to appear in The Linguistic Review 17.1 2000

Word-Faithfulness and the Direction of Assimilations

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This paper proposes that differences in the direction of application of phonological rules can be attributed to the differences in the observed patterns of faithfulness at the WORD and ROOT-levels. Using data from English and Dutch I show that Progressive Voicing Assimilation is characteristically restricted to the inter-word environment (ie. it occurs at the WORD-level) and is the consequence of WORD-faithfulness. I consider whether the same kind of faithfulness effect can account for assymetrical patterns observed with other phonological processes such as vowel harmony, vowel elision and nasal place assimilation.

1. Introduction

WORDs and ROOTS have characteristically different phonological properties. Morphology at the ROOT-level is incorporated into the word while morphology at the WORD-level is not. Root level derivatives look like underived words; the edge between root and affix is 'knit' together so that the whole of a poly-morphemic word at this level of derivation satisfies the same well-formedness constraints that a monomorphemic word satisfies. For example in English whenever an affix is added at this level the prosody is reorganised. Syllable structure is modified by vowel shortening rules to ensure that no overlarge syllables arise, eg. *keep~kep [kEpt]* cf. **[ki:pt]*. In words derived at the second level the boundary between the word base and the affixes is not erased by the phonology; the resulting forms look derived. In addition these forms may violate well-formedness constraints that a ROOT-level form would not, eg. *reap~ reaped [ri:pt],* but not **[rEpt]*.

These differences in the phonology of ROOTs and WORDs have been discussed in work in Lexical Phonology as for example in Selkirk (1982), Borowsky (1986, 1993) and more recently given an interpretation in Optimality Theory by Benua (1997). In this paper I will discuss another interesting consequence of the separation of these levels. Kiparsky (1985) presented an account of the differential application of rules at the various levels of the phonology in the Lexical Phonology model. The same rule, subject to principles such as Structure Preservation or the Strict Cycle Constraint, may have different outputs depending on where in the phonology it applies. Work in Optimality Theory has provided new explanations for some of these effects, in particular for those effects known as over -and underapplication (see for example

McCarthy and Prince 1995, Benua 1995, 1997) . These effects are contrasted with so called “normal” application. Normal application is the outcome in a situation where a wellformedness constraint outranks or is equally ranked with the relevant faithfulness constraints and the output is the one is expected in a derivational model where the rule applies if and only if its structural description is satisfied. “Normal application” in OT allows for yet another situation similar to those discussed in Kiparsky’s (1985) paper: where a wellformedness constraint outranks the faithfulness constraints but its satisfaction results in different outputs due to the effects of faithfulness. The structural description of the rule (constraint) is met in all cases and the phonological process that occurs is the same one but crucially the output is different. It is this situation, in which the surface satisfaction of the wellformedness constraint is different in different circumstances, which I consider here.

Consider the situation in which an output clearly satisfies some wellformedness constraint by application of a phonological process but crucially that form is quite different from another output which also satisfies that constraint by means of the same process. For example assume a hypothetical language in which sequences of distinct consonants are forbidden and this is ensured by the constraint, $*C_{\alpha}\ C_{\beta}$. Violations of this constraint are repaired by total assimilation. All other things being equal, either of the two consonants in a sequence may be the assimilatee and the constraint will be satisfied. Thus: l+t --> ll or l+t --> tt.

Generally speaking all other things are not equal. In many cases there is some clear reason why one of the two consonants should be the target of the assimilation (place markedness or sonority, for example) however it is also often the case that either may be targeted depending on the mophological and prosodic properties of the form. The result of the assimilation process is different in different circumstances in the same language. In this paper I consider this situation and propose that one of the ‘other things which is not equal in such cases is faithfulness, in particular faithfulness to WORDs.

The major point of the paper is illustrated with an explanation of the pattern of progressive voicing assimilation . Lombardi (1995,1996, 1999) observes that regressive voicing assimilation is the norm and progressive voicing assimilation is rare. She presents a solution to the progressive assimilations in which high ranking special constraints ensure progressive assimilation by overriding the effects of the usual regressive assimilation constraint ranking. Building on Lombardi’s idea I show that progressive voicing assimilation in English and Dutch is systematically associated with WORD-level morphology (Borowsky 1993). While regressive assimilation may be found at both WORD and ROOT-level, progressive assimilation is only observed at WORD-level[1], never at ROOT-level.[2]. This is followed by a discussion of Casali's (1997) analysis of the resolution of vowel sequences which provides further evidence for the differential faithfulness patterns associated with the WORD/ROOT distinction. I then consider patterns of harmony and suggest that differences in the direction and degree of vowel harmony be explained by the same mechanisms. Lastly I consider nasal place assimilation in Dutch diminutives as an instance of the same phenomenon.

2. Voicing Assimilation in Dutch and English

Lombardi (1995,*et ann seq.*) presents an analysis of voicing assimilation which accounts for the fact that voicing assimilation is generally regressive. According to her the few documented cases of progressive voicing assimilation can be explained as due to the interplay of the general voicing assimilation constraints with, in each case, some other morphological or phonological constraint which has the effect of reversing the direction of assimilation. She provides a comprehensive discussion of a number of cases of progressive assimilation in which, for each language, an additional higher ranked constraint ensures the correct direction of assimilation . I show in this paper that in fact only one additional assumption is necessary for the explanation of progressive assimilation patterns and that is WORD-faithfulness.

I adopt in its entirety Lombardi's (1996) analysis of voicing assimilation. (Lombardi's analysis builds on her own earlier work and makes assumptions justified in that work to which I refer the reader.)

Regressive voicing assimilation is described as follows: Assimilation is due to satisfaction of the constraint AGREE which requires that sequences of obstruents have the same value for voicing.

(1) AGREE: Obstruent Clusters agree in voicing

[1] Modulo that progressive assimilation found in Dutch obstruent+fricative sequences. See fn 4 below.
[2] The notion of Word and Root Faithfulness I present is similar to, but not identical with, the idea of level specific Output-Output faithfulness (Benua 1997).

The voicing assimilation constraint, AGREE, says nothing about the direction in which assimilation should occur and thus progressive assimilation is equally possible as a means of satisfying this constraint.

Voicing is privative and marked. This is encoded in the constraint *LAR which is violated by voiced consonants though not by voiceless consonants.

(2) *LAR: No Laryngeal features

Faithfulness formulated as a correspondence constraint between input and output (IO) ensures that voicing of segments does not change.

(3) Ident Laryngeal (IDLAR): Consonants should be faithful to underlying laryngeal specification

Voicing assimilation will occur in a language when the constraints are ranked: AGREE>> IDLAR>>*LAR as illustrated in (4).

(4)

pik+ben	AGREE	IDLAR	*LAR
☞pikpen		*	
pigben		*	!**
pikben	*!		*

This kind of voicing assimilation will always be always toward the unmarked value for voicing and it is thus directionless. The result is always a sequence of voiceless consonants: kb→kp; gp → kp.

