasal/oral vowel contrast only after a nasal or voicing contrast in obstruent only intervocalically.

- {na, nã, ta} (y = *NASV, x/z =NV$_{\text{[+oral]}}$, DEP[NAS], MAX[NAS])
- {ta, ata, ada} (y =*VOIOBS, x/z= *VtV, DEP[VOI], MAX[VOI])

In summary, the approach that admits both directional faithfulness constraints and the loose interpretation of the meta-ranking (39) is undesirable. On the empirical side, it predicts that Zoque allows nasalized glides outside of the fusion, contrary to fact. Moreover, allowing these possibilities predicts some patterns that are not attested in natural languages, hence undesirable.

5. Alternatives to FAITH$_{\text{ROOT}}$ >> FAITH$_{\text{AFFIX}}$

Having argued that the patterns of the Zoque fusion can be given a unified understanding under FAITH$_{\text{ROOT}}$ >> FAITH$_{\text{AFFIX}}$ theory, I turn now to the consideration of alternative approaches. First, I critically assess a rule-based theory, which is given by Dell (1973) and second, the theory of positional markedness (Zoll 1998). I will show that neither of the theories can provide an insightful and elegant account.

5.1. Rule-based theory

The problem that the Zoque fusion patterns pose is embodied by the following pair:

(44)	a.	/**N** + **j**ohs + u/	=>	[**j̃**ohsu]	'my working'
	b.	/mi**n** + **j**ah + u/	=>	[mi**ɲ**ahu]	'they came'

Even though both of the forms above involve the fusion of a nasal and a glide, the outcome of fusion is different. In account for these data, Dell (1973) poses two separate rules.

(45) a. [-syll, -cons, +cont] => $_{\text{Wd}}$[[+nas] + __

b. [+cor] j => [+high, -back, -ant] φ
    1   2   1   2

The first one is aimed to account for (44a) which nasalizes a segment after a morphological edge, which is preceded by [+nas] segment, which is at the left edge of a word. A subsequent rule deletes a prefixal nasal. The second rule is to palatalize the coronal consonants before [j] with concomitant deletion of [j].

There are several problems. First, (45a) is a highly specific rule, which is nothing more than a restatement of the empirical fact. Second, (45b) is a very powerful transformational rule that predicts the existence of other implausible patters (e.g., changing the sequence of a coronal and a dorsal into a uvular sound). Third, (45b) implicitly accounts for why the manner features of roots are preserved in the output of fusion by not mentioning these features in the formulation of the rules. However, it misses the generalization that the preservation of root features is cross-linguistically common phenomenon. In this formulation, it is as easy to posit a rule that requires the preservation of affix features, which is unlikely to be found in natural languages. Finally, this approach treats the two processes in (44) as completely different processes, but they are quite similar in that both are root-controlled and both aim to fuse two segments into one. The rule-based approach cannot capture this point.

5.2. Positional Markedness

Another alternative conceivable within OT is the theory of positional markedness (see, for example, Zoll 1998). In this theory, marked structures are required to be in particular strong positions e.g., roots or stressed syllables. However, what is at issue in Zoque fusion is the root-affix asymmetry in the *preservation* of underlying specifications, and it has nothing to do with particular marked structures found only, or required to be, in strong positions. Hence, positional markedness constraints are not at issue here, and postulating position-specific faithfulness constraints is inevitable.

6. Concluding Remarks

To conclude, this paper has made two important theoretical claims:

(i) Root-controlledness is also observed in the context of fusion.

(ii) The thesis of root-controlledness can be disturbed by a higher ranked constraint, in the case of Zoque, by *MERGE constraint.

Regarding (ii), one interesting future research is to see how much the thesis of root-controlledness holds for other fusion processes cross-linguistically, and how the pattern is distracted by other wellformedness constraints.

The final point that I want to stress here is the interplay between *MERGE and faithfulness constraints. *MERGE by its definition avoids contrast neutralization, and so do faithfulness constraints. They are equivalent in their functional role in phonology, but not redundant with respect to each other. The root-controlledness in Zoque is, as I argued throughout, best accounted for by postulating $\text{FAITH}_{\text{ROOT}}$ and $\text{FAITH}_{\text{AFFIX}}$. However, *MERGE overrides their effect: when it would result in contrast neutralization within a paradigm, root-controlledness is disregarded. Hence I conclude that faithfulness constraints and *MERGE are both vital in phonological theory.

References

Akinlabi, Akibiya (1996) Featural Affixation. *Journal of Linguistics* 32, 239-289.

Alderete, John (1999) *Morphologically Governed Accent in Optimality Theory*. Doctoral dissertation, University of Massachusetts, Amherst.

Alderete, John (2001) Root-controlled Accent in Cupeño. *Natural Language and Linguistic Theory* 19, 455-502.

Bokovic, Eric (2000) *Harmony, Dominance and Control*. Doctoral dissertation, Rutgers University.

Beckman, Jill (1998) *Positional Faithfulness*. Doctoral dissertation, University of Massachusetts, Amherst.

