North East Linguistics Society

Volume 16
Issue 1 *NELS 16*

Article 4

1985

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THE OCP AND NYANGUMARDA BUFFER VOWELS

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Nyangumarda exhibits a type of vowel harmony which, in certain respects, is not uncommon among Australian languages (cf. Warumungu (Dixon(1980)), Mayi (Breen (1981)): the vowels of some morphemes surface as identical to the preceding vowel. The Nyangumarda data are found in Hoard and O'Grady (1976) and O'Grady (1964).*

(1)

a.	yurpa-lama-rna	rub-future-1s
b.	wirri-limi-rni	put-future-1s
c.	kalku-lumu-rnu	care for-future-1s

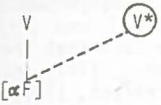
(2)

a.	yurpa-rna-ma-l#nqa-ngarra	'If 3s had rubbed 3s (long ago)...'
b.	kalku-rnu-mu-l#njurru-ngurru	'If 2p had cared for 3s (long ago)...'

These forms are readily handled in autosegmental terms by positing underlying representations of some morphemes with no vowel features combined with a rule spreading all vowel features rightwards.

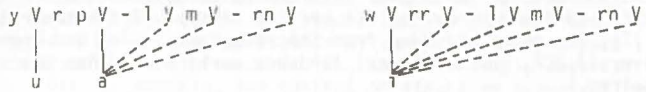
(3)

Vowel Harmony (first version)



For surface forms lik yurpalamarna or wirrilimirni, the derivations are shown in (4) (the solid lines indicate the effects of the Universal Association Convention (from Pulleyblank 1983) and tne dasned lines indicate the effects of (3)).

(4)



There is an empirical problem with this account however. In words with more than one harmony trigger, the domains affected by these triggers are separated by the vowel a, called a buffer vowel.

(5)

a.	yurpa-lapa-li	(*yurpa-lapa-la)	rub-fut-1dinc
b.	wirri-lipa-li	(*wirri-lipi-li)	put-fut-1dinc
c.	kalku-lupa-li	(*kalku-lupu-li)	care for-fut-1dinc

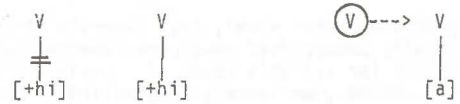
(6)

a.	wurra-lama-ngu	(*wurra-lama-nga)	tell-fut-to2s
b.	wirri-lima-ngu	(*wirri-limi-ngu)	put-fut-to2s
c.	kaku-luma-ngu	(*kaku-lumu-ngu)	forget-fut-to2s

If we adopt rule (3), we must include two additional rules to insert a in the correct environments, one which delinks the features of i/u and the other which inserts a.

(7)

a. delink high vowel b. insert a



In this article, I show that the peculiar appearance of the vowel a is readily explained as the combined effects of the theory of underspecification (Pulleyblank (1983), Archangeli (1984)) and the Obligatory Contour Principle (OCP) (McCarthy (to appear), Archangeli and Pulleyblank (in prep)). Underspecification is used to account for the fact that the vowel a behaves asymmetrically with respect to i and u, (7b), and the OCP is invoked to explain the "buffer vowel" effect, (7a). Following Archangeli and Pulleyblank (in prep), I extend the OCP to prevent adjacent syllable nuclei from bearing identical feature matrices. In these configurations, the OCP causes a vowel slot to be left featureless. Redundancy rules required by the theory of underspecification to specify feature values provide the unspecified slot with the values for [a]. The resultant grammar is simpler than one which uses neither underspecification nor the OCP because instead of the two rules in (7), the effects follow from the redundancy rules and the universal OCP.[1] No additional language particular rules are required.

We first consider the formulation of the OCP and of the underlying representations necessary to account for the buffer vowel phenomenon without additional rules. Certain problems arise, all of which involve palatal consonants. An additional rule of regressive harmony triggered by the palatal consonants not only resolves these problems, but also provides evidence for the precise underlying (and underspecified) representations of the vowels.

1 The Account

Central to the analysis offered here are two proposals, the theory of underspecification and a parameterization of the Obligatory Contour Principle. We discuss each in turn.

1.1 Underspecification

The quality of the buffer vowel, [a], suggests strongly that /a/ is the totally unspecified vowel, represented by a featureless vowel slot (or syllable head, cf. Levin 1985). Following Archangeli (1984), we leave a unspecified in underlying representation. This means that the specifications of a's

features are not present in the underlying representation of any vowel. In other words, [-high], [+low], [-labial], and [+back] are not specified on any vowel. We are left, then, with the underlying specifications in (8) and the two redundancy rules of (9).