To account for the fact that voicing assimilation is almost always regressive Lombardi (1996) introduces a positional faithfulness constraint which takes into account the privileged status of onsets with regard to the voicing contrast.[3] This is encoded in the constraint: Ident Onset Laryngeal (IDONSLAR) which ensures the faithful parsing of laryngeal features in the Onset. (This constraint is clearly perceptually motivated in that the cues for voicing are mainly found in the release of obstruents and onset consonants are more likely to be released than consonants in other positions.)

(5) Ident Onset Laryngeal (IDONSLAR): Onsets must be faithful to underlying laryngeal specification

[3] Voicing is not the only feature of onsets which is privileged- see Beckman (1998) and Padgett (1997 ms.) for a full discussion of positional markedness and onset privilege.

IdOnsLar outranks the other constraints governing the identity of voicing in consonants but is itself outranked by Agree. It thus ensures that assimilation will always be regressive; Thus kb→ gb; gp→pk. The following tableau illustrates. The successful candidate is the one in which the laryngeal value of the onset consonant is faithfully parsed. Assimilation in this case is in favour of the marked voice contrast of the onset consonant.

(6)

pik+ben	Agree	IdOnsLar	IdLar	*Lar
pikpen		*!	*	
☞pigben			*	**
pikben	*!			*

The positional faithfulness constraint, in the normal ranking, always induces regressive assimilation.

In Lombardi's account, progressive assimilation is only "possible when some other constraints come into play outranking the effects of the positional faithfulness constraint" p 39. I will show that this is indeed true and that the relevant factor inducing progressive assimilation is always WORD-faithfulness.

2.1. Dutch

Dutch has an interesting pattern of neutralisation and voice assimilation which is discussed in detail in Lombardi's work. Regular voicing assimilation in Dutch is regressive except in obstruent+fricative sequences which always show progressive assimilation always devoicing the fricative.[4] In (7) we see examples of regressive assimilation in compounds (egs from Lombardi and Gussenhoven and Jacobs 1998).

(7)	/kas + buk/	[kAzbuk]	'cash book'	cf.	[kAs, kas´] cash sg.,pl.
	/kaz+bot /	[ka:zbot]	'cheese boat'		[ka:s, ka:z´] cheese, sg.,pl
	/ka:z+pers/	[ka:spErs]	'cheese press'		
	/kas+post/	[kAspçst]	'cashbook entry'		
	/goud korts/	[xAUtkçrts}	'gold fever'		
	/le:z bril/	[le:zbrIl]	'reading glasses'		
	/la:t bloeier/	[la:d blUj´r]	'late bloomer'		

[4] I shall omit this from the discussion. Lombardi 1995 proposes a fricative specific constraint which forbids voicing on fricatives which follow obstruents. This constraint outranks the rest and ensures the correct outcome - see Lombardi ms. p11.

Dutch also has progressive voicing assimilation with nonfricatives. The regular or weak past in Dutch is formed by adding the suffix /-de/ to verbs. A voiced allomorph occurs following voiced segments: vowels, sonorants and voiced obstruents; a voiceless allomorph occurs after voiceless obstruents. The examples in (8) from Lombardi and Van der Hulst and Kooij 1981 illustrate.

(8)

verb	*past tense*	*gloss*
brei en	breide	knit
rijmen	rijmde	rhyme
leven	levde	live
krabben	krabde	scratch
stappen	stapte[5]	step
schrappen	schrapte	scrape
blaffen	blafte	bark

In the past tense forms above we might have expected that the assimilation trigger is the onset consonant in the affix, however in fact the onset is the target of assimilation instead.

Both compounding and affixation of past tense /-de/ are word-level morphological processes in Dutch but, as we have seen, the patterns of assimilation differ. When the conflicting sequence of voiced and voiceless consonants occurs at the boundary of a word and an affix, faithfulness to the word is paramount[6] and the affix consonant assimilates in voicing to the word-final consonant: progressive assimilation. When the conflicting sequence occurs between two words the final consonant of the first word assimilates to the initial consonant of the second word:

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[5] I believe these forms can be pronounced in casual speech with voice throughout the cluster. This is not problematic - we assume that for these speakers the ranking of the relevant O-O_2 Identity constraint and the Id Ons constraint is not fixed and in the casual speech situation the IdOns constraint dominates.

Voicing Assimilation can be regressive in identical phonological environments. Thus the ordinal numbers *vijfde*, *zesde* are pronounced [veivd´, zezd´] showing regressive assimilation; compare [vijf] [sez]. These forms are not problematic but rather support the hypothesis presented here in that the cardinal -de is presumably a root level affix and these forms behave as other root level forms behave. That is with the expected regressive assimilation. See section 2.2 where a similar pattern in English (five~fifth) is discussed.

[6] Some word-level affixes behave differently; for example *-baar*. Their pattern is exactly like that found with compounds thus *maak+baar* --> *maa[gb]aar* and not * *maa[kp]aar*. In my analysis I follow earlier work in which such affixes are considered word-like. Booij and Rubach (1987) show that they function like words. Indeed they are prosodially more like words than true affixes like *-de*. So forms like these are considered pseudo-compounds I am grateful to Janet Grijzenhout for reminding me of these cases. Grijzenhout and Kramer (1999) present an detailed and interesting analysis of Dutch voicing assimilation which is in important respects very similar to mine making crucial use of the distinct prosodic organization of forms constructued at the different levels. I refer the reader to their excellent paper.

regressive assimilation. That is, the assimilation pattern for compounds seems to revert to the normal regressive assimilation pattern as ensured by IDONSLAR.

Let us now account for this apparent paradox. We introduce the constraint IDWD.

(9) IDWD: Do not change features of the WORD[7]

(IDWD is a shorthand constraint. In these forms it refers to the identity of the laryngeal feature in the word and should more properly be: IDWD-LAR in contrast to IO-IDLAR which corresponds to IDLAR above. I use the shorthand version to make the point that the WORD domain is the crucial thing: identity of WORDs overall is a feature of the phonology. (In what follows IDWD will be used to stand for identity in the word domain of the value of the harmonizing feature/s and of place features as well.)

Word faithfulness as formalized in IDWD outranks IDONSLAR and sanctions the violation of IDONSLAR. In consequence the voicing of the affix changes rather than the voice of the base-final consonant resulting in progressive rather than regressive voicing assimilation. We illustrate the effect of IDWD in the tableaux in (10) and (11)

(10)

stap+de	AGREE	IDWD	IDONSLAR	IDLAR	*LAR
stapde	*!				*
☞ stapte			*	*	
stabde		*!		*	**

Once the effects of IDONSLAR in (10). are cancelled out by higher ranked IDWD, AGREE is satisfied by the progressively assimilated voiceless sequence. When the base word ends in a voiced consonant the selected candidate is the most faithful one.

