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A Constraint on Phonological Variables*

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Received January 8, 1983

0. INTRODUCTION

The purpose of this article is to propose a general condition that limits the possible class of segments that may be allowed to intervene between the determinant and focus, that is, in the variable X of the following template for a phonological rule.

$$(1) \begin{array}{ccc} [&] \rightarrow [&] / \\ \text{input} & & \text{structural} \\ (= \text{focus}) & & \text{change (= SC)} \\ & & \text{determinant} \quad \text{X} \\ & & \text{intervening (= focus)} \\ & & \text{material} \end{array}$$

This condition will hold only for assimilatory and dissimilatory rules, and not for rules affecting prosodic features like stress, pitch, and length. For as Howard [8:104–111] points out, the latter type of rules, first of all, generally do not obey such a condition but instead require disjunctive application. Second, as Jensen and Stong-Jensen [12:126] rightly point out, it is extremely difficult in the case of prosodic rules to distinguish the determinant from the intervening material. Third, the fact that recent metrical phonologists have mostly dealt with prosodic phenomena of various sorts (cf. [17–19]) suggests that prosodic rules may be different in nature from assimilatory and dissimilatory rules.

My arguments proceed as follows. In section 1 a condition on phonological variables called the Class Complement Constraint is first proposed on the basis of the examples from Menomini, Latin, and English. This Constraint will admit neither focal nor determinant nor SC elements as intervening material. Then rather much space will be allotted

* This is a slightly revised version of a paper read at the regular meeting of the Tokyo English Linguistic Circle on September 18, 1982. I would like to thank Akira Ota, Toshio Nakao, and Masaru Kajita for their invaluable comments and suggestions. Needless to say, all the errors and inadequacies of the paper are my own.

to section 2 for the purpose of accounting for many apparent counter-examples to the Constraint that have been discussed in the literature. In section 3 a comparison is made between my hypothesis and each of the other theories advocated by Howard [8], Jensen [10], Jensen and Stong-Jensen [12], and Battistella [2]. As a consequence, the Class Complement Constraint will be seen to represent a true generalization about how phonological variables should be interpreted.

1. THE CLASS COMPLEMENT CONSTRAINT

1.1. MEMONINI MID VOWEL RAISING

According to Odden [21] Memonini has a rule of Mid Vowel Raising that raises the vowels *e*: and *o*: to *i*: and *u*:, respectively, "when followed anywhere in the word by a sequence consisting of a consonant immediately preceding a high vowel or glide" ([21:184]), as in

- (2) a. ne:mow 'the dances'
 b. ni:mit 'when he dances'
 c. nato:mekot 'if he calls him'
 d. natu:mekotwa? 'if he calls them'
 e. mave:ček 'that which he eats'
 f. mavi:čekwa? 'that which they eat'
 g. a:te?no:hkew 'he tells a sacred story'
 h. a:te?nu:hkuwew 'he tells him a sacred story'
 i. ko:n 'snow'
 j. ku:nyak 'lumps of snow'
 k. mo:skamow 'he emerges'
 l. mu:skamit 'if he emerges'
 m. ko:ʔnačen 'if he fears him'
 n. ku:ʔnatwa? 'if they fear him'

Odden assumes the following rule:

$$(3) \begin{bmatrix} + \text{syll} \\ - \text{low} \\ + \text{long} \end{bmatrix} \rightarrow [+ \text{high}] / \text{---} C_0(V C_0)_0 C \begin{bmatrix} - \text{cons} \\ + \text{high} \end{bmatrix}$$

However, as Jensen and Stong-Jensen [12:154-159] rightly point out, Odden's formulation fails to accommodate the following crucial facts about this process. The first fact is that glides can intervene between the determinant and focus as in

- (4) a. keme:wan 'it is raining'
 b. kemi:wawwal 'is it raining?'
 c. ke:we:w 'he goes home'
 d. ki:wiane:w 'he takes him home'

Second, the long mid vowels *e*: and *o*: cannot intervene, so that Mid Vowel Raising must apply leftward repeatedly as in

- (5) n + e:t + e:ski:w → n + e:t + i:ski:w → n + i:t + i:ski:w (→ ni:ci:ski:w 'my enemy')

Third, the high vowels *i*:, *i*:, *u*:, *u*: also cannot intervene. Thus in the following form *mi*, nearer to the focus than *ni*:, must be regarded as a determinant element.

- (6) wi:smani:w 'horned owl' (we:s 'horned')

Fourth, in addition to consonants, low vowels and short mid vowels are allowed to intervene as in

- (7) a. mo:skamow (= 6k)
 b. mu:skamit (= 6l)
 c. ko:ʔnačen (= 6m)
 d. ku:ʔnatwa (= 6n)
 e. po:set 'when he embarks'
 f. pu:setuaq 'when they embark'
 g. nato:mekot (= 6c)
 h. natu:mekotwa? (= 6d)

Lastly, although a glide might appear to constitute the determinant only when it immediately follows a consonant (cf. the contrastive forms in (8a)), yet, quite importantly, the postconsonantal vowel sequences /Cua/ and /Cia/ are always pronounced [Cwa] and [Cya], respectively, in this language. Thus if a postconsonantal glide is assumed to be derived from the corresponding underlying high vowel via a late rule of Glide Formation like (8b), then the determinant can be restricted to the set of high vowels.

- (8) a. ne:mow (= 6a) vs. natu:mekotwa? (= 6d)
 b. $\begin{bmatrix} + \text{high} \\ - \text{long} \end{bmatrix} \rightarrow [- \text{syll}] / C \text{---} a$

On the basis of these observations Jensen and Stong-Jensen assert that Odden's rule be revised as follows:

$$(9) \begin{bmatrix} -\text{cons} \\ +\text{syll} \\ -\text{low} \\ +\text{long} \end{bmatrix} \rightarrow \text{I + high} / \text{--- C}_0 \left\{ \begin{array}{l} +\text{syll} \\ [+ \text{low}] \\ [-\text{high}] \\ -\text{low} \\ [-\text{long}] \end{array} \right\} \text{C}_0 \delta \text{C} \begin{bmatrix} +\text{syll} \\ +\text{high} \\ -\text{low} \end{bmatrix}$$

In section 3 we will consider why certain redundant features are forced to be included in the statement of this rule.

Now, recall that the element 'C' that stands immediately before the determinant of rule (9) was also included in Odden's rule merely to ensure that a postconsonantal glide could be matched with the determinant. However, once a postconsonantal glide is represented underlyingly as a (high) vowel the alleged requirement that a consonant stand immediately before the determinant obviously becomes unnecessary. Even more interesting and important to our discussion is the fact that the intervening material (10) is precisely equivalent to the complement of the class of elements (11) that consists of the focus and the determinant.

(10) Nonsyllables, low vowels, short mid vowels

(11) Long mid vowels (the focus), high vowels (the determinant)

Such a class complement relation is not accidental but seems to hold true for phonological rules in general, as I will attempt to demonstrate in the remaining parts of this article. Thus rule (9), because it has the fully predictable intervening material specified in its environment, must consequently be discarded. Alternatively, rule (9) can be simplified as follows:

$$(12) \begin{bmatrix} +\text{syll} \\ -\text{low} \\ +\text{long} \end{bmatrix} \rightarrow \text{I + high} / \text{--- X} \