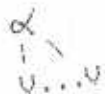


1. Introduction

1.1. The issue

This paper investigates the conditions under which phonological rules may apply to structures like (1), where α is a feature or group of features characterizing point of articulation in vocalic segments and where its associated V positions are non-adjacent.

(1)



1.2. Geminate blockage

Autosegmental phonology makes available the structural distinction between a single autosegment multiply linked, as in (1) and (2)a, and a sequence of identical but distinct, singly linked autosegments, as in (2)b¹:

(2)

a.



b.



Tier 1

Tier 2

Instances of the structures in (2)a are long (geminate) segments or multiply linked feature specifications, the latter resulting typically from rules of partial assimilation².

1. See Leben (1980), Hayes (1986), Schein and Steriade (1986) and references therein. The distinction between (2)a and (2)b has been documented by Kenstowicz (1982) and Schein (1981).

2. On partial assimilation resulting in structures like (2)a, rather than (2)b, see Goldsmith (1979), Schein (1981), Steriade (1982), Hayes (1986a), Schein and Steriade (1986).

One test of the distinction between the structures in (2)a and (2)b is the fact that they undergo phonological rules in different ways. A rule like (3), Tigrinya Spirantization, is not undergone by the structural equivalent of (2)a - a geminate kk - but is undergone by the first in a sequence of two distinct k's³, as shown schematically in (4):

(3) Tigrinya Spirantization

k → x /
 -
 |
 V C, where V and C are adjacent

(4)

a.

 k
 / \
V C C

b.

 k k -→ x k
 | | | |
V C C V C C

The impossibility of applying rules like Spirantization to strings like (4)a - a phenomenon I refer to as geminate blockage - has been documented so far only for autosegments linked to adjacent positions. Kenstowicz (1986) has suggested that adjacency between β and γ in (1) may be critical factor in geminate blockage. If so, the discontinuous constituent in (1) will permit rule applications normally blocked by 'close range' linkings. The main goal of this study is to show that all types of multiple linking - both at close range and at a distance - block phonological rules in the same way.

Geminate blockage has been given two formal accounts. One is Hayes' (1986) Linking Constraint:

(5) The Linking Constraint (Hayes (1986))

Association lines in structural descriptions are interpreted as exhaustive.

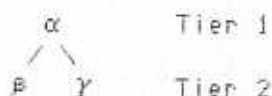
3. See Kenstowicz 1982 and Schein 1981.

If the structural description of a rule mentions an autosegment α singly linked to elements of some tier T, the Linking Constraint will block the application of that rule to strings in which α is multiply linked to T. In the case of Tigrinya Spirantization, the structural description of the rule mentions a single link from the segment \underline{k} to the skeleton: the rule may not therefore apply to strings containing multiply linked \underline{k} 's.

Schein and Steriade (1986) have proposed, as an alternative explanation for geminate blockage, the Uniform Applicability Condition (UAC):

(6) Uniform Applicability Condition (from Schein and Steriade (1986))

No rule may alter α in the configuration below unless β and γ satisfy the same structural conditions.



According to the UAC, Tigrinya Spirantization cannot affect the geminate \underline{k} in (4)a because only one of the two C's associated with it is adjacent to the context U.

There are two factors differentiating the UAC from the Linking Constraint. First, the UAC claims that multiply linked autosegments will block only rules whose effect is to alter them, by changing or removing their contents: context geminates are predicted never to block rules. In contrast, the Linking Constraint is based on the hypothesis that target and context autosegments will have the same effect on rule application. Second, the UAC allows a class of rules to alter geminates even when their structural

description mentions only singly linked structures. To see this, let's imagine that adjacency is not a factor in the statement of Spirantization: assume that Spirantization is the rule in (7), which applies every time k is preceded anywhere in the string by a V.

(7)
 $k \rightarrow x / \quad \begin{array}{c} - \\ | \\ V \dots C \end{array}$

This rule will be allowed by the UAC to apply to the geminate in (4)a: both C's in (4)a follow the context V and therefore both C's satisfy the same condition of precedence imposed by the rule. The Linking Constraint, however, will continue to prevent geminate kk's from being affected by rule (7).

In the course of investigating geminate blockage with the structures in (1), we will uncover evidence that supports both hypotheses expressed by the UAC.

1.4. Outline

The paper is structured as follows: I present first (section 2) a set of data from Javanese which form the basis of Kenstowicz's (1986) argument that discontinuous constituents like (1) are not subject to geminate blockage. I show next, in section 3, that an alternative analysis of these data is possible; that the alternative is the only one compatible with a restrictive view of phonological locality conditions; and that it is supported by further evidence from Javanese. The conclusion of section 3 will be that the structure in (1) exists in Javanese, as argued by Kenstowicz, but that the

multiply linked α in (1) is a context rather than a target autosegment, in the rules considered by Kenstowicz. Therefore the application of the Javanese rules to (1) is consistent with the UAC and with the hypothesis that geminate blockage may be triggered by discontinuous geminates. I examine in section 4 what happens when the multiply linked α in (1) is the target rather than the context of a rule: in this case, evidence from Yakan and Lowland Murut indicates that α undergoes the rule just in case each one of the associated V positions satisfies its structural conditions. However, when one of the V 's fails to do so, the rule is blocked: this is then direct proof that discontinuous geminates may cause blockage.

2. The Javanese Vocalism

In the analysis proposed by Dudas (1976), Javanese, an Austronesian language spoken on Central and East Java, has the six underlying vowels in (8).

(8) Underlying Vowels of Javanese

i	a	u
e	a	o
	a	

The surface vocalism is derived mainly by two processes: vowels are laxed in closed syllables, as shown in (9), and word-final a is rounded to o, as in (10).

(9) Tense and Lax Vowels⁴

- a. i/I: apI? 'good, nice', wiwIt 'beginning', buri 'back', murIt 'student'
- b. u/U: jamUr 'mushroom', JupU? 'go get', ibu 'mother', tuku 'buy,'

4. Unless otherwise indicated, the data comes from Dudas (1976).

gUrudi 'drill'

- c. e/E: aKEh 'much,' oIEh 'get', ket0? 'to appear as spirit,'
do.ngEng 'story,' gâde 'big,' Kere 'beggar,' rewang 'servant'.
d. o/O: je.ng0t 'beard', kat0n 'appear', kâno 'ca', bodo 'stupid,'
rosa- 'strong' donEn 'story'.

(10) A/O Alternations

- a. jiwa-ku 'soul-mine' Jiwo 'soul'
 jiwa-ne 'soul-his'
- b. rupa-ku 'color-mine' rup0 'color'
 rupa-ne 'color-his'
- c. ng-iya-ni 'say yes' iy0 'yes'
- d. meja-ku 'table-mine' mej0 'table'
 meja-ne 'table-his'

Dudas posits underlying representations like /api?/, /akeh/ and a rule of Laxing in closed syllables that yields the surface api?, akeh. For the a/O alternation, Dudas argues that a is basic, hence underlying /meja/ is turned into mej0 by a rule of final a rounding. In both cases, Dudas considers a wide range of alternative analyses and shows that they are inferior to the one adopted. I give a provisional statement of both rules below:

(11) Laxing (provisional)

[ɨ] → [-tense] / -
 |
 VC.

(12) Rounding (provisional)

[+low] → [+round] / __##

Both Laxing and Rounding appear to overlap in morphemes containing identical vowels. Morphemes of the form eCeC, oCoC lax both vowels, although

5. Syllabic divisions are not indicated, except where unusual (cf. (9)d je.ng0t). On the syllabification of Javanese see Yallop's (1982) comments.

only the second is in a closed syllable.

(13) Overapplication of Laxing

eCeC -> ECEC: 1ErEn 'to rest,' E.ntjEr 'thin'
.oCoC -> OCOC: gOdOg 'to boil,' kOdO? 'frog'

Morphemes of the form aCa round both vowels when the latter only is word-final:

(14) Overapplication of Rounding:

CaCa -> COCO: basa-mu 'language-yours': bOsO 'language'
ka.nca-ku 'friend-mine': kO.ncO 'friend'

Laxing and Rounding overapply only when the vowels are strictly identical - compare 1ErEn with ketO? - and tautomorphic. A word-final suffixal -a undergoes Rounding without however allowing the rule to affect a preceding heteromorphic a:

(15)

/n-dolan-a/ 'play-imperative' -> ndolanO
/djara-nana/ 'drill-locative/imperative' -> djara-nOnO

According to Dudas, the apparent overapplication of Laxing and Rounding in (13) and (14) is due to independent rules of vowel harmony. But stating these is not a trivial task: the harmony rules must apply between tautomorphic, underlyingly identical vowels. The condition of underlying identity is necessary because, by the time the harmony rules apply, the vowels of aCa, oCoC morphemes are no longer identical: an aCa string has been turned by Rounding into aCO, a oCoC string has become oCOC. Dudas' harmony rules must distinguish between a derived -oCO- (from oCa by Rounding) and a derived -oCO- (from :oCoC by Laxing), since they must apply to the latter but not the former. A second source of difficulty is the restriction to morpheme-internal environments (recall (15)): this condition violates strict

cyclicality, on any of its formulations.