(11)

krab+de	AGREE	IDWD	IDONSLAR	IDLAR	*LAR
☞ krabde					**
krapte		*	*	*	

In compounds each word should satisfy IDWD. However, satisfying the higher ranked AGREE means one of the consonants must change. This results in an IDWD

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7 Specifically: Correspondents in a WORD-level output relation agree in voice.
The output relation referred to here is not exactly the same as Benua's O-O_2 (Benua 1997) but rather follows from the category the affix attaches to. The inflectional affix attaches to the verb before final devoicing has occured. Final devoicing is an exceptionless rule in Dutch but clearly only occurs take

violation no matter which way assimilation goes. The forms will tie with respect to the IDWD constraint. The decision then falls, in what Lombardi has shown to be the 'normal' pattern, to IDONSLAR and the form with regressive voicing assimilation is the winner.

(12)

kas+buk	AGREE	IDWD	IDONSLAR	IDLAR	*LAR
kasbuk	*!				*
-> kazbuk		*		*	**
kaspuk		*	*!	*	

kaz-pers	AGREE	IDWD	IDONSLAR	IDLAR	*LAR
kazpers	*!				*
-> kaspers		*		*	
kazbers		*	*!	*	**

So the Dutch voicing assimilation patterns in compounds exhibit a regressive assimilation effect which we understand to be the normal or unmarked pattern of assimilation. Where word faithfulness effects play a role, that is between a WORD and an affix, this pattern is systematically violated in favour of the form which is faithful to the WORD base. Where WORD-faithfulness is irrelevant because the various candidate forms violate it equally (i.e. between two words) the unmarked or normal pattern is observed.

Thus we see that the constraint triggering voicing assimilation is satisfied by assimilation in two different directions because of the requirements of faithfulness. In the following section we turn to English where we see both regressive and progressive voicing assimilation patterning in the same way as in Dutch.

2.2. English

English has both regressive and progressive voicing assimilation in affixed forms. Voicing assimilation is also observed generally as a static regularity in monomorphemic words, examples in (13.)[8]

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when the obstruent is in absolute word-final position. A word level form with an adjoining inflectional affix is not absolute word-final while a word level form in a compound (or pseudo-compound) is.

[8] There are quite a lot of exceptions; many are old derived forms (some look like level 2 derivatives eg. *roadster*): *disgust disguise disgrace* (however these often seem to be pronounced [zg]). Some are from the Greek vocabulary : *ob<u>t</u>use*, *obsolete*, but once again these are often pronounced especially in casual speech with assimilated clusters; *o[pt]use*).

(13)	abdomen [bd]	observe
	absurd ([ps] or [bz])	absent
	subdue,	subject
	fidget	absolve (?absolution [ps])
	risky	adze
	wispy	mist
	elect	cocktail
	lecture	rupture

Regressive voicing assimilation can also be observed under derivation. This assimilation is limited to a relatively small number of idiosyncratic lexical items and occurs frequently with fricatives, which I will not attempt to account for here. I will confine my discussion to the voicing patterns. Notice that all the examples in (14) below show regressive assimilation with the change in voicing showing up in the base and not in the affix.

(14) a. /-th/

five	fifth	(fifty, fifteen)
twelve	twelfth	
hundred	hundredth	
thousand	thousandth[9]	
broad	breadth [bretQ]	
wide	width [witQ]	

b. irregular inflection: /-t/[10]

leave	left	
bereave	bereft	(cf. *bereaved* [vd]..derived with regular past tense)
cleave	cleft	
heave	heft	(adjective; verb has *heaved* (past))
lose	lost	

c. irregular inflection: /-z/

leaf	leaves
sheaf	sheaves
thief	thieves
calf	calves
wolf	wolves
wife	wives
knife	knives
etc	

[9] Even though here the assimilation is not reflected in the spelling, [tQ] seems to me to be a better pronunciation than * hundre[dD] or ?hundre[dQ].

[10] We could add verbs ending in [d] which have [t] in the past: *bend~bent, lend lent,build built, spend spent,rend rent, send sent*. In derivational terms, the affix / -t/ attaches triggering assimilation and the resulting geminate degeminates: *spend+t* --> *spent-t* --> *spen*t.

d. words in -*scrib*e:

describe	description, descriptive
scribe	scripture, script
scribble	

e. words in -*ceive*:

conceive	conception, conceptive
receive	reception

An interesting alternation, which according to Jespersen 1909 [1961], is a remnant of Verner's law, shows that assimilation is regressive word-internally as well. Words with orthographic *x* are pronounced either [ks] or [gz] and in some cases the *k* ~*g* alternation is the result of voicing assimilation to the [z] which arose historically as a result of the voicing of an [*s*] in / _V⁄ (see Jespersen p203) This can be seen in the alternations below:[11]

(15)

[ks]	[gz]
e$xhibi@tion	exhi@bit
e@xercise	exe@rt, exe@rtion
e@xecute	exe@cutive
exha@le	e$xhala@tion[12]

Consider now the account of the regressive assimilation pattern in English. Observe the interaction of Lombardi's constraints in tableaux (16) and (17) in which we see the selection of the regressively assimilated candidates for two English words. In (16) we see a voiced stop becoming voiceless when an affix which begins with a voiceless consonant is attached. In (17) we consider the case of regressive assimilation preceding a voiced stop.

(16)

describe +tion	AGREE	IDONSLAR	IDLAR	*LAR

[11] This change can be seen in words like: *disease* (cf. MEng. *disese*), *design* (cf. MFr. *designer*) *disaster* (cf MFr. *desastre*, OI *disastro*), *desire* (cf. MEng. *desiren*), *resemble, resent dessert* etc. Compare: *disobey disagree disadvantage* all with [s], where in contrast the *s* is part of the prefix and the preceding vowel has secondary stress.

It must be noted that some words do not participate in this alternation at all, and others have optional variants whatever the stress; for example: *exit* may have a voiced cluster or a voiceless cluster: [egzit] or [eksit] even though the s voicing rule would not apply in this environment. Nevertheless, the crucial point here is that the cluster always agrees in voice. its never *[EkzIt]. The alternation also occurs sometimes in non ks/gz clusters. For example, *absolve* ~ *absolution* may be pronounced [Qbzolv~ QpsoluS´n]. Note that this is not the case for all speakers some of whom have non-agreeing clusters [bs] in the second word.

[12] The last example may be pronounced as [Egz´ leS´n] or [Eksh´leS´n] . Where the voiceless [h] is pronounced the preceding consonants are also voiceless. This can be observed also in forms like: *extort* ~ *extortion* (both [kst]) which do not show a voicing alternation because all segments in the cluster must agree in voicing with the last consonant, the [t] which is voiceless. So this example shows regressive assimilation as well.

descri [bZ] ion		*!	*	**
☞descri [pS] ion			*	
descri [bS]ion	*!			*

(17)

exe@cutive	AGREE	IDONSLAR	IDLAR	*LAR
☞e[gz]ecutive				**
e[ks]ecutive		*!	*	
e[kz]ecutive	*!		*	*

The analysis must be augmented for the cases where a single word-final consonant induces an alternation. Since the affix laryngeal value remains faithful, I introduce a constraint asserting that the affix be faithfully parsed.