Casali, Roderic (1996) *Resolving Hiatus*. Doctoral dissertation, University of California, Los Angels.

Causley, Trisha (1997). Featural Correspondence and Identity: The Athapaskan Case. *The Proceedings of North East Linguistic Society* 27, 93-105.

Cohn, Abigail (1993) The Status of Nasalized Continuants. In M Huffman and R. Krakow (eds.), *Nasals, Nasalization and the Velum: Phonetics and Phonology* 5. New York: Academic Press, 329-367.

de Lacy, Paul (2002) *The Formal Expression of Markedness*. Doctoral dissertation, University of Massachusetts, Amherst.

Dell, Francois (1973 [1980]) *Generative Phonology and French Phonology*. Cambridge: Cambridge University Press.

Gnanadesikan, Amalia (1997) *Phonology with Ternary Scale*. Doctoral dissertation, University of Massachusetts, Amherst.

Gouskova, Maria (2001) Falling Sonority Onsets, Loanwords, and Syllable Contact. *The Proceedings of Chicago Linguistic Society 37: the Main Session.*

Hall, T.A. (2000) Syllabically Conditioned Coalescence and Deletion in Zoque: an Optimality-theoretic Approach. *Linguistics* 38-4, 711-738.

Kenstowicz Michael, and Charles Kisseberth (1979) *Generative Phonology*. New York: Academic Press.

Kenstowicz, Michael (1996) Base-identity and Uniform Exponence: Alternative to Cyclicity. In J. Durand and B. Laks. (eds,). *Current Trends in Phonology: Models and Methods*. Paris-X and Salford: University of Salford Publications, 363-393.

Kenstowiz, Michael (1997) Uniform Exponence: Exemplification and Extension. In *University of Maryland Working Papers in Linguistics 5: Selected Papers from Hopkins Optimality Theory Workshop / University of Maryland Mayfest*. 139-155.

Kiparsky, Paul (1973) Abstractness, Opacity and Global Rules. In O. Fujiyama (ed.), *Three Dimensions of Linguistic Theory*. TEC: Tokyo. 57-86.

Kiparsky, Paul (1985) Some Consequences of Lexical Phonology. *Phonology Yearbook* 2, 85-138.

Kurisu, Kazutaka (2001) *Phonology of Morpheme Realization*. Doctoral dissertation, University of California, Santa Cruz.

Lamontangne, Greg and Keren Rice (1995) A Correspondence Account of Coalescence. In J. Beckmen W. Dickey, and S. Urbanczyk. (eds.,) *Papers in Optimality Theory*. *University of Massachusetts Occasional Papers in Linguistics* 18. Amherst: GLSA. 211-223.

Lahiri, Aditi and Vincent Evers (1991) Palatalization and Coronality. In C. Paradis and J. Prunet (eds.) *The Special Status of Coronals: Internal and External Evidence*. San Diego: Academic Press, 79-100.

Lombardi, Linda (1995) Restrictions of Direction of Voicing Assimilation: An OT Account. *Maryland Working Papers in Linguistics* 3, 89-115.

Lombardi, Linda (1999) Positional Faithfulness and Voicing Assimilation in Optimality Theory. *Natural Language and Linguistic Theory* 17, 267-302.

Lombardi, Linda (2001) Why Place and Voice are Different: Constraint-specific Alternations in Optimality Theory. In Linda Lombardi (ed), *Segmental Phonology in Optimality Theory: Constraints and Representations* Cambridge: Cambridge University Press. 13-45

McCarthy, John (1998) Morpheme Structure Constraints and Paradigm Occultation. In *Proceedings of Chicago Linguistic Society 32 Part 2: the Panels*. 123-150.

McCarthy, John (2002) Optimal paradigm. Ms., University of Massachusetts, Amherst.

McCarthy, John (1999) Sympathy and Phonological Opacity. *Phonology* 16, 331-399

McCarthy, John and Alan Prince (1995) Faithfulness and Reduplicative Identity. In J. Beckman, W. Dickey, and S. Urbanczyk. (eds.,) *Papers in Optimality Theory*. *University of Massachusetts Occasional Papers in Linguistics* 18. Amherst: GLSA. 249-384.

Ní Chiosáin, Máire and Jaye Padgett (1997) Markedness, Segmental Realization and Locality in Spreading. Report no. LRC-97-01, Linguistics Research Center, UCSC, Santa Cruz.

Ní Chiosáin, and Jaye, Padgett (2001) Markedness, Segment Realization, and Locality in Spreading. In L. Lombardi (ed.,) *Segmental phonology in Optimality Theory: Constraints and Representation*s. Cambridge: Cambridge University Press.

Pater, Joe (1999) Austronesian Nasal Substitution and Other NC Effects. In Kager R, H. ver der Hulst, and W. Zonneveld (eds.), *The prosody-morphology interface*. Cambridge: Cambridge University Press. 310-343.

Padgett, Jaye (1994) Stricture in Feature Geometry. *Natural Language and Linguistic Theory* 12, 465-513.