Kenstowicz (1986) has given an alternative analysis of the Javanese vocalism that obviates each of these problems. The central idea of Kenstowicz' study is that Javanese morphemes with identical vowels in adjacent syllables are in fact monovocalic: there is a single instance of a in aCa, a single instance of o in oCoC. The specifics go like this. Vowel and consonant segments are assumed to occupy different tiers, with the Obligatory Contour Principle (OCP) holding of both tiers and enforcing the multiply linked representations in (16):

(16)



Laxing and Rounding apply to both singly and multiply linked vowel segments. In structures like (16)a, the structural description of Laxing is met in the second syllable and the rule applies: but because the segment affected is shared by the preceding V, Laxing affects this position too. Similarly, in (16)b, Rounding is met by the second, word-final instance of a: it applies and cannot help affecting both V positions to which this a is linked.

The reader will have noted that Laxing applies across-the-board only with mid vowels: forms like wiwit, jupit, cited earlier in (9)a-b, show that the laxing of high vowels is strictly limited to closed syllables. Kenstowicz offers several alternative explanations for this fact. The one that seems most plausible relates to this detail of Laxing a fact about cross-boundary

syllabification: before vowel-initial suffixes, a stem-final mid vowel always undergoes Laxing, thus anEi 'difficult', n-anEi-i 'make difficult'. Since the surface syllabification appears to be na.nE.li, this indicates that Laxing affects mid vowels at a point in the derivation where the cyclically assigned syllable boundaries are still in place: na.nel.i undergoes Laxing to become na.nEi.i, then resyllabification, to yield the surface na.nE.li. High vowels behave differently in this respect as well: /tulis/ 'write' becomes tulis word-finally and before consonants, but /n-tulis-a/ becomes ntulisa, and eventually nulisa before a vowel-initial suffix. This suggests that Laxing affects high vowels only after cross-boundary resyllabification has taken place. It follows then that Laxing applies on a first round to mid vowels only and only on a second round, perhaps postlexically, to high vowels as well. Kenstowicz suggests that the multiply linked structures in (16) are available only lexically, for the first application of Laxing: this will explain why there is no across-the board effect in stems like wiwit.

Kenstowicz notes that the application of Laxing and Rounding to structures like (16) is incompatible with both the Linking Constraint and the UAC. The UAC is violated because, in each case, one of the two positions to which the target vowel is associated fails to satisfy a requirement of the rule: the first V in (16)a is in an open syllable; the first V in (16)b is non-final. The Linking Constraint is violated because, although Laxing and Rounding mention a singly linked vowel in their structural description⁶, these rules

6. The statement of Rounding given in (12) mentions no link to the skeleton at all. But the reader should bear in mind that, within Kenstowicz' analysis, Rounding must be reformulated as below, in order to ensure that the segment affected is indeed word-final:

apply to doubly linked vowels in (16).

The interest of Kenstowicz' analysis lies in the fact that a single postulated property - the monovocalism of certain morphemes - explains an intricate pattern of overapplication. The monovocalism itself is attributed to the interaction between a general principle (the OCP) and the Javanese separation between vowel and consonant tiers. Kenstowicz shows that several other properties of the Javanese sound system support this separation. I will review these facts briefly, as they bear indirectly on the analysis to be presented here.

Several phenomena confirm the monovocalism of aCa(C) morphemes. The first involves a word-formation rule consisting of reduplication and change in the vocalism: this rule is referred to by Dudas as Habitual-Repetitive (Hab-Rep) formation. One of the provisions of Hab-Rep is that stems whose last vowel is a reduplicate as CVCa(C)-CVCe(C): thus udan 'rain' becomes udan-uden by Hab-Rep, then udan-udEn by Laxing. In verb roots that contain two a's, like salah 'err', this change in vocalism affects both syllables: salah becomes

[+low] -> [+round]/ -
 |
 V#

This revision is necessary because, once vowels and consonants are placed on distinct tiers, a vowel may be final on the vowel tier without being in absolute word-final position. For this reason, peripherality must be stipulated on Kenstowicz' analysis of the skeletal position associated to the target segment of Rounding, rather than of the target segment itself. It is the application of this revised Rounding rule to (16)a that violates the Linking Constraint.

solah-seleh by Hab-Rep⁷, and later Laxing derives -sEIEh in the second half. Kenstowicz notes that the overapplication of the a -> e change in roots like salah is explained if we assume that the root is monovocalic.

The second process supporting the monovocalism of aCa(C) roots is an assimilation rule. Stem-final a is rounded to o when next to a suffixal o that originates as a:

(17)
/bisa/ -> biso 'can'
/bisa-a/ -> biso-o 'if one could'

In aCa roots, the assimilation of the stem-final a to the derived suffixal o affects both vowels:

(18)
/maca/ -> moCo 'read'
/maca-a/ -> moCo-o 'read !'

The analysis of this fact is somewhat less clear but the facts themselves strongly suggest that roots like /maca/ are monovocalic.

Placing the vowels on a separate tier predicts that the consonants, left on a tier of their own, will behave in similar ways. Kenstowicz notes that the Javanese consonantism displays constraints similar to those observable in Semitic, a language family for which tier separation is more widely accepted (cf. McCarthy 1981). Roughly, Javanese and Semitic bar the occurrence of distinct homorganic consonants morpheme-internally. This fact can be identified as an OCP effect holding on the consonantal place tier: but such an analysis requires removing the place features of the vowels on a distinct

7. The change from salah to solah in the first half of the stem is due to unrelated processes; see Dudas' (1976) and Kenstowicz's (1986) discussion.

tier, so as to obtain adjacency between the consonantal place autosegments. I will return to this point in the next section.

For our purposes, the essential conclusion of Kenstowicz' analysis is that the constraints on geminates do not hold at a distance: that structures like (16) may undergo a rule, provided that at least one of the positions to which the target is linked meets the requirements. This conclusion is in fact inescapable if we maintain intact every detail of the analysis. There is, however, reason to revise one of its aspects, while maintaining the basic insight that the structures in (16) contain a multiply linked vocalic autosegment.

3. An Alternative

3.1. The Vowel Tier

I introduce now two new elements into the discussion: feature geometry and locality conditions on phonological rules.

Assume Clements' (1985) suggestions on segment-internal hierarchical relations between features: within each segment, certain sets of features - such as ([anterior], [coronal], [round]) or ([voice], [spread gl.], [constricted gl.]) - form constituents dominated by non-terminal nodes called class nodes. The set ([anterior], [coronal], [round]) is dominated by the class node Place; the ([voice], [spread gl.], [constricted gl.]) set is dominated by the Laryngeal node. The totality of supralaryngeal specifications of a segment form a constituent dominated by the Supralaryngeal node; the Supralaryngeal and Laryngeal nodes are sisters, dominated by the Root node, which is in turn linked to the skeleton.

Following Sagey (1986), assume further that the place component dominates not terminal features but one or more articulator nodes; these include Labial (dominating [round]), Coronal (dominating [anterior], [distributed], [lateral]), Dorsal (dominating [high], [back], [low]) and perhaps Tongue Root. A model of this sort has the effect of placing each terminal node (each feature specification) as well as each non-terminal node (each articulator or class node) on its own tier. Clements (1985) and Sagey (1986) argue for this arrangement on the grounds that the clusters of features corresponding to each non-terminal node posited are found to function as constituents in phonological rules.

A different sort of argument for the hierarchical model is provided in Steriade 1987a. The locality conditions of many assimilation and dissimilation rules - the sets of segments that can be 'skipped' in a long-distance application of the rule - turn out to be largely predictable from the tier on which the rule operates. For example, rules spreading the root node cannot skip any tautomorphic segments, while rules spreading the place or the supralaryngeal node may skip segments lacking supralaryngeal features and hence lacking the Supralaryngeal node (such as ʔ or h). The least restrictive locality conditions are encountered with rules operating on the tier of a terminal feature F: in such cases, the only opaque segments are those endowed with specifications for F at the stage in the derivation when the rule applies. In contrast, rules operating on non-terminal tiers such as Root, Place or Supralaryngeal are blocked by most segments even at the earliest stages in the derivation, where segments lack most redundant values: the reason for this being that most segments have the class nodes Root, Supralaryngeal and Place, regardless of whether they share any feature

specifications with the segments actively involved in the rule. These observations on the link between the segments transparent to a rule and the tier on which the rule operates argue both for Clements' hierarchical model of feature organization and against the idea that vowels and consonants occupy separate tiers. If vowels and consonants occur on distinct sets of tiers, one would expect rules spreading the Supralaryngeal node of one consonant to another to apply across intervening vowels: but such phenomena are never encountered. Similarly, one would be at a loss to understand why rules spreading the Supralaryngeal node of a vowel onto another vowel can skip only ɤ and ɪ rather than all consonants. It follows that the geometry of features can be exploited to predict locality conditions only if the class nodes Root, Supralaryngeal and Place of vowels and consonants occupy the same tiers.