(18) IDMS: don't change a morpheme which consists of only one segment

This constraint is ranked above IDLAR. (Notice that this constraint is essentially a type of AFFIXFAITH (McCarthy and Prince 1993), or MORPH-REAL constraint. I have formulated it this way in anticipation of a similar constraint formulated by Casali 1997, see below. Whatever we call it, it is only required here where the single consonant *is* the morpheme[13].)

Below I show two tableaux illustrating the interaction of this constraint with the rest of Lombardi's system.

(19)

five+th	AGREE	IDMS	IDLAR	*LAR
fi[vQ]	*!			*
fi[vD]		*!	*	**
☞fi[fQ]			*	

(20)

leaf+z	AGREE	IDMS	IDLAR	*LAR
lea[fz]	*!			*
lea[fs]		*!	*	
☞lea[vz]			*	**

Lombardi's system accounts for all the regressive assimilations of English. We note also that all the cases of regressive assimilation are associated with level 1 or

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13 This constraint, or an AFFIXFAITH version of it, is probably unnecessary. If we had a different explanation for the voicing assimilation effects in words like *leaves, houses* the observed patterns would fall out without IDMS/AFFIXFAITH not merely as a response to*Lar. This can be seen clearly in the tableau for *fifth*.

ROOT-level morphology and the pattern of voicing assimilation reflects that found inside underived words. Note that this intraword satisfaction of constraints means that IDWD is irrelevant here. The parallel constraint IDRT, which we have not considered here, is relevant but is outranked by the constraint ensuring faithfulness to the affix. The markedness of the whole form is paramount.

In sharp contrast to regressive voicing assimilation, progressive voicing assimilation in English is highly productive. It is associated with all the regular inflections and is also found to occur obligatorily after vowel deletion in casual speech variants of certain auxiliaries. (Voicing assimilation within words is also observed in casual speech however it is regressive (see the egs in fns 8, 11 and 12)). In these cases it is always the affix which shows the change in its laryngeal value. All the affixes concerned here are the level 2 or WORD-level variety so not surprisingly we see in these cases the predicted effect of faithfulness to WORDs.

(21) a. *regular inflection plural*:

rope~rope[s]	robe~ robe[z],
reef~reefs,	five~fives,
cat~ cats	dog~dogs...
pipe~pipes	scribe~scribes

b. *past*:

kick~kick[t]	hug~hug[d],
leaf~leafed	heave~heaved
loose~loosed	hose~hosed
hop~hopped	bereave~bereaved

c. *3ps sg.*

the cat walk[s]...	the train speed[z]
he leafs through...	the man heaves ...
he hops over...	the boy rubs...

d. *possessive*:

Pete’[s] ball	Jed’[z] cat etc
the reef’s ecology	the hive’s honey
Jack’s ball	the scribe’s pen

e. *contracted is:*

Pete’[s] going...	Jed’[z] leaving ...
Leif’s singing...	Genevieve’s running...

As noted by Lombardi, progressive voice assimilation occurs quite rarely in the languages of the world while regressive voice assimilation is frequent. It is thus very interesting that it is progressive voicing assimilation which occurs productively in English while regressive assimilation is observed only in the irregularities of the language. Notice that if regressive voicing assimilation is the normal pattern we would expect it to be observed in the irregular historical detritus. The difficulty comes when we ask ourselves why it does not occur in the regular phonology as well. Why is the productive pattern one of progressive assimilation? The answer is clearly related to the fact that it is observed with, and restricted to, the WORD-level morphology?

Ranking markedness constraints above faithfulness constraints at the first level and faithfulness constraints above markedness constraints at the second level will not provide an explanation of the English facts. The markedness constraint, AGREE , is satisfied at both levels. There is assimilation at the second level, it is just not regressive. The phonology selects the progressively assimilated forms which are faithful to the base word, rather than the regressively assimilated forms which have changes in the base word. We see from this that IDWD is ranked equal to (or above)[14] all the other constraints involved in the account of voicing alternations.

(22)

cat+z	IDWD	AGREE	IDMS/AFFAITH	IDLAR
ca[tz]		*!		
☞ ca[ts]			*	*
ca[dz]	*!			*

IDWD rules the regressively assimilated form out. Because IDWD outranks IDMS a voicing change in the affix is permitted and the progressively assimilated form is the successful candidate.

With the addition of IDWD the account of progressive assimilation in English is straightforward. Word-level identity forces faithfulness to the base and the assimilation constraint is satisfied by altering the affix instead. Since the only assimilating affixes are these productive word-level suffixes it follows that all productive voicing assimilation is progressive. The analysis predicts that a word-level prefix should assimilate regressively for the same reasons. No such prefix exists in English to use as a test case however.

It has been pointed out by Mohanan (1993) that in English the voiced segment always assimilates to the voiceless one - i.e. the change is always toward the unvoiced form. (There are some forms which seem to belie this claim, such as alternations like those illustrated by words like *wolf~ wolves* or *exert~ exercise.)* This alone might be

[14] Actually IDWD probably outranks AGREE in English. The fact that there is no regular Voicing Assimiliation between compounds as in Dutch shows that AGREE does not dominate IDWD. IDWD comes into effect in compounds and blocks voicing assimilation between the two. Between a word and an affix it ensures that the laryngeal quality of the word is always faithful.

considered explanation enough for English voicing assimilation, especially the productive progressive assimilation pattern.

However, this explanation fails to explain the distribution of the two types of affixes: why it is the WORD-level suffixes that show progressive assimilation and the ROOT level ones that show regressive assimilation. Why are the ROOT-level affixes voiceless and the WORD-level affixes voiced? Why are there no voiceless suffixes at the WORD-level which cause regressive assimilation? The analysis I propose allows for the possibility that the affixes at either level could be either voiced or voiceless - the correct patterns will come out whatever they are underlyingly but more importantly the analysis suggests a reason for why the affixes are distributed this way.

The existence of only voiceless consonantal suffixes [15]can be explained at the ROOT-level as a markedness >> faithfulness effect, as is characteristic of I-O faithfulness. Bound root level morphemes tend to be unmarked in general; they usually contain less marked segments such as coronals, they are voiceless; they exhibit restricted sets of vowels etc. This is because the effects of dominant markedness constraints would preserve the unmarked forms which will anyway be more frequent. Voiceless suffixes are unmarked - regressive voicing assimilation resolves everything in favor of the unmarked value for voicing. This is exactly what the theory predicts should be the case.