Padgett, Jaye (1995a) *Stricture in Feature Geometry*. CSLI Publications.

Padgett, Jaye (1995b) Partial Class Behavior and Nasal Place Assimilation. In *Proceedings of the Arizona Phonology Conference: Workshop on Features in Optimality Theory*.

Padgett, Jaye (1997) Perceptual Distance of Contrast: Vowel Height and Nasality. In R. Walker, M. Katayama, and D. Karvonen (eds.,) *Phonology at Santa Cruz* vol 5, 63-78.

Padgett, Jaye (2002) The *Unabridged* Feature Classes in Phonology. The abridged version appeared in *Language* 78-2. 81-110.

Padgett, Jaye (2003a) Systematic Contrast and Catalan Rhotics. Ms., University of California, Santa Cruz.

Padgett, Jaye (2003b) Contrast and Post-velar Fronting in Russian. *Natural Language and Linguistic Theory* 21, 39-87.

Padgett, Jaye (to appear) The Emergence of Contrastive Palatalization in Russian. To appear in E. Holt (ed.), *Optimality Theory and Language Change,* Kluwer Academic Press.

Pulleyblank, Douglas (1996) Neutral Vowels in Optimality Theory: A Comparison of Yoruba and Wolof. *Canadian Journal of Linguistics* 41, 295–347.

Pulleyblank, Douglas (1997) Optimality Theory and Feature. In D Archangeli and D.T. Langendoen (eds.,) *Optimality Theory: An Overview*. Oxford: Blackwell Publishers, 59-102.

Pullum, Geoffery and Rachel Walker (1999) Possible and Impossible Segments. *Language* 75, 764-780.

Prince, Alan (1997) Two Lectures on Optimality Theory. Handout from Phonology Forum 1998, Kobe University. September 3rd and 4th, 1998.

Raffelsiefen, Renate (1995) Conditions for Stability: The Case of Schwa in German. Report number 69. Düsseldorf. Heinrich Heine Universität.

Raffelsiefen, Renate (1999) Constraints on Schwa Apocope in Middle High German. In A. Lahiri (ed). *Analogy, Leveling, Markedness*. Berlin and New York: Mouton de Gruyter.

Sagey, Elizabeth (1986) *The Representation of Features and Relations in Non-linear Phonology*. Doctoral dissertation, MIT.

Samek-Lodovici (1993) Morphological Gemination. Paper presented at Rutgers Optimality Workshop I.

Sanders, Nathan (2002) Dispersion in OT: Color Contrast in Middle Polish Nasal Vowels. In L. Mikkelsen and C. Potts (eds.,) *Proceedings of West Coast Conference on Formal Linguistics*. Sommerville, MA: Cascadilla Press, 415-428.

Smolensky, Paul (1996) The Initial State and "Richness of the Base" in Optimality Theory, Technical Report, JHU-Cogsci-96-4, John Hopkins University.

Steriade, Donca (1993) Closure, Release, and Nasal Contours. In M Huffman and R. Krakow (eds.), *Nasals, Nasalization and the Velum: Phonetics and Phonology* 5. New York: Academic Press, 401-470.

Suzuki, Keiichiro (1998) *A Typological Investigation of Dissimilation*. Doctoral dissertation, the University of Arizona.
Urbanczyk, Suzanne (1996) *Patterns of Reduplication in Lushootseed*. Doctoral dissertation. University of Massachusetts, Amherst.
Urbanczky, Suzanne (1998) A-templatic Reduplication in Halq'emeylem. In *Proceedings of West Coast Conference on Formal Linguistics* 17, 655-669.
Ussishkin, Adam (2000) *The Emergence of Fixed Prosody*. Doctoral dissertation. University of California, Santa Cruz.
Walker, Rachel (1998) *Nasalization, Neutral Segments and Opacity Effects*. Doctoral dissertation, University of California, Santa Cruz.
Walker, Rachel (1999) Esimbi Vowel Height Shift: Implications for Faith and Markedness. Ms., University of Southern California. [1997 version available in Rachel. Walker, Motoko. Kayama and Daniel. Karvonen (eds.,) *Phonology at Santa Cruz* 5, 103-115.]
Walker, Rachel (2001). Round Licensing, Harmony, and Bisyllabic Triggers in Altaic. *Natural Language and Linguistic Theory* 19, 827-878.
Wonderly, William (1951) Zoque I, II, III, IV. *International Journal of American Linguistics* 17. 92-95, 162, 235-251.
Wonderly, William (1952) Zoque V, VI. *International Journal of American Linguistics* 18. 35-48, 189-202.
Zhang, Jie (2000) Non-contrastive Features and Categorical Patterning in Chinese Diminutive Suffixation: Max[F] or Ident[F]? *Phonology* 17: 427-278.
Zoll, Cheryl (1997) Conflicting Directionality. *Phonology* 14:263-286
Zoll, Cheryl (1998) Positional Asymmetries and Licensing. Handout of paper presented at the annual meeting of the Linguistic Society of America. New York, January, 1998.