On the other hand, certain phenomena require a limited independence between vocalic and consonantal place specifications. The Javanese data are among the clearest cases of this sort: as argued by Kenstowicz, one must have representations equivalent to (16) in order to understand the distribution of laxing and roundness in Javanese. Kenstowicz' remarks on the patterns of Javanese consonantism make a similar point. The non-cooccurrence of homorganic consonants morpheme-internally can be characterized as Articulator disharmony, the effect of filter such (19), which disallows adjacent instances of the same Articulator dominating identical specifications.

(19) *...Articulator_i Articulator_j...⁸

8. It is sometimes assumed (Kenstowicz (1986); McCarthy (1985); Archangeli and Pulleyblank (1986); Yip (1986)) that filters like (19) are simply

Filter (19) is meant to rule out, among other things, tautomorphic velars. But if the articulator node of velars is the same as that of vowels (Dorsal in Sagey's terminology) problems arise: first, there is no incompatibility between vowels and velars, suggesting at the very least that no vowel of Javanese has the underlying place specifications of a velar consonant. Second, if vowels have Dorsal nodes, a [...gVK...] morpheme will incorrectly escape filter (19): the two identical Dorsal nodes are not adjacent, because separated by the Dorsal node of the vowel.

It has been suggested (Steriade (1987a)) that the most conservative solution to this class of problems is to assume that tongue body position in vowels and consonants is characterized by distinct articulator nodes: [high], [low], [back] specifications, minimally necessary in most vowel systems, form a constituent, Dorsal, which characterizes vowels and distinctive palatalization/velarization in consonants. Velar/uvular consonants have a distinct articulator node, Velar⁹. On this hypothesis, filter (19) will characterize correctly the cooccurrence restrictions on Javanese consonants,

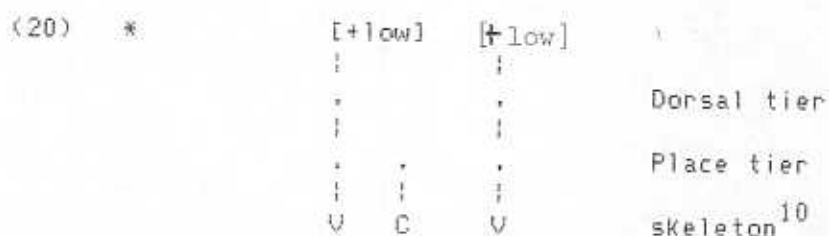
reflexes of a generalized OCP. This hypothesis must be rejected, as indicated by Odden (1986b), because it predicts a wide range of unattested effects: for example, if filter (19) held in English, one would predict that morpheme-internal sequences like [s...s] would either be forbidden or would behave as geminate structures. Alternations like ob-sess/ob-~~se~~sion indicate that neither claim can be maintained. In contrast, the OCP interpreted conservatively as a prohibition against adjacent identical full segments is compatible with most evidence known to me. For this reason, I assume that filters like (19) are language specific.

9. A different proposal is made by Archangeli and Pulleyblank (1986), who characterize consonantal place features by using [anterior] and [coronal], dominated directly by the Place node. Vocalic place features - not only [high], [low], [back] but also [round] and [ATR] - appear under the Secondary Place node, itself dominated by Place. A more detailed comparison between this model and the one presented in the text appears in Steriade (1987b).

including the impossibility of [...gVK...] morphemes.

3.2. The Vowel Tier in Javanese

We may now invoke filter (19) to explain also the fact that morpheme-internal V_iCV_i sequences are monovocalic, as argued by Kenstowicz. Filter (19) disallows (20) as a representation for the tautomorphic sequence aCa:



The only representation for aCa sequences compatible with (19) contains a multiply linked Dorsal node:



Note now that, if we exclude @ from consideration, the entire underlying vowel inventory of Javanese can be specified in terms of Dorsal features, which means that all V_iCV_i sequences can be represented as in (21). The next section will show that @ must indeed be eliminated from the underlying vowel

10. Here and below I omit the Supralaryngeal, Laryngeal and Root tiers, where irrelevant.

set of Javanese. Assuming this, I present (22) as a possible set of underlying specifications for the Javanese vowels:

(22)

	a	e	o	i	u
High				+	+
Low	+				
Back			+		+

3.3. Excursus: Javanese @ Is Epenthetic

The exclusion of @ from the set in (22) reflects the observation that @ behaves in Javanese like an epenthetic vowel.

First, @ is absent from stem-final open syllables: the fact that no other Javanese vowel is subject to this distributional limitation suggests that @ is inserted before a syllabically stray consonant (hence /bosn/ -> bos@n 'tired of'; /serp/ -> ser@p 'a spare'). Second, the @ in stems like bos@n, ser@p conditions Laxing: the surface forms are bOs@n, sEr@p. This indicates that Laxing applies either to the pre-epenthesis stage (bos.n, ser.p), or to a representation that has already undergone epenthesis but not yet resyllabification (bos.@n, ser.@p)¹¹ In either case, the assumption that @

11. An argument for the latter hypothesis goes like this. Recall Kenstowicz' suggestion that Laxing applies first to non-high vowels and that this application precedes cross-boundary resyllabification. The rule ordering is then: (1) Laxing of non-high vowels; (2) Resyllabification; (3) General Laxing, including Laxing of high vowels. It is natural to equate cross-boundary resyllabification with the resyllabification occasioned by epenthesis (bos.@n -> bo.s@n). If so, we predict, correctly, that high vowels will be tense before an epenthetic syllable: din@s 'employed', qur@n 'chicken flea'.

is epenthetic explains both its distributional limitations and the Laxing facts.

Another argument for the derived status of @ can be based on Dudas' (1976: chapter 3) observation that Javanese ʔ and k are in complementary distribution: ʔ occurs stem finally after vowels other than @, while k occurs elsewhere. This distribution suggests a rule that turns syllable-final, stem-final k into ʔ. If this rule applies before epenthesis, the exclusion of @ from its context (as in ub@k 'inharmonious', grun@k 'complaint') is explained without further stipulation: before epenthesis the representations of these stems are ub.k, grun.k, with a stray k rather than a syllable final k¹².

3.4. The Vowel Tier and Geminate Blockage in Javanese

We may return now to the vowels present underlyingly in Javanese. As noted above, underspecification allows the set {a,e,o,i,u} to be characterized entirely by means of Dorsal features. If so, any stem of the form CV_iCV_i(C) - with V_i an underlying vowel - can be given a monovocalic representation, along the same lines as (21). And given filter (19), this is the only

12. A fact that might seem to argue against deriving all @'s by epenthesis before stray C's is their occurrence in the first syllable of certain stems: b@dug 'mosque drum', tj@kaʔ 'short (of distance)'. It is clear that the rule proposed here (~~C~~ --> @ / __C') is insufficient to derive these instances of @. I note however, that all native Javanese stems are disyllabic: it is likely then that the @'s in forms like b@dug are derived by a distinct epenthesis rule which functions to insure that no stem remains monosyllabic. See also Horne's (1964:xvii) observations on the variant pronunciations of stems consisting of @ + monosyllable.

possible representation of such stems¹³.

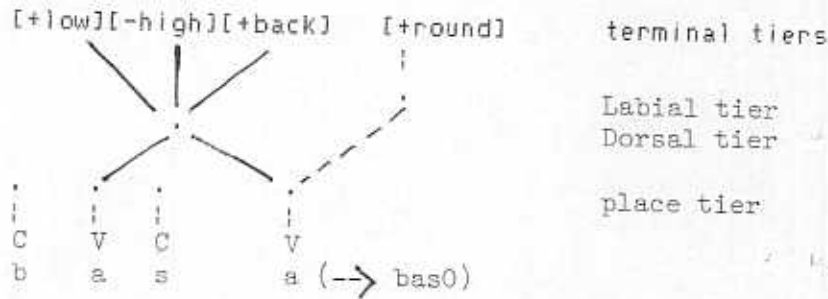
What we have seen then is that the assumption of Dorsal as a tongue body articulator specific to vowels allows a partial translation of the 'vowel tier' representations in (16). Like (16), (21) contains a single instance of all essential specifications of the vowel a: in that sense, both representations implement Kenstowicz's idea that $CV_i CV_j (C)$ morphemes are monovocalic. But there is a critical difference between (16) and (21): the multiply linked node in (21) is not the full vowel but just one of its component autosegments. There is no way to apply any rule to the segment a in (16) without affecting both V positions a is linked to. In contrast, it should be possible to apply certain rules to a in (21) in such a way that only one of the two V's will be affected. We will see now that this change in representations, dictated originally by our rejection of the vowel tier, has important consequences for the discussion of geminate blockage.

Note first that the two Javanese rules discussed by Kenstowicz, Rounding and Laxing, introduce features that are not dominated by Dorsal. This is transparently so in the case of Rounding: following Sagey, I assume that [+round], both for rounded vowels and for rounded labial consonants, is a specification dominated by the articulator node Labial. This is arguably so for Laxing, if we equate the Javanese [-tense] with [-ATR]: ATR is, by definition, a specification of tongue root position, hence not a Dorsal (= tongue body) feature. To highlight these points, I represent in (23) the

13. A further assumption underlies this analysis: Javanese allows Dorsal nodes to be multiply linked - as in (21) - but no other articulator nodes. This assumption explains why an impossible sequence like [...g...k...] cannot be represented as a single Velar node multiply linked.

The application of Rounding to a representation like (16) is shown below:

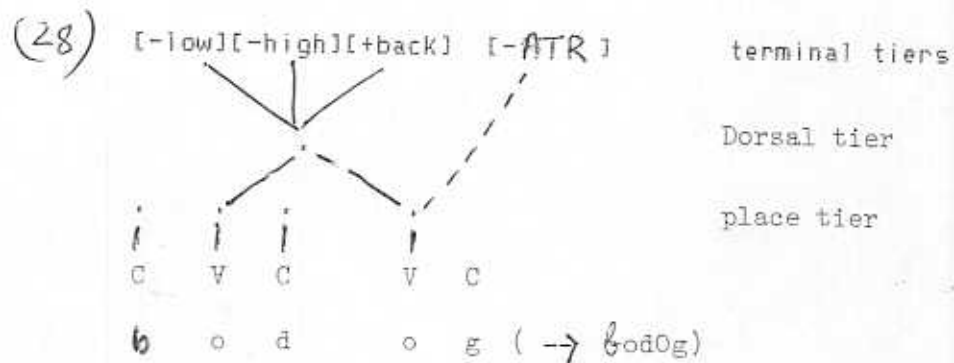
(27)



This application has not violated the UAC because the node whose contents have been altered is the place node of the second vowel, and this node is not multiply linked.

Similarly, the application of Laxing to a monovocalic stem like /bodog/, shown in (28), will not violate the UAC because, once again, the node whose contents are altered is the place node of the second vowel: this node is not multiply linked either.

 14. As usual, the symbol # indicates that the element to its left is peripheral on its tier.



Note, however, that the Linking Constraint will not permit either of these rule applications, because the Dorsal node mentioned as a context in both rules happens to be multiply linked.

But the analysis is incomplete. Rounding and Laxing have created intermediate representations where only one vowel is laxed or rounded: we need surface b0s0, not bas0, the output of Rounding in (27); we need g0d0g, not god0g, the result of Laxing in (28). I therefore suggest a second revision of Kenstowicz's account, in the form of the harmony rule in (29). This rule spreads a feature specification within the domain of a multiply linked Dorsal node.

(29)
Linked Structure Harmony (LSH)



The format for harmony used in (29) is discussed more extensively by Cole and Trigo (1986). They argue that a multiply linked node frequently forms the context in the spreading of another autosegment. A well known instance

of this harmony type is Rounding Harmony in Yokuts, which takes place only between [α high] vowels and is blocked by an intervening [-αhigh] vowel. Cole and Trigo show that the proper statement of Yokuts Rounding Harmony is (30), a rule almost identical to LSH:

(30) Yokuts Rounding:



Dorsal tier

place tier

Labial tier

Before justifying LSH as an independent rule of Javanese, let me spell out how it derives the overapplication of Laxing and Rounding. We have seen that these rules appear to apply across the board in tautomorphic sequences $V_i CV_i$. LSH must apply in exactly the same circumstances. Two questions arise then. First, what will restrict LSH from affecting heteromorphic sequences? The answer is given by filter (19): this constraint governs the underlying representations of Javanese morphemes and, for this reason, can enforce representations like (21) within a single morpheme, but not across a morpheme boundary. In other words, no constraint or rule of Javanese will create multiply linked Dorsal nodes across a boundary: for this reason, LSH will never be met in heteromorphic sequences. Second, what features will LSH spread? It will spread [-ATR] in (28) and [+round] in (27). But in principle, it will spread any feature specification differentiating the two vowels of monovocalic stems like /basa/ or /godog/.

The analysis incorporating LSH combines elements of Dudas' and Kenstowicz' analyses: from Kenstowicz, it adopts the idea that the apparent overapplication of Laxing and Rounding is related to the fact that Javanese

stems are monovocalic. From Dudas, it borrows the distinction between the local rules of Laxing and Rounding, on the one hand, and the harmony that spreads specifications introduced by these rules.

This hybrid analysis is clearly more complex than Kenstowicz's: what his account accomplishes by convention, mine attributes to a separate rule, LSH. I show next that LSH is made inevitable, not only by the theoretical considerations outlined above but also by some specific details of the Javanese sound system.

3.5. More on LSH

3.5.1. LSH and Laxing

Laxing is a general and transparent rule in Javanese. It applies to all surface closed syllables, including in recent loanwords:

(31)
po.trEt 'portrait', ho.tEl 'hotel', Es.prEs 'express'
dOk.t@r 'doctor'¹⁵

But Laxing does not overapply in recent loanwords: a sequence like e.lek surfaces as e.lEK in non-native morphemes:

(32)
e.lEK.trIs 'electric', e.lEK.tro.niK 'electronic', de.tEK.tiF 'detective'
de.rEK.si 'director', re.sEp.si 'reception', re.sEn.si
'recension'¹⁶

15. Data from Horne (1964) and Ras (1982).

16. Data from Dudas (1976) and Horne (1964). I have so far been unable to document this effect with rounded vowels, despite the fact that loanwords with the required structure exist in Javanese. The reason for this is that the official spelling of Javanese records laxness only for the mid unrounded vowel e, not also for o. None of my sources provide phonetic transcriptions for loans like ko.mo.dor 'commodore', ko.mplot 'complot'. There is, however,

Within the analysis provided for Laxing in the preceding section, there are two possible interpretations for the data in (32). The simplest hypothesis is that LSH applies only in the native vocabulary. The alternative is that LSH is potentially applicable but never satisfied outside of the native stock, because loanwords are not subject to filter (19) and therefore do not display the multiply linked Dorsal nodes required as context for LSH. The latter possibility is perhaps the preferred one, because it stipulates nothing: filter (19) is transparently violated in loans like detEktif (d...t...t), dok.t@r 'doctor' (d...t), potrEt 'portrait' (t...t), mobIl 'mobile' (m...b).

We may ask now how the same facts can be analyzed if we adopt Kenstowicz's proposal, outlined in (16). Of the two interpretations sketched above, the first will clearly be unavailable, precisely because it relies on the distinction between Laxing and LSH: LSH cannot be suspended in loans if it does not exist. The second interpretation is available within an analysis like Kenstowicz's, but in a form that makes it unattractive: the required representation for underlying /resensi/ 'recension' will have to violate not only a language specific filter like (19) but also the OCP.

(33)

e	e	i
C	V	C
C	V	C
C	C	V
r	s	n s

 no reason to suspect that o and o would behave differently in this respect, as they pattern in parallel throughout Javanese phonology.

While there is good evidence that the loan vocabulary contains violations of (19), there is no indication that loans disobey the OCP, on any interpretation¹⁷; Javanese does not allow sequences of identical consonants or vowels in either its native vocabulary or among the loanwords.

3.5.2. LSH and Rounding

Rounding applies at the end of word-final aC.Ca morphemes but it does not overapply in such contexts:

(34)

at.ma 'soul' -> at.m0, *0t.m0
djal.ma 'human' -> djal.m0, *dj0l.m0
swar.ga 'heaven' -> swar.g0, *sw0r.go
bras.ta 'wipe' -> bras.t0, *br0s.t0

Dudas (1976) suggests that the pattern in (34) could be explained by reference to the non-native status of these stems: indeed, no Javanese stem begins with a closed syllable and the items in (34) are borrowed from Sanskrit. If so, atm0 is explained in the same way as detEktif, resEnsi: LSH fails to apply to loans because (19) does not affect this part of the lexicon.

This explanation may be undercut by the observation that borrowed aCa stems surface as OCO in word-final position. Both the items in (34) and those below are transparently borrowed from Sanskrit: Rounding, however, does overapply in the latter class.

(35)

pari-basa 'proverb' -> parib0s0
pa.nca 'five' -> p0.nc0

17. See above, footnote 8.

We may interpret the contrast between /pa.nca/ and /at.ma/ in two ways: one possibility is that LSH affects only the vowels of open syllables. A less stipulative explanation may be the following: Rounding and LSH aside, any native speaker will find /pa.nca/ indistinguishable from a native morpheme and will posit for it a representation conforming to (19), with a single [+low] Dorsal node. In contrast, the initial closed syllable of /at.ma/ brands it as non-native: for this reason, the underlying representation of its vocalism will be that of resEnsi, with two distinct Dorsal nodes. This explains why LSH fails in this class.

We may ask again how these facts will be analyzed under the analysis of Rounding proposed by Kenstowicz. The first explanation suggested (LSH affects open syllables only) relies, once again, on the distinction between Rounding and LSH and for this reason cannot be recovered by any analysis that does not draw the same distinction. The second explanation (non-native /atma/ violates (19) and is bivocalic) raises the same difficulty as that illustrated for resEnsi in (33). Bivocalic /atma/ turns out to violate not only (19) but also the OCP, a constraint otherwise upheld in the native and nonnative lexica.

(36)
 a a
 | |
 UCCV
 ||
 tm

A different argument for separating the effects of LSH from those of Rounding can be based on the fact that trisyllabic aCaCa stems surface, when final, as aCOCO. This indicates quite simply that LSH is, in general,

non-iterative.

(37)

/nayaKa/ 'councillor' -> nayOkO
/caraKa/ 'messenger' -> carOkO
/nawala/ 'letter' -> nawOlO

Yallop (1982:305) cites, however, data from Uhlenbeck (1949) which include pronunciations like nOyOkO, as a less common variant of nayOkO. It is possible then that both iterative and non-iterative versions of LSH exist.

18.

None of the details mentioned here - exemplified by resEnsi, atmO, nayOkO - can be straightforwardly explained unless we distinguish LSH from Laxing and Rounding: that is, unless we disassociate precisely the effects that Kenstowicz's analysis was meant to unify.

3.5.3. LSH outside Javanese

The distinction between LSH and the local rules of Laxing and Rounding can be further supported by considering related dialects. Our prediction is that a phonological system otherwise identical to that of Javanese may lack LSH entirely or may have a slightly different version of that rule.

To investigate this prediction, I consider two dialects of Malay: Bahasa Indonesia (BI), the national and official language of Indonesia, and Jakarta Malay (JM), the native dialect of the majority of the inhabitants of Jakarta. Both BI and JM are descendants of "the Malay dialect spoken for

18. It is not possible to verify that LSH applies in non-iterative fashion when spreading laxing: no native stems with the required structure are recorded *in phonetic transcription*.

centuries as a lingua franca among the islands" (Dudas 1976:3). Javanese itself descends from a different Malay dialect. As co-descendants from Proto-Malay, BI and JM share some distinguishing phonotactics with Javanese. Among them appears to be filter (19), at least insofar as consonants are concerned: as Adelaar (1983) shows, the constraint against homorganic consonants within the same morpheme holds not only of Javanese, but also of all the Malay dialects. One expects then that the native vocalism of BI and JM be subject to the same constraint as that of Javanese: tautomorphic U_iCV_i sequences should be monovocalic.

Neither JM nor BI have Rounding. But, since both dialects have local rules introducing some value of ATR, the input to LSH is created.

In BI, Laxing applies but LSH does not:

(38)

/pendek/ 'short' -> pe.ndEK	/obor/ 'torch' -> ob0r
/benteŋ/ 'fort' -> be.ntEŋ	/pohon/ 'tree' -> po.h0n
/leher/ 'neck' -> le.hEr	

In JM, LSH does apply but in a wider set of contexts than in Javanese: Muhadjir (1981) and Wallace (1976) note that any sequence of tautomorphic [-high][-high] vowels, will have the same tenseness specification.

(39)

	identical vowels	non-identical vowels
CVCVC stems	0r0K 'baby'	k0rEK 'to scrape'

19. Data from Lapoliwa (1981). Lapoliwa notes one difference between the Javanese and the BI version of Laxing: the latter affects only word final syllables: /jejer/ 'to stand in a row' becomes je.jEr in word final position, but je.jer-kan, with tense e, before the transitive suffix -kan. Similarly, /bioskop/ 'movies' becomes bios.k0p, despite the fact that both o's are in closed syllables. This fact may be related to the apparent absence of LSH in this language, although not enough data is available to determine this.

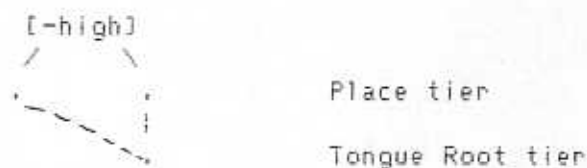
	←	b0,nt0t 'spoiled' ErEt 'to deceive' gEIEr 'nod'	bEIOk 'turn' EkOr 'tail' bEsOk 'tomorrow'
XCVCV stems		boto 'beautiful' s@pele 'worthless'	bole 'may' sero 'fish trap'

Formulating the exact details of the JM harmony system will depend on the status of the tense or ATR values that spread. According to Muhadjir, the mid vowels e and ɛ are -ATR in the unmarked case and surface as +ATR in two circumstances only: when word-final and when followed by a tautomorphic mid +ATR vowel.²⁰ It appears then that a final tensing rule applies to mid vowels, followed by a harmony rule structurally similar to LSH:

(40) Final Tensing in JM



(41) LSH in JM



The derivation of bole 'may' is sketched below. My assumption is that both vowels originate without ATR specifications, but this is tangential to the

 20. This distribution is obscured by a pervasive, variable rule whereby final a becomes E. Thus /gula/ 'sugar', realized variously as gulE, gula, gul@, gula?, contrasts with /gule/, realized as gule 'kind of soup'. An extensive discussion of this rule is offered in Wallace (1976).

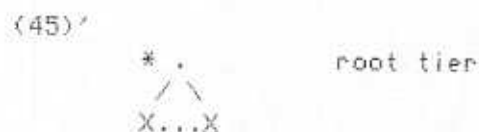
A second, related question, is whether JM stems like boto 'beautiful' are monovocalic, as in Javanese, or whether they are structurally identical to bivocalic stems like bole. If boto is monovocalic, the structural description of (41) will have to read as follows: spread +ATR from right to left, within the span of a single [-high] specification. This statement covers both cases like bole, where the two vowels share just a [-high] value, and cases like boto, where they share a Dorsal node dominating [-high]. It is entirely possible that this should always be the interpretation of rules like (41).

The central point illustrated by the JM paradigm is clear, regardless of how these details are settled: a rule structurally similar and historically related to the Javanese LSH is attested in this dialect. This rule is unambiguously a harmony rule and cannot be mistaken for the overapplication of a local process like Final Tensing.

insert page (32')



A final argument in favor of our reanalysis of the Javanese data is provided by the observation that no Javanese dialects allow surface long vowels or, for that matter, long segments of any sort: we express this fact by the filter in (45)', where X is a variable over V and C positions.



Note that filters like (45)' need not be restricted to configurations where the two skeletal positions are adjacent: what they rule out are all multiply linked root nodes regardless of the distance between their anchors. Kenstowicz's analysis, in contrast, must introduce an unprecedented distinction between 'overt' geminates and discontinuous geminates: the former must be ruled out while the latter are allowed. Filter (45)' must be replaced by (45)'', where the two X's are stipulated to be adjacent:



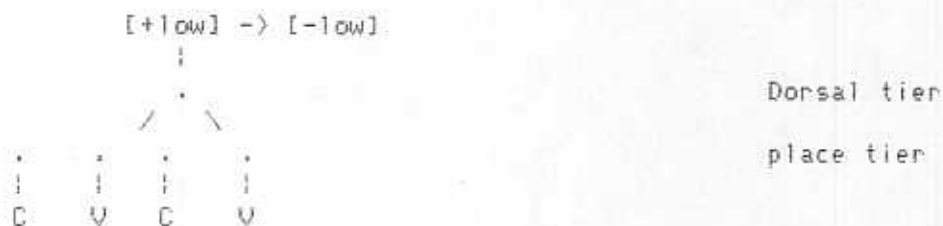
Since the need for statements like (45)'' does not arise independently, they represent a drawback for any analysis based on the vowel tier hypothesis.

4. Geminate Blockage in Yakan

So far we have seen that the application of Rounding and Laxing in Javanese is in fact compatible with at least one of the geminate constraints, the UAC. Both rules affect only one vowel at a time: Rounding yields intermediate bas₀, as in (27), Laxing yields bod₀g, as in (28). A later rule, LSH, explains surface b₀s₀ and b₀d₀g. Both Laxing and Rounding alter the contents of a singly linked node, the place node of the last vowel: for this reason, the UAC is not violated by either rule.

Suppose, however, that we attempted to apply a rule affecting a dorsal feature to a multiply linked Dorsal node. Suppose that the input structure was identical to (27) and that the rule attempted had the effect of turning [+low] into [-low]:

(45)



The rule application sketched in (45) has the potential of activating the UAC, because a change in the [low] feature will affect the contents of the multiply linked Dorsal node. We encounter a case of this sort in Yakan.

The morphophonemics of Yakan, a Philippine language, have been described by Behrens (1975). This language has a vowel inventory identical to the underlying system of Javanese: a, e, o, i, u. The major vocalic alternation is dependent on the location of stress, which falls regularly on the

penultimate syllable.

In Yakan, the vowel a raises to e when it precedes the stressed syllable.

Raising produces the alternations in (46):

- (46)
- | | | | | |
|----------------------|--------------------------|---------------|-------------|------------------------------|
| a. la'bo? | 'fall' | lebo'? | -ne | 'he falls' |
| b. ?a'su | 'dog' | ?esu' | -hin | 'the dog' |
| c. ha'get | 'fix' | /pa-haget-un/ | 'fix it' | -> pe-heg ²² t-un |
| d. /mag-pa-labo?-an/ | 'repeatedly jumping off' | -> | megpelebo'? | an ²² |

Raising applies only in derived environments. Monomorphemic forms like Lami'tan surface unchanged, but undergo Raising under suffixation:

- (47)
- | | | | |
|--------------|--------------|--------------|-------------------------------|
| a. pagka'win | 'wedding' | pegkewi'n-an | 'place of wedding' |
| b. Lami'tan | (place name) | Lemita'n-in | 'Lamitan-focus' ²³ |

A further detail of Raising is that the target vowel need not immediately precede the stressed syllable. This is already indicated by some of the forms in (46)-(47) and can be illustrated by further examples:

- (48)
- | | | | | | |
|---------------------|------------|--------------|----------------|----|-------------|
| a. pe'at | 'red' | /ma-peat-in/ | 'the red one' | -> | me-pea't-in |
| b. /mag-don-da'nan/ | 'to swing' | -> | meg-don-da'nan | | |

A rule with the properties of Yakan Raising can be stated as in (49):

22. For evidence on the underlying representation of the prefix /mag-/, see (50)e below.

23. Behrens' statement of Raising reflects the restriction to derived environments: "Suffixation causes a to change to e before the stressed syllable." One may wonder what is the sense in which the environment of Raising is derived in the suffixed forms of (47). The vowel a has been already before suffixation in a pre-stress syllable: in that sense, its status with respect to the environment of Raising has not changed. The metrical structure of the word has, however, been changed by suffixation: the vowels of Lamitan- belong now to different stress feet. It is this fact that appears to be critical in the identification of a derived environment for stress-dependent rules like Raising. Mascaro (1976) makes a similar point.

(49) Yakan Raising
 [+low] → [-low]
 ↓
 · Dorsal tier
 ↓
 √ / _____ ... ɔ'

Behrens (1975) notes that Raising is systematically blocked in the following class of environments: "in open syllables if the vowel of the newly stressed syllable is also a and if the vowels of intervening open syllables are also a." Thus Raising will not apply in a string like ... aCaCaCa'...:

- (50)
- a. /ta-ʔagad-ku/ 'I wait' → ta.ʔa.ga'd.ku
 - b. /paKa-taban-an-ne/ 'she causes somebody to help her' → pa.Ka.ta.ba.na'n.ne
 - c. /ʔalabaʔa-hin/ 'the particular Wednesday' → ʔa.la.ba.ʔa'.hin
 - d. /nakanak-in/ 'the child' → na.Ka.na'.kin
 - e. /ma-mag-aKa'-hin/ 'the one who told it' → ma.ma.ga.Ka'.hin²⁴

As implied in Behrens' statement, Raising does apply to aC.Ca' strings:

- (51)
- /mag-bayed/ 'to pay' → meg.ba'.yed
 - /mag-gantiʔ/ 'to change' → meg.ga'.ntiʔ

Raising applies to the closed syllable aC, even when it precedes a string that blocks Raising:

- (52)
- /mag-pa-panjadi/ 'to create' → meg.pa.pan.ja'.di

Behrens does not provide examples with the structure Ca.CaC.Ca' but, knowing that the a in a closed syllable will raise (cf. (50)), we expect any preceding a to raise as well.

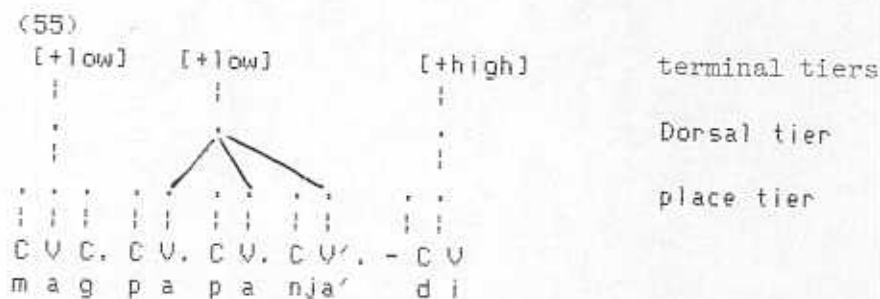
Insert (35a)

As a first step towards an explanation of these facts, let us assume that

24. Behrens lists the verb aKa- 'to tell' as /ʔaka/. She notes, however, that ʔ is lost after a velar; we must assume that the syllabification ma.ma.ga... is created by this rule.

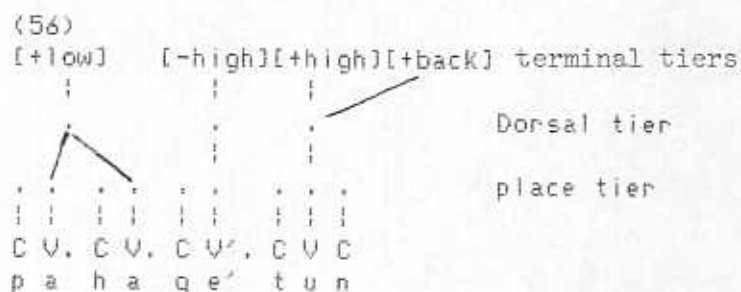
One may attempt to explain Behrens' observations by postulating a harmony rule in the output of Raising. Thus ta?aga'dku would undergo first Raising to intermediate te?ega'dku, after which the stressed a would spread its [+low] value leftwards onto the preceding open syllables; this would restore the expected ta?aga'dku. But such an approach predicts that underlying e will be subject to the same lowering harmony: forms like mepea'tin from /ma-peat-in/ (in (48)a above) discredit this hypothesis.

Dorsal Collapse merges two identical Dorsal nodes when the first is in an open syllable. This rule will create the proper input to Raising in the entire class of forms described by Behrens and illustrated in (50). Dorsal Collapse will not apply in forms like /mag-bayed/ (cf. (51)) because the first a is in a closed syllable. It will apply only partially to mag.pa.pa.nja'.di (cf.(52)), leaving intact the initial a in its closed syllable: this accounts for the fact that Raising affects only this initial a.



As in (53), the open syllables of (55) will block Raising, because they share the [+low] feature with the stressed vowel, which does not meet the precedence condition of Raising. The independent [+low] feature of mag- will undergo Raising because its associated V precedes the stressed syllable.

According to Behrens' statement, aCa sequences do not block Raising except immediately before a stressed a. A relevant case is that of pehege'tun from intermediate pa.ha.ge'tun:



In this case, Raising applies. It can do so, under the UAC, because both V's associated to [+low] satisfy the same conditions: they both precede the stressed syllable.

Forms like pehege'tun are not only interesting as an illustration of how the UAC functions: they also provide evidence distinguishing between the Linking Constraint and the UAC. The Linking Constraint cannot differentiate the effect on Raising of structures like (56) from that of structures like (53): it predicts that both will block Raising, because this rule does not mention multiple associations between [+low] or Dorsal and any other tier²⁵. In other words, the Linking Constraint cannot distinguish between cases in which all positions an autosegment is linked to satisfy a rule's description and the case where some positions do and some don't: the Yakan data show that this distinction is necessary. We will encounter in the next section a phenomenon illustrating the same point.

Before concluding the discussion of Yakan, let me mention the fact that the rule of Dorsal Collapse, central to this analysis, has numerous precedents: Clements (1985), Kenstowicz (1985), Odden (1986a, 1986b), Cole and Trigo (1986) have demonstrated the need for language specific rules that merge identical autosegments, tonal and segmental, terminal and non-terminal.

25. A caveat here: pehege'tun, the only form of its kind that Behrens lists, is morphologically complex /pa-haget-un/ and could be given an alternative derivation if prefixation follows suffixation: ha'get -> hage't-un (by affixation) -> hege'tun (by Raising) -> pa-hege'tun (by affixation) -> pehege'tun (by Raising). This doesn't alter the point made in the text, since Behrens states quite explicitly that only aCaCa' sequences block Raising: the incorrect prediction of the Linking Constraint is that any tautomorphic aCa sequence, whether it immediately precedes stressed a or not, should also block Raising.

Dorsal Collapse is a member of this rule family. There are obvious questions to be raised concerning the structural similarity between the effects of a rule like Dorsal Collapse and those of a constraint on lexical entries, like filter (19): but these questions cannot be resolved here.

5. Geminate Blockage in Lowland Murut

Having observed that geminate blockage occurs with multiply linked Dorsal nodes, we ask next whether the same effects are encountered with other features. The answer comes from Lowland Murut, an Austronesian language spoken on North Borneo. I will rely here on Prentice's description (1971).

Murut has a vowel inventory with only four members: (a,o,i,u). Of these, a, i and u are unrestricted in distribution and occur in all positions of the word. In contrast, o may not be followed by any vowel other than itself. It may occur in the last syllable of a word or in non-final syllables followed by o. When underlying o is followed by any other vowel it becomes a:

(57)

patoy 'die'	patay-an 'die-intransitive'
onoy 'go'	anay-an 'go-intransitive'
atod 'escort'	atad-i-n 'will escort'
kodojo 'work'	pa-kadaja-i-n 'will cause to work'
luuton 'firewood'	paki-luutan-an 'asks for firewood'

The vowel u does not occur in any of the suffixes mentioned by Prentice: for this reason, alternations like (57) cannot be documented before suffixal u. It is clear, however, that u participates like all other vowels in the derounding process illustrated by (57): there are very numerous morphemes containing the sequence aCu and no morpheme containing oCu. Prentice's statement (1971:22) supports this generalization: "o may occur in

non-ultimate syllables of morphemes and words only if o occurs in all following syllables".

When a suffix containing -o- is added, the stem vocalism remains intact: kodojo-on 'will work (on object)'; onoy-on 'will go (for object)'.

Lowland Murut has also a harmony rule whereby a becomes o before a sequence of two syllables containing o:

(58)

- | | |
|--|--------------------------------------|
| (a) panakod 'live' | ponokod-on 'will live (with woman)' |
| (b) tanom 'plant' | tonom-on 'will plant' |
| (c) kaladom 'sharpens' | kolodom-on 'will sharpen' |
| (d) ŋa- 'plural'
(cf. ŋa-taun 'years') | ŋo-odow 'days', ŋo-gongom 'fistfuls' |
| (e) maka- 'participle'
(cf. maka-alok 'having smelled') | moko-doŋog 'having heard' |

A single o will have no harmonic effect: the suffix -on induces no change on the stem akan 'eat' in pa-akan-on 'will cause to eat'. But when added to an aCo sequence like the stem datok 'mix', suffixal -o triggers harmony: /pa-datok-on/ becomes podotokon 'will cause to mix with each other'.

An analysis of this system must explain two related facts: why Derounding cannot apply if o follows (recall kodojo) and why Harmony cannot apply unless o follows (recall pa-akan-on). I begin the analysis by showing that the condition restricting Harmony is prosodic in nature.

Stress falls in Murut on the penultimate syllable. This pattern can be analyzed by having the final syllable extrametrical and constructing a right-dominant foot over the remaining string. The foot structure of pa-akan-on will be [pa.a.kə'.ɔ](non). That of underlying /pa-datok-on/ will be [pa.da.to'k](on). Suppose now that the Harmony rule of Murut, like those

of Eastern Cheremiss (Hayes 1980), Guarani' (van der Hulst and Smith (1984)) and others, has the stress foot as its domain. This will explain the different outcome of /pa-akan-on/ and /pa-datok-on/: there is no o inside the stress foot in [pa.a.ka'] (non), but there is one in [pa.da.to'k] (on). It follows that Harmony will apply only in the second case. In a form like underlying /atod-in/ (cf. ⁽⁵⁷⁾ above), whose foot structure is [a.to'] (din), Harmony may in principle apply, but its effect will be obliterated later by Derounding. It is also possible that Derounding bleeds Harmony, so that the input to the latter is already [a.ta'] (din): Prentice provides no data bearing on the ordering between these rules. Bearing in mind the partial conclusion that harmony is foot-bound, let us consider now Derounding.

As a preliminary step, let's set aside the forms where Derounding is blocked: forms like Kodojo or Kodojo-on, containing a final sequence of (C)o(C) syllables. If we disregard these, we observe that the effect of Derounding is to ensure that the vocalism of metrical syllables in Murut is drawn from the maximally unmarked inventory (a,i,u). The vowel o is allowed only outside the stress domain: as in [pa.a.ka'] (non), [ka.la'] (dom), [lu.u'] (ton). Derounding is then the rule whose function is to keep o at the periphery of the stress domain: it removes [+round] from a footed vowel.

This idea can be implemented as follows. I analyze any underlying (a,i,u) inventory in terms of the Dorsal features [high] and [back]. I take the values [+high] and [+back] to be underlying, here and elsewhere²⁶ The odd

 26. On [+back] as the underlying value for [back] see Kiparsky's (1981) arguments. On the choice of [+high] see Cole (1985). The choice of [back] over [round] is dictated, in part, by Keyser and Stevens' (1984) observation that they stand in an asymmetric enhancement relation: [round] enhances the

vowel in the Murut system, o, is specified as [+round]. This is dictated by Prentice's observations on the range of allophonic variation in Murut vowels: the allophones of o and a differ consistently in rounding, while backness and height is variable for both. In contrast, u and i are consistently [+back] and [-back] respectively. This difference between the high and the low vowels of Murut is reflected in their underlying specifications: the feature differentiating underlyingly each pair, [round] for {a,o} and [back] for {i,u}, turns out to be the specification not subject to allophonic variation.

(59)

	a	i	u	o
H		+	+	
B			+	
R				+

Having settled on (59), we explain why Derounding is restricted to the non-high vowel o: this is the only rounded vowel of the underlying system. Derounding is stated below, as the rule that eliminates [round] from the stress foot, thereby reducing the Murut vowel system to the unmarked {a,i,u} set:

(60) Derounding

[round] → ∅ /
 $\begin{matrix} \text{---} \\ | \\ \dots \text{V} \dots \end{matrix} \text{ }_0$

Note that Derounding leaves behind a matrix indistinguishable from

 perception of [back] distinctions rather than vice-versa.

underlying a. Redundancy rules will now specify underlying a's and vowels derived by Derounding in the same way.

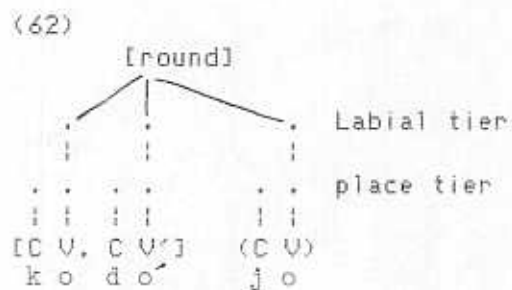
The rule in (60) predicts that stressed monosyllables will never contain a surface ə: this prediction cannot however be verified because Murut free-standing morphemes must be at least disyllabic (Prentice 1971: 21). A verifiable prediction is this: stress-neutral suffixes will not induce Derounding because they will not change the metrical structure of the stem they attach to.

(61)
 lo'go-i 'the price'
 ku'ku'o-i 'the snake'
 bua'yo-i 'the crocodile'

Any analysis must stipulate that the definite suffix -i falls outside the domain of application of the stress rule. But our analysis can use this fact to predict the non-application of Derounding: since the stress rule does not apply after -i is affixed, the metrical structure of buayo-i continues to be [bu.a']yo.i, with ə outside the foot.

We may turn now to the forms where Derounding encounters geminate blockage. Consider first monomorphemic words like kodojo. Assuming that Murut allows at most one [round] autosegment per morpheme, a condition frequently encountered in harmony systems, kodojo can be represented as in


(62):



It is clear now why Derounding is blocked in (62): the last vowel to which [round] is linked falls outside the foot.

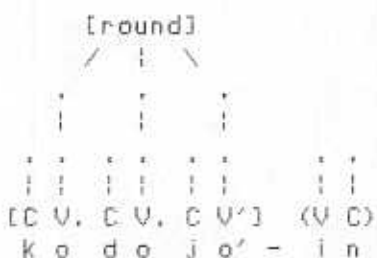
But, as in Yakan, we note that a condition on the distribution of [round] in lexical entries is insufficient to ensure geminate blockage in heteromorphic sequences like Kodojo-on. For this reason, we must posit an explicit merger rule for sequences of [round] autosegments. This rule parallels Yakan's rule of Dorsal Collapse.

(63) Round Merger (iterative)

[round] [round]
 \neq  Labial tier

Rule (63) must precede Derounding: this will explain the blockage of Derounding in Kodojo-on and similar bi-morphemic forms. We reconsider now the applicability of Derounding to /kodojo-in/. Here Derounding applies and affects simultaneously all three vowels: according to the UAC this is possible, because each vowel to which [round] is linked meets the condition of being foot-internal.

(64)

 Labial tier
 place tier
 [C V] [C V] [C V'] (V C)
 k o d o j o' - i n

But, as in Yakan, the Linking Constraint will block such rule applications, because the string contains not one but several links between the target

autosegment and the skeleton. As in the case of Yakan, the difficulty stems from the fact that the Linking Constraint focuses on the number of associations between two tiers rather than on whether the rule is met by each position the target is linked to.

7. Conclusions

The main goal of this paper was to investigate the possibility of geminate blockage with discontinuous constituents. We have encountered two relevant cases : that of Yakan Raising, blocked by multiply linked Dorsal nodes and that of Murut Derounding, blocked by multiply linked [round] autosegments. It is safe to conclude that the available evidence supports the notion that multiple linking blocks phonological rules, regardless of whether the target structure is discontinuous or not.

A secondary point established here was that the occurrence of geminate blockage can be predicted if we focus on the conditions of applicability of a rule rather than on the number of links explicitly mentioned in its structural description: both Yakan and Murut show that a rule mentioning a single link between two tiers may affect a multiply linked structure, provided that all points in the structure uniformly satisfy the rule's requirements. A related observation is that the principle explaining geminate blockage must distinguish target and context autosegments: recall the fact that the context autosegments in structures affected by Javanese Rounding and Laxing may be multiply linked.

The paradigm of geminate blockage studied here has also provided an argument against a radical separation between vowel and consonant tiers. Our

starting point was Kenstowicz's suggestion that Javanese has discontinuous vocalic geminates, and its implication that such structures disobey geminate constraints. We have seen that a different picture emerges once the vowel-tier structures proposed by Kenstowicz - (16) above - are replaced with representations in which vowels and consonants occupy overlapping rather than disjoint sets of tiers. In such representations, the multiply linked autosegments of a V_iCV_i sequence can be either individual features or the vocalic articulator node Dorsal, but not higher level class nodes such as Root, Supralaryngeal or Place. Postulating multiply linked Dorsal nodes in the representation of Javanese V_iCV_i sequences explains the fact that rules like Laxing and Rounding, which introduce non-dorsal features, can affect such sequences without encountering geminate blockage. The possibility of explaining why Yakan Raising is subject to blockage while Javanese Rounding is not is a strong indication that the our proposals on feature geometry are on the right track.

References

Adelaar, K. A.: 1983, 'Malay consonant-harmony: an internal reconstruction', in J. Collins (ed.) Studies in Malay Dialects, part 1, Universitas Atma Jaya, Jakarta 1983, p. 57-67.

Archangeli, Diana: 1985, 'Yokuts harmony: evidence for coplanar representation in non-linear phonology', Linguistic Inquiry, 16, 335-372.

Archangeli, Diana and Douglas Pulleyblank: 1986, 'The Content and Structure of Phonological Representations', unpublished, University of Arizona and University of Southern California.

Behrens, Dietlinde: 1975, 'Yakan Phonemics and Morphophonemics', Papers in Phillipine Linguistics no 7, Pacific Linguistics Series A no. 44.

Clark, Mary: 1985, 'Downsteps without floating tones', unpublished, University of New Hampshire.

Clements, George N.: 1985, 'The Geometry of Phonological Features' Phonology Yearbook vol. 2

Cole, Jennifer and Lauren Trigo: 1986, 'On the representation of neutral segments', unpublished, MIT.

Dudas, Karen: 1976, The Phonology and Morphology of Modern Javanese, unpublished Ph.D. dissertation, University of Illinois at Urbana-Champaign.

Goldsmith, John: 1979, 'Subsegmentals in Spanish phonology: an autosegmental approach', in W.W.Cresey and D.J. Napoli (eds.) Proceedings on the 9th Symposium on Romance Linguistics, Washington, D.C., Georgetown University Press.

Hayes, Bruce: 1980, A metrical theory of stress rules, Ph.D. Dissertation, MIT (distributed by the Indiana University Linguistics Club, Bloomington).

Hayes, Bruce: 1986a, 'Inalterability in CV Phonology', Language 62, 2, 321-352.

Hayes, Bruce: 1986b 'Assimilation as Spreading in Toba Batak', Linguistic Inquiry, 17.3.

Horne, Elinor: 1964, Javanese-English Dictionary, New Haven, Yale University Press.

van der Hulst, Harry and Norval Smith: 1984, 'Prosodic domains and opaque segments in autosegmental theory' in Harry van der Hulst and Norval Smith (eds.) The Structure of Phonological Representations Part II, Dordrecht, Foris.

Ito, Junko: 1984, 'Melodic dissimilation in Ainu', Linguistic Inquiry, 15, 505-513.

Kenstowicz, Michael: 1982 'Gemination and Spirantization in Tigrinya', Studies in the Linguistic Sciences 12.1.

Kenstowicz, Michael: 1986 'Multiple Linking in Javanese,' in S.Berman, J.W. Choe and J. McDonough (eds.) Proceedings of the 16th NELS Meeting 230-246, University of Massachusetts, Amherst.

Kenstowicz, Michael and Maino Kidida: 1985, 'The Obligatory Contour Principle and Tangale Phonology' to appear in David Odden (ed.) Current approaches to African linguistics IV, Dordrecht, Foris.

Kiparsky, Paul: 1981, 'Vowel Harmony', unpublished, MIT.

Kiparsky, Paul: 1985, 'Some consequences of lexical phonology', Phonology Yearbook vol. 2, 85-136.

Leben, William: 1980, 'A metrical analysis of length', Linguistic Inquiry, 11, 497-509.

Lapoliwa, Hans: 1981, A Generative Approach to The Phonology of Bahasa Indonesia, Pacific Linguistics Series D- No. 34, Canberra, Australian National University.

Mascaro, Joan: 1976, Catalan phonology and the phonological cycle, unpublished Ph.D. dissertation, MIT.

McCarthy, John J.: 1981, 'A Prosodic Theory of Nonconcatenative Morphology', Linguistic Inquiry, 12, 373-418.

McCarthy, John J.: 1986, 'OCP effects: gemination and antigemination', Linguistic Inquiry, 17, 207-263.

Muhadjir [sic!]: 1981, Morphology of Jakarta Dialect: Affixation and Reduplication. Universitas Atma Jaya, Jakarta.

Odden, David: 1980, 'Associative Construction in Shona', Journal of Linguistics Research 1,2, 37-51.

Odden, David: 1986a, 'On the role of the Obligatory Contour Principle in phonological theory', Language, 62, 2, 353-383.

Odden, David: 1986b, 'Anti Anti-Gemination', unpublished, Ohio State University. Prentice, D.J.: 1971, The Murut Languages of Sabah, Pacific Linguistics, Series C, No. 18, Canberra, Australian National University.

Ras, J.J.: 1982, Inleiding tot het modern Javaans. 'S-Gravenhage Martinus Nijhoff.

Sagey, Elizabeth: 1986, The representation of features and relations in autosegmental phonology unpublished Ph.D. dissertation, MIT.

Schein, Barry: 1981, 'Spirantization in Tigrinya', in H. Borer and J. Aoun (eds.) Theoretical issues in the grammar of Semitic languages, MIT Working Papers vol. 3.

Schein, Barry and Donca Steriade: 1986, 'On Geminates', Linguistic Inquiry 17,4, 691-744.

Steriade, Donca: 1987a, 'Locality Conditions and Feature Geometry', to appear in the Proceedings of the 17th NELS Meeting (1986), University of Massachusetts, Amherst.

Steriade, Donca: 1987b, 'On the vowel:consonant distinction', to appear in Harry van der Hulst and Norval Smith (eds.) Proceedings of the June 1986 Leiden Workshop on Distinctive Features, Dordrecht, Foris.

Stevens, Kenneth, Samuel J. Keyser and Haruko Kawasaki: 1986, 'Toward a phonetic and phonological theory of redundant features', in J. Perkell and D. H. Klatt (eds.) Symposium on Invariance and Variability of Speech Processes, Hillsdale, N.J., Lawrence Erlbaum Assoc.

Wallace, Stephen: 1976, Linguistic and Social Dimensions of Phonological Variation in Jakarta Malay, unpublished Ph.D. dissertation, Cornell University.

Yallop, Colin: 1982, 'The Phonology of Javanese Vowels', in A. Halim et al. (eds.) Papers from the 3rd International Conference on Austronesian Linguistics, Pacific Linguistics Series C no. 75, Canberra, Australian National University.

Yip, Moira: 1986, 'The Obligatory Contour Principle and phonological rules: a loss of identity', unpublished, Brandeis University.