(8)

	i	a	u
high	+		+
labial			+

(9)

a. [ ] --> [-high]
b. [ ] --> [-labial]

The feature complexes of (8) are more than simply a set of possible matrices from which underlying representations are concatenated. They also define which sounds may be created by rules: lexical rules create only those feature combinations present in (8). If the application of some rule would create some combinations not present in (8), the rule simply does not apply. This is, roughly, the concept of structure preservation. (See Borowsky (1984) for more on structure preservation.)

The effect of these feature matrices on phonological representations is that some vowel slots have corresponding vowel matrices (either [+high] or [+high, +labial]), and some have no corresponding matrix. In particular, the morphemes subject to harmony have no vowel matrix in underlying representation.

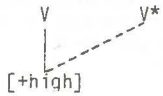
(10)

l V p V	r n V	n g V r r V
'future'	'Is'	'if'

The featureless vowel slots surface as [i] or [u] if harmony (or possibly some other rule) applies, but if nothing at all applies, they surface as [a], by application of redundancy rules. The revised harmony rule is given in (11).

(11)

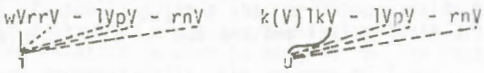
HARMONY (second version)



In the derivations in (12), the effects of the Universal Association Convention are given with solid lines and of the harmony rule with broken lines.[2]

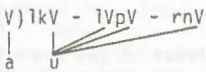
(12)

HARMONY



REDUNDANCY RULES

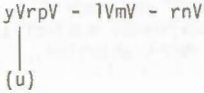
n/a



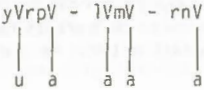
High vowels, both /i/ and /u/, spread rightward onto featureless slots; a is inserted on any slots not assigned features by harmony. However, when the rightmost "available" vowel is a, no harmony takes place since there are no features to spread. Instead, the redundancy rules of (9) supply the features for a to the empty slots. Compare the derivations of (12) with (13).

(13)

HARMONY



REDUNDANCY RULES



The vowel a is inserted by redundancy rule (9).

1.2 The Obligatory Contour Principle

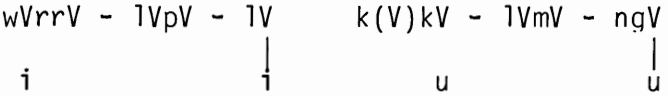
As stated in McCarthy (to appear), the OCP prohibits adjacent identical elements at the melodic level. Following Archangeli and Pulleyblank (in prep), I allow a parameterization of the OCP, in which the default parameter is as stated in McCarthy. The marked parameter prohibits adjacent identical melodic elements at the skeletal level. The result is that although a melody may contain adjacent identical elements these elements may not associate to adjacent skeletal positions on the relevant projection. Here, consonant positions are ignored, since they are not part of the vowel projection.

Let us consider the interaction of the harmony rule and the skeleton-sensitive OCP in Nyangumarda. These two interact only

in sequences which have two harmony triggers -- for example when an i- or u-final root is followed by a harmonizing suffix which is in turn followed by an invariable suffix -- one which is always either i or u. This situation is seen when wirri 'put' is followed by the future suffix lVpV which in turn is followed by li 'we two'. Similarly, kVku 'forget', lVmV 'future', and ngu 'to you'. (The alternation between lVmV and lVpV depends on whether there is a nasal in the following morpheme.)

(14)

UNDERLYING REPRESENTATION

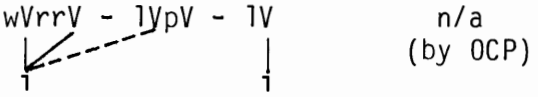


UAC & HARMONY -- first association line

The operation of harmony is separated into each addition of an association line to make evident the effect of the OCP. In kakulumangu, harmony cannot add a second association line because that would create the disallowed u-u sequence on adjacent V slots. However, in wirrilipali, a second association line is possible:

(14) cont.

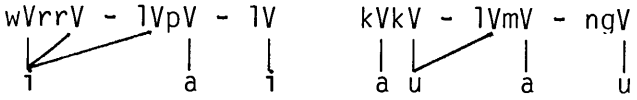
harmony -- second association line



Harmony is no longer applicable in either form for if it were to apply the impermissable [high]-[high] sequence on adjacent V slots would arise. The extrametricality in kaku is lost and redundancy rules now apply, inserting the features for [a] on all featureless skeletal slots. In addition, of course, the matrices of /i/ and /u/ are filled out as well.