It is less clear why there are only voiced suffixes at the word-level. A possible explanation might go as follows: If only voiced suffixes occur and voicing assimilation is always resolved toward the unmarked then the affixes will be affected by the change, as indeed they are. However if there are underlyingly voiceless suffixes as well, and if the voicing assimilation situation is always resolved toward the unmarked then underlying voiceless affixes would force violations of word-faithfulness. So we might construe the distribution of voiced and voiceless suffixes in English to be itself a consequence of word-faithfulness.

Richness of the Base allows for the possibility that the WORD-level suffixes might just as well be considered to be underlyingly voiceless. It is worth noting that the same constraint ranking will pick the correct output in this situation. No matter what the voicing status of the suffix, word-faithfulness will ensure progressive voicing assimilation.[16]

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[15] Assuming there is some other story to be told about the /z/ of *wolves*, *leaves*.

[16] Lombardi's account of these facts utilizes something she attributes to Harms 1973 and names it Harms' generalization. This asserts that a voiced segment cannot follow a voiceless one at the end of a

(23)

cat+s	IDWD	AGREE	IDMS	IDLAR
ca[tz]		*!	*	*
☞ ca[ts]				
ca[dz]	*!			*

dog+s	IDWD	AGREE	IDMS	IDLAR
☞ do[gz]			*	*
do[ks]	*!			*
do[gs]		*!		

Faithfulness to words allows for a unified analysis of both regressive and progressive voicing assimilation in English. The pattern found in English parallels in many respects the pattern of assimilation in Dutch. In the following section we shall see that the analysis in terms of word faithfulness can be seen to hold true also of the patterns exhibited by vowel deletion in hiatus.

3. Vowel elision

In this section I consider Casali's (1997) explanation of vowel elision in terms of the ideas developed in this paper. The reader should be aware that, in large part, what follows is merely a reformulation of the work of Casali though I do note at relevant places where our analyses differ. The interest to us of this data is the fact that the analysis fits the general schema I am arguing for in this paper: that is that faithfulness to words has the effect of changing the manner in which a wellformedness constraint is satisfied.

When sequences of vowels arise by morphological concatenation in languages which disallow vowel sequences in syllables as well as onsetless syllables, one of them must delete, eg: $V_1\ V_2 \rightarrow V_2$ *or* $V_1\ V_2 \rightarrow V_1$. Both patterns have been observed.

The more common pattern observed is when the last vowel of a series of vowels survives while the others delete. An example is given below:

(24). Chichewa (examples taken from Casali 1997, originally from Mtenje 1992)
/si - u - pita/ --> [supita] 'you will not go'
Neg-2sg-go
/zi - a - gona/ --> [zagona] 'they have slept
NCl-Perf- sleep

---

syllable because it violates sonority. As Lombardi has noted however, Harms' generalization cannot account for the facts if the affixes are underlyingly voiceless.

To explain deletion in the crosslinguistically common case in which the second vowel wins we introduce a pair of constraints: V_2WINS and $*V_1V_2$. The first is a shorthand constraint which ensures that the second or last vowel in a sequence is retained when other vowels are deleted;[17] the second is a constraint that rules out sequences of adjacent vowels. When V_2WINS outranks MAX it forces the deletion of the first vowel as shown in the tableaux below

(25)

si -u - pita	$*V_1$ V_2	V_2WINS	Max
☞s~~i~~-u-pita			*
si-~~u~~-pita		*!	*
si-u-pita	*!		

Examples can also be found of forms in which the second vowel in a series deletes and the first one survives. Consider the examples below in which the deleted second vowel is boldfaced.

(26) Etsako: (egs from Casali p493)

/Ona ePi **O**na/ --> [OnePina]
the tortoise the 'this tortoise'

/Ona aru **O**li/ --> [Onaruli]
the louse that 'that louse'

/akpa **O**nikeTe/ --> [akpanikeTe]
cup small 'a small cup'

Casali 1997 presents an interesting explanation of patterns of vowel elision like these. He shows that the V_2WINS pattern is overriden in certain circumstances; most notably when one of the vowels is in a lexical category and the other is in a nonlexical category, such as an affix or a function word. In this situation the vowel of the lexical category is always the survivor in preference to the vowel of the non lexical category.

[17] As it stands V_2WINS is sufficient for our purposes but see Casali for further explanation. The V_2WINS pattern between affixes has not yet, to my mind, received a convincing explanation (though see Lamontagne and Rosenthall (1996) ms). In the material presented here I rely on the observations and explanations of Casali (1997) with respect to most of the facts but continue to use the mystery constraint V_2WINS when no other explanation suffices.

Among the environments he identifies as those in which faithfulness holds preferentially are the following :

- word initially
- in content words
- in root words.[18]

When any of these play a role the V_2WINS pattern breaks down. To ensure this Casali provides the following faithfulness constraints.

(27) MAXWI : Every word-initial segment in the input must have a corresponding segment in the output
MAXLEX: Every input segment in a lexical word[19] or morpheme must have a corresponding segment in the output
MAX: Every segment in the input must have a corresponding segment in the output

These constraints are universally ranked: MAXWI >>MAX; MAXLEX >>MAX. Notice the positional faithfulness constraints MAXWI and MAXLEX both refer specifically to the WORD and can be assumed to be the same as my WORD -faithfulness constraints[20].

The system of constraints given in (27) accounts for the various patterns of vowel elision observed. Thus, modulo some special cases, V1 deletes when it occurs in a prefix or function word and is followed by a content word; V2 deletes when it occurs in a suffix or a function word which follows the content word. Consider the example from Etsako below where the function word */çna/ 'the'* both precedes and follows a noun. Two sets of vowel sequences arise and are resolved differently. In both cases resolution is in favor of the vowels of the lexical word. In the first sequence the first vowel (that of the function word) is deleted, leaving the vowel of the WORD, which happens to be V_2. In the second sequence the first vowel of the function word goes and V_1 (the vowel of the WORD) wins. (The reader should assume the constraint $*V_1\ V_2$ is at the top of the ranking forcing deletion of one of the vowels in all the examples below.)

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[18] I do not include all Casali's positional faithfulness constraints here. I have restricted myself to those which illustrate the point I am making. Other cases he discusses are perceptual (long vowels survive in preference to short vowels) or morphological (the beginnings of morphemes are more faithful than the ends of morphemes). Some of these are covered by the interpretation given in this paper.

[19] I take Casali's 'lexical word' to correspond to my 'WORD' which refers to those forms which have exited the first level of the Lexical Phonology, though as discussed below, this is not what it means for him.

[20] MAXLEX= MAXWORD.

(28)

/Ona ePi Ona/ --> [OnePina]
the tortoise the 'this tortoise'

/Ona ePi Ona/	MAXLEX	MAXWI	MAX
☞On~~a~~ ~~e~~Pi ~~O~~na		*	**
Ona ~~e~~Pi ~~O~~na	!*	**	**
Ona ~~e~~P~~i~~ Ona	!**	*	**
On~~a~~ eP~~i~~ Ona	!*		**

The crucial factor in this example is the WORD-faithfulness constraint (MAXLEX) which ensures that neither of the vowels of {ePi]'*tortoise*' deletes.

For Casali, MAXWI refers to a function word as well as a lexical word. As we see it does no real work in the above example. However when elision takes place with two lexical words, as in a compound for example, elision universally targets V1. Casali attributes this to the MaxWI constraint. The reader will recognize here the situation we have seen before with compounds. There is a tie with respect to the WORD-faithfulness constraint (MAXLEX) and the violation is resolved in terms of the general/unmarked pattern of satisfaction of the constraint hierarchy. For vowel elision this is the V2 Wins pattern. I propose that the elision of V1 in this circumstance occurs because of WORD-faithfulness. Consider the examples and tableau below[21]:

(29) a.

egs. <u>Emai</u>:
/kO ema/ --> [kema]
plant yam

/kE Oka/ --> [kOka]
share maize

<u>Ogori:</u>
ebi oboro --> [eboboro] 'good water
water good

Otele Okeka --> [OtelOka] 'big pot'
pot big

b.

ke oka	MAXLEX	V_2WINS
-> k~~e~~ oka	*	
ke ~~o~~ka	*	!*

Both words in the compound are subject to the same Wordfaithfulness constraint (MAXLEX) and there is a tie. The decision falls to the lower ranked constraint so the

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21 Compare Casali's tableau:

ke oka	MAXLEX	MAXWI
-> k~~e~~ oka	*	
ke ~~o~~ka	*	!*

second vowel wins. Whatever the explanation for V_2WINS between two affixes is, it is also the explanation for this pattern observed in compounds[22]. This is because it is the one situation in which the word faithfulness constraints will be violated equally no matter which vowel is deleted. Thus vowel elision in compounds can be seen to be behaving just like voicing assimilation between two compounds in Dutch. The pattern of satisfaction of the markedness constraint reverts to the unmarked one when word faithfulness is eliminated from the picture. The second vowel wins as it does between two affixes where WORD-faithfulness constraints are irrelevant as shown in (25) above.

In many cases where suffixes follow roots the second vowel is retained. Casali's analysis predicts that the second vowel should delete in this circumstance. This is because he does not distinguish between ROOTs and WORDs which are both covered with the same constraint: MAXLEX . In discussing this, Casali rejects the notion of ROOT or WORD specific constraints because he considers the single constraint to encode the general preference for preserving material which "typically encode greater semantic content"(p500). We have argued here and elsewhere (Borowsky 1993) that there is a difference between words and roots and their relationship to faithfulness constraints and two subsets of constraints are required: those which ensure faithfulness to WORDs (MAXWD, IDWD, DEPWD) and those which ensure faithfulness to ROOTs (MAXRT, IDRT, DEPRT) and their ranking with respect to other constraints may differ. Thus where Casali has a single constraint universally ranked high we now have two constraints. The MAXRT constraint may be ranked below the V2Wins constraint. Consider (30) from Siswati in which we require this ranking. (Note that the MAXWD constraint is irrelevant because the affix - *ana* attaches to ROOTs. Changes to a root form triggered by an affix (intra-word changes) are typical ROOT-level patterns of behaviour as we saw in the pattern of assimilation found in English. This is encoded in the notion markedness >> IO faithfulness which is typical of intraword, or ROOT-level, phonology.)

(30)

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22 Casali's explanation for the pattern of vowel elisions observed in vowel sequences which arise with two affixes involves additional constraints: Max MI (Do not delete a Morpheme-Initial vowel) and Max MS (Do not delete a Monosegmental morpheme).

Consider for example the form given in (23) above repeated here using Casali's constraints:

si -u - pita	MAXMS	Max
->s~~i~~-u-pita		*
si-~~u~~-pita	*	*

imbisi-ana	V_2WINS	MAXRT	MAX
☞imbisana		*	*
imbisina	*!		*

Thus the vowel deletion facts show a robust V_2 Wins effect. I propose we understand this pattern to be the normal or unmarked pattern. Wherever WORD-faithfulness constraints do not have an effect this unmarked pattern is observed. Where WORD-faithfulness plays a role the V_2Wins effect may be knocked out of the computation. The result is that the same process of vowel deletion has different outputs depending on the faithfulness requirements of the morphological construction in which the vowels occur.

In the following section I consider some patterns of harmony and show that WORD-faithfulness can be shown to play a crucial role in the direction of harmony as well as in the patterns of harmony observed in socalled 'mismatches' (as observed by Selkirk 1980 and Nespor and Vogel 1986). Furthermore it is suggested as an interesting explanation for local harmony (Poser 1982).

4. Harmony Mismatches

Clements (1980) observed that vowel harmony systems are generally 'root controlled'. That is, it is the property of the vowels of the root which determine the quality of the vowels in the affixes and not the other way around. The property of root control has also been described as an instance of positional faithfulness. Beckman (1997, 1998) proposes that ROOTs are privileged positions requiring faithfulness. In general harmony goes ourward from the root onto prefixes or suffixes. There are however some cases in which the affix causes the ROOT to harmonize, for example in Warlpiri verbs the past and nonpast suffixes condition harmony in the ROOT.

(31) egs from Nash (1980)
kiji-rni 'throw NonPast' kuju-rnu 'throw- Past'.
kipi-rni 'winnow NonPast' kupu-rnu 'winnow-Past'

There are not to my knowledge however any cases in which WORD-level suffixes condition harmony in a WORD. Thus root control is probably more properly WORD-control.

Let us therefore consider how the privileged status of WORDs will affect harmonic processes with a discussion of mismatches (Selkirk 1980, Nespor and Vogel 1982).

Mismatches are found in compound constructions. While these compounds are single morphological domains they often have more than one phonological domain. A compound in a harmonizing language may be made of of two words with distinct and harmonic properties. If an affix is attached to the compound as a whole that affix will harmonize with the vowels of the adjacent word. The result is that phonologically the affix appears to be attached to the adjacent word directly instead of to the compound as a whole. So, a suffix attached to a compound made of two words with different harmonic patterns behaves like a suffix attached to a disharmonic root which harmonises with the vowel in the preceding syllable. This pattern is called a 'mismatch' by Nespor and Vogel because the structure of the phonological word is not isomorphic with that of the morphosyntactic word. Mismatches have been discussed recently in the Pre OT literature in such works as Cohn (1989) and Zsiga (1992). In OT they have been described in terms of alignment (Cohn and McCarthy 1994) as well as receiving a faithfulness account (Kenstowicz 1996).

WORD-faithfulness makes a very clear prediction about compounds made of words which differ in their harmony. Any compound[23] automatically has as many prosodic domains as there are WORDs in that compound since each of the WORDs must itself satisfy the prosodic constraints governing WORD. Given dominant WORD-faithfulness constraints the harmony-inducing constraint/s could not effect any change in the vowels of WORDs in a compound.

Hungarian has root controlled backness harmony: suffix vowels share the backness value of the root. Examples (taken from Nespor and Vogel 1986) are given in (32). The harmonic domains are shown in b.

(32)	a.	o‹lelesnek	'embracement Dat sg.'	cf.	o‹leles	'embracement'
		hajonak	'ship Dat sg'	cf.	hajo	'ship'
	b.	[$_{\text{-B}}$ o‹leles -nek $_{\text{-B}}$]				

[23] Note there are also root compounds which will not be subject to word faithfulness Eg. compare the word *shepherd* with *sheepskin* and *goatherd*. The first is a root compound while the latter are both word compounds. We know this because *shepherd* has one stressed syllable and the vowel of *sheep* is shortened by the level 1 process which shortens vowels when they are followed by two consonants. *Sheep* in *sheepskin* has a long vowel even though there are three consonants following it; and there are two stresses. While English does not have a great many root compounds, many languages have regular processes of root compounding as well as word compounding.

$[_{+B}$ hajo + nak $_{+B}]$

The pattern of harmony in a compound as a whole in Hungarian depends on the harmonic domains of the words which make up the compound. Harmony does not change the backness value of either of the two words. They may be the same or they may be different as shown below:

(33) $[_{+B}$ Buda $_{+B}][_{-B}$ Pest$_{-B}]$ 'Budapest' *Budapast
$[_{-B}$ konyv$_{-B}]$ $[_{+B}$ tar$_{+B}]$ 'library' *konyvter
'book collection'
$[_{+B}$ alul jaro$_{+B}]$ 'tunnel'
'under path'
$[_{+B}$ Buda $_{+B}][_{-B}$ Pest$_{-B}]$ $[_{+B}$ alul jaro$_{+B}]$ 'Budapest tunnel'

Any compound whose constituents are disharmonic remains disharmonic and if affixed the compound behaves exactly as it would if it were a disharmonic root- the affix harmonizes with the adjacent vowel. The harmonic domains of an affixed compound are shown below.

(34) { **{** { } { }**}** } *morphological structure*
$[_{+B}$ lat $_{+B}]$ $[_{-B}$ kep ‹unk$_{-B}]$ *phonological structure*
'our view' (latkep 'view' ‹unk 'our')

Without going into details about the description of the harmony process (see for example Cole and Kisseberth (1995), Beckman (1997), Reddel (1996) for analyses of harmony within OT) we can see how our system will account for this pattern. In the tableau below the optimal form is the one which satisfies WORD-faithfulness (IDWD) at the expense of a violation of harmony because there are two harmonic domains. The last form has two violations of harmony because the affix has not harmonized. The first and third forms each have fatal violations of IDWD because the backness value of the the words making up the bases have been altered.

(35)

lat+kep+unk	IDWD	Harmony
{{$[_{+B}$ lat + kap}unk$_{+B}]$ }	*!	
☞{{ $[_{+B}$ lat$_{+B}]$ $[_{-B}$ kep} ‹unk$_{-B}$ }		*
{{$[_{-B}$ let kep} ‹unk$_{-B}$]}	*!	
{{$[_{+B}$ lat] $[_{-B}$ kep$_{-B}$]}unk$_{+B}$]}		**

From this point of view the mismatch pattern is unsurprising and parallels the root controlled pattern discussed in Beckman. What would happen however in an affix controlled harmony?

Imagine a hypothetical situation in a dominant/recessive language in which the harmonic value spreads from ta dominant affix onto its host? In a compound in this language the affix could in principle trigger a change in the adjacent word so that that word harmonised with the affix but not with the word on its other side.

(36) {{[let $_{-B}$] }{[kop }unk $_{+B}$]}

This is a logically possible mismatch pattern yet, to my knowledge, no such a case has been reported.[24] WORD-faithfulness predicts that this situation would be, if not impossible, certainly highly marked.

The prediction is that harmony can, in ROOT-level constructions, be either ROOT or affix controlled but in WORD-level constructions harmony should only be WORD-controlled. Affix controlled harmony into WORD compounds which changes the vowels of the word adjacent to the affix should be highly marked if not impossible . Only the affixes should change. This prediction seems to be born out. It is not inconceivable that a dominant affix could trigger changes in the host word so why is the pattern in (33) so rare? A dominant WORD-faithfulness constraint makes changes in the host word impossible without massive word-faithfulness violations. If however the constraint motivating harmony outranks the word-faithfulness constraints then violations should be permitted equally in both of the words forming the compound so the mismatch pattern would not occur. The mismatch pattern requires some kind of dominant word-faithfulness to ensure that the word boundaries are recognized.

While there are no reported examples of this mismatch pattern with regressive dominant-affix harmony there are some interesting cases where WORD-level violations

[24] Note the pattern in (32) must be distinguished from a similar one which at first looks like it may be this pattern is in fact a construction in which the affix attaches to the second word or root prior to compounding and not one in which the affix is attached to the whole compound:

{{ root $_{-B}$ } { root aff$_{+B}$ }}

An example like this occurs in Warlpiri (Nash 1980) which has a regressive dominant harmony occuring in verbs. Regressive harmony is seen in: *kiji-rni* ‘throw NonPast’ as compared with *kuju-rnu* ‘throw-Past’. In the form *miyi-kupu-rnu* ‘food winnower’ which is a Nominal Nomic Agentive compound, the second member of the compound has harmonized with the suffix . The morphological analysis given by Nash for forms like these is:

{{miyi}{kupurnu }}
{food} {winnow-Past}

and hence the example is in fact not a counter example.

seem to occur locally in contrast to the usual long distance harmony patterns in the language. I would like to propose that such cases are minimal WORD -faithfulness violations. The point is that while it is unlikely that a harmony rule could affect a whole word because that would result in massive violations of WORD-faithfulness, it is possible that the grammar might choose to satisfy harmony minimally, governed by the number of WORD-faithfulness violations that occur. One such violation would be better than two or three - and so on.

In his discussion of harmony in Nez Perce, which has dominant affix harmony, Aoki (1966) observes:

> "In terms of word classes, morphological words and harmonic sequences are always coterminous in verbs, eg./wu:lelikepese/ '*I am riding into bushes*', /wo:lalikapasaqa/ '*I rode into bushes recently*'. On the other hand there is considerable discrepancy in substantives: for example, the word for the *Red River* in Idaho has three freely varying forms: /tukpe:nwawa:m/, /tukpa:nwawa:m/, /tokpa:nwawa:m/..." p 761

Let us consider the hypothesis that the difference in the patterns in verbs and nouns is attributble to the ROOT/WORD distinction. Complex verbs like these, made of bound root plus affixes are frequently ROOT-level constructions. They are, as a result, single phonologic domains; the harmony is 'intraword' harmony.

(37) {[wu:lelikepese$_{-F}$]}$_{WD}$
{[wo:lalikapasaqa$_{+F}$] }$_{WD}$

The harmony constraint in Nez Perce dominates ROOT-faithfulness constraints with the result that all the vowels of the form harmonize.

(38)

/wU:lElIkEpEsE+ qa/	Harmony	IDRT
->{wo:lalikapasaqa$_{+F}$}		*
{wu:lelikepeseqa$_{-F}$}	*	

WORD-faithfulness comes into the picture with the nouns (which are free forms and not bound roots). If IDWD is not crucially ranked above the harmony constraint variation can occur. The IDWD constraint may block harmony completely, however the phonology will always be able to choose between a series of other possibilities going from the least unfaithful, with one harmonized vowel, to a completely unfaithful one, where all the vowels are harmonic. So harmony is gradient in this circumstance because of the conflict between the requirement of faithfulness to WORD and the markedness constraint: Harmony. I do not know how the system accounts for why all the different variants occur but it seems to me these gradient patterns indicate that when violating a constraint like this the grammar prefers less violation to more violation.

(39)

/tUkpE:nwAwa:m	IDWD	Harmony
☞tukpe:n{wawa:m$_{+F}$ }	*	**
tuk{pa:nwawa:m$_{+F}$ }	**	*
{tokpa:nwawa:m$_{+F}$}	***	

(40)

/tUkpE:nwAwa:m	Harmony	IDWD
tukpe:n{wawa:m$_{+fF}$ }	**	*
tuk{pa:nwawa:m$_{+F}$ }	*	**
☞ {tokpa:nwawa:m$_{+F}$ }		***

In rapid speech in Nez Perce harmony often occurs across word boundaries by one syllable. Compare the normal speech and rapid speech variants in the following phrase:

(41) normal speech /?itamya:tas ?ewsi:x/ 'they are for sale'
rapid speech /?itamya:tes ?ewsi:x/

These examples suggest that while WORD faithfulness is dominant in careful speech, in rapid speech minimal violations occur. The point is that they are minimal - on a single syllable rather than the whole phrase and they seem to indicate that while the fully hamonized forms may occur (like one of the options for Red River), the preferred pattern is the one with the minimal violation: that is, only one vowel harmonizes. A similar explanation might be offered for other cases where the harmonizing feature is known to spread to only one adjacent vowel: see for example the discussion of local harmony in Chamorro and Lango in Poser (1982)[25]. WORD-faithfulness, if it must be violated in satisfaction of harmony, is violated minimally.

[25] In Chamorro the first vowel of a word harmonises when the word is preceded by a high vowels particle. In Lango certain suffixes cause the last vowel of the preceding form to harmonize. In Somali which has ATR harmony which is root controlled, certain determiners which attach to nouns as suffixes cause the final vowel of the noun to harmonize with the determiner.

In these cases the morphemes concerned are certainly consistent with the assumption that they are word-level morphemes however at the moment this remains speculation.

5. Nasal Place Assimilation

In the last section of this paper I turn to another set of facts which seem to support the ideas in this paper. Nasal Place Assimilation, like voicing assimilation, is a process which characteristically spreads place features regressively from a segment to a preceding nasal. Padgett (1997), following Lombardi, explains this directional property of place assimilation with a positional faithfulness constraint requiring faithfulness to place in onsets: IDONS-Pl. I will not give details of his analysis here. It need only be noted that once again the analysis predicts regressive assimilation so any progressive assimilations that occur require special explanation.

Such an explanation is therefore required for the pattern of progressive nasal assimilation observed in Dutch. Van der Hulst and Kooij observe that in diminutives in Dutch nasal place assimilation is progressive. As above we shall show that this pattern can be derived as a consequence of WORD-faithfulness.

The diminutive in Dutch is marked with the word-level suffix *-tje [c´]*. The suffix has various allomorphs as shown in (42). We will be concerned here only with the last three forms which show progressive place assimilation

(42)	bal + tje	[bAl´c´]	'little ball'
	ei	[Eic´]	'little egg'
	stoel	[stulc´]	'little chair'
	lap	[lapj´]	'little rag'
	duim	[dømpj´]	'little thumb'
	mes	[mESj´]	'little knife'
	mand	[mAnc´]	'little basket'
	koning [N]	[ko:n´Nkj´]	'little king'
	besem	[bez´mpj´]	'little broom'

In all forms like the last three above where the word ends in a nasal consonant, the obstruent of the suffix assimilates in place to the the word-final nasal rather than the nasal to the preceding obstruent. Thus these forms are not pronounced **koni[¯c]e* or **beze[[¯c]e*. The place of the word-final segment remains faithful and the affix consonant undergoes the rule. The tableaux in (43) and (44) illustrate:

(43)

duim +tje	NAS-AGREE	IDWD	IDONSPL
☞duimpje			*
dui[¯c]e		*!	

dui[mc]e	*!		

(44)

koni N +tje	NAS-AGREE	IDWD	IDONSPL
-☞koni{Nk}je			*
koni[¯c]e		*!	
koni {Nc}e	*!		

The nasal assimilation constraint dominates the others so assimilation is obligatory here. IDWD dominates the positional faithfulness constraint and hence the form in which the word level affix assimilates is selected by the constraint hierarchy.

Thus we see another case in which WORD-faithfulness results in a constraint being satisfied by assimilation in a different direction from the normal one[26]. While nasal assimilation in Dutch is generally regressive from the onset onto the preceding nasal, here it is progressive from the final nasal onto the following obstruent.

I have shown in this paper that faithfulness to WORDS is a robust phenomenon in phonological systems. I have discussed various processes which apply to different kinds of morphological inputs and shown that faithfulness to the WORD has the effect of causing different kinds of outputs in satisfaction of the same constraints. We have seen as well that in these cases where a constraint is satisfied differently at the WORD or ROOT level, the WORD-level is characterised by a return to the common or 'normal' pattern: in voicing assimilation and nasal place assimilation the normal direction is regressive assimiliation. When WORD faithfulness blocks this progressive assimilation takes place instead. When there is a choice of which vowel to delete where two vowels come together, WORD faithfulness usually determines which one will remain.

References:

26 There is another possible explanantion for this pattern of assimilation. We can assume instead that the direction of place assimilation in these examples is governed by the hierarchy of markedness of place. The coronal consonant is always the undergoer of harmony because it is less marked. Since it is the affix consonant which is coronal it will always be the affix consonant which undergoes the assimilation. An analysis like this is supported by the pattern of assimilation found in Afrikaans. In Afrikaans the diminutive begines with a dorsal consonant and the assimilations go always in the direction of the less marked consonant: thus labial>>dorsal>>coronal. The assimilation is regressive when the word-final consonant is coronal and progressive when it is labial:

duim+kie	dui[mpi]	little thumb
koning	koni[Nki]	little king
soen	soi[Nki]	little kiss

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