(14) cont.

REDUNDANCY RULES



A final question which must be addressed is which features are relevant for determining "identity" for the OCP. I suggest that it is exactly the feature which is required in the harmony rule itself, [+high]. In other words, when the OCP constrains operation of a rule, the features it is responding to are those features required by the rule, here [+high]. Thus, Nyangumarda does not allow sequences of any [+high] vowels, regardless of the value held for the feature [+labial] by the vowels. This is, in fact borne out -- the buffer vowel effect obtains whether the two harmony triggers are /i/ and /u/ or both are /i/ or both are /u/:

(15)

/kalku - lVpV - li/ /wirrV - lVmV - ngu/
[kalkulupali] [wirrilimangu]
(*kalkulupuli) (*wirrilimingu)

UNDERLYING REPRESENTATION, UAC, and HARMONY

REDUNDANCY RULES

Thus, with the underlying representations necessitated by underspecification theory and the parameterized OCP, nothing more need be said about Nyangumarda buffer vowels than that there is a harmony rule spreading the value [+high] rightward.

2 Consonant-Induced Harmony

Palatal consonants appear in the midst of unexpected harmony patterns: the vowel to the left of a palatal consonant is not a buffer a nor a harmonized u as expected. Instead, the vowel i appears.

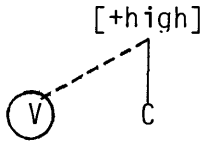
(16)

a.	yurpa-lami-nji	rub-fut-1pinc
	(*yurpa-lama-nji)	
b.	wirri-limi-nji	put-fut 1pinc
	(*wirri-lima-nji)	
c.	kalku-lumi-nji	care for-fut-1pinc
	(*kalku-luma-nji)	
	(*kalku-lumu-nji)	

I follow O'Grady (1964), Hoard and O'Grady (1976), and van der Hulst and Smith (1985) in expressing this as a rule of consonant-induced assimilation. The rule spreads the feature [+high] leftward from a consonant to a vowel.[3]

(17)

C ASSIMILATION



Note that if this rule precedes the redundancy rules, then structure preservation prevents (17) from applying if the consonant is [+high, +back] (i.e. /k/, /ng/, /w/) since [+high, +back] is not a permissable combination for vowels (see (8)). Thus, the formalization of the rule need not overtly rule out [+high, +back] consonants as triggers. There is evidence for this rule preceding the redundancy rules: assimilation from palatal consonants only occurs if the target vowel slot has no features. If it has features in underlying representation, C-induced Assimilation has no effect. We see this with lku, the expectative mood suffix, which always surfaces with [u], regardless of what follows.

(18)

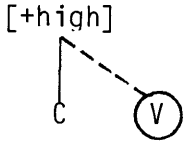
yurpa-lku-rnu	yurpa-lku-nji
	(*yurpa-lki-nji)
'2sexc will rub'	'1plin will rub'
ngalp-u-rnu	ngalp-u-nji
	(*ngalp-i-nji)
'2sexc will enter'	'1plinc will enter'

Exactly this distribution is predicted if (17) precedes the redundancy rules.

There is a further generalization about the distribution of vowels around palatal consonants. Palatal consonants are followed either by u (njurru '2p', njumpulu '2du'), or by i (yi '3p', nji '1pinc', yirni '1pexc'), and rarely by a (tjana '3p-nonsubj'). The rarity of a after palatal consonants is expressed by a rule spreading [+high] to a following featureless slot, a rule which is exceedingly like the rule of vowel harmony.

(19)

C-INDUCED HARMONY (preliminary)



This rule derives i from featureless slots thus making a costly in this environment. If the vowel that is a target of (19) is already specified as u, (19) cannot apply as the slot is not featureless.

The vowel derived by the application of (19) in turn is a vowel harmony trigger:

(20)

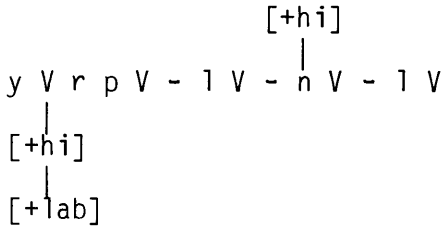
yurpa-li-nji-li	</yurpA-lV-njV-lV/
	rub-imp-1pinc-neg
*yurpa-li-nji-la	

Consequently, not only must (19) be ordered before (11), but also some kind of transfer from C melody to V melody must occur. Furthermore, the similarity between (11) and (19) coupled with the observation that the vowel resulting from (19) induces (11)

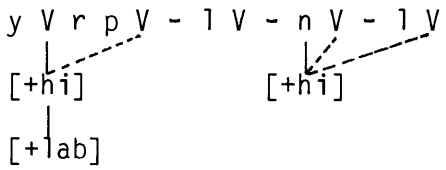
is so striking that these two perhaps should be expressed as a single rule. Adapting work by McCarthy (to appear) and Schlindwein (1985), I suggest that the transfer from consonant melody to vowel melody is a process of "melody alignment" (McCarthy's "tier conflation"), and that it is the nature of this alignment that allows expressing the two rules as one. (This proposal is expanded in Archangeli (1986).)

In consonant-induced harmony, the [+high] feature of the consonant spreads onto a vowel slot. The effect of such a rule and the notion of melody alignment is that the consonantal [+high] aligns with the vocalic melody in order for the consonantal feature to anchor to the vowel position. Consider the derivation of yurpalinjili </yurpA-lV-njV-lV/. In (21), the consonantal features other than palatalization are represented in the core skeleton for clarity. All morphemes are concatenated here.

(21)



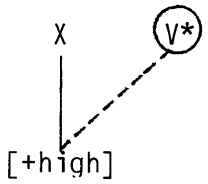
HARMONY (11 & 19) -- induces melody alignment



We can now collapse the two harmony processes into a single one, a rule which takes either consonants or vowels as the trigger. (This rule is identical to the one proposed in Sharp (1986) for the southern dialect of Nyangumarda. The dialect she discusses has a more complex harmony system, however.)

(22)

HARMONY (final version)

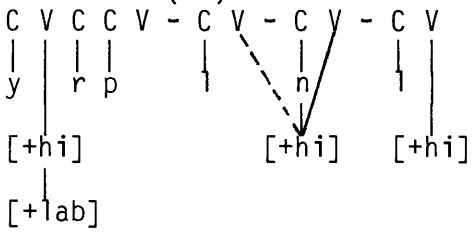


The feature [+high] spreads rightward onto a sequence of featureless vowel slots.

The derivation in (21) above is incomplete. C Assimilation can also apply, yet this creates an apparent problem. An OCP violation is created if the rule applies to the representation in (21). If this rule is ordered in the post-lexical component, however, then the rule is applying after all melodies have aligned. As a result, consonants and vowels are now on the same plane, and the consonantal features block the OCP violation.

(23)

C ASSIMILATION (17)



3 Conclusion

An OCP sensitive to the core skeleton is invoked to prevent i-u, i-i, u-i, u-u sequences, where the two vowels have independent matrices. This use of the OCP explains the distribution of buffer vowels in Nyangumarda (the a that appears between two harmony domains). Underspecification is used to determine the quality of the buffer vowel -- /a/, not /u/ nor /i/. Melody alignment provides a principled means for expressing all rightward spread of [+high] as a single rule, and provides an explanation of why C Assimilation is possible. Thus the language suggests support for the parameterized OCP, the theory of underspecification, and melody alignment induced by phonological

rules.

FOOTNOTES

*The idea of the OCP being sensitive to the skeleton as well as to melodies originated with Doug Pulleyblank -- many thanks to him for the stimulating discussions which inspired this analysis. A more complete version of the analysis appears in Archangeli (1986).

[1]A similar proposal about the quality of the buffer vowel is made in van der Hulst and Smith (1985). Their proposal makes use of vowels specified in underlying representation as [-high] (/a/), [+high, -back] (/i/), and [+high, +back] (/u/), and a completely unspecified vowel slot which undergoes harmony. Here we adopt a more restrictive theory of underspecification, in which features are specified either as + or as -, but not with both values, in underlying representation. See references cited in text.

[2]Following van der Hulst and Smith (1985), I assume that in kalkulumarnu, the leftmost vowel is extrametrical and so is not available when the Universal Association Convention initially anchors matrices in vowel slots. Similarly, in yurpalamarna, vowel harmony does not spread /u/ because the vowel matrix itself is extrametrical. Before redundancy rules apply, however, all vowels and all matrices lose extrametricality and are available for being filled in by redundancy rules. In the case of kalkulumarnu, the initial vowel is supplied with the features for [a]. With yurpalamarna, the floating /u/ loses its extrametricality and so associates to the leftmost (free) vowel slot. Harmony has applied previously and so does not re-apply at this stage. Rather, all other vowel slots are supplied with the features for [a].

[3]This rule (17) and rule (19) are both similar to the analysis in van der Hulst and Smith (1985). The present account differs in the use of the OCP, structure preservation, underspecification (as noted in footnote 1), and melody alignment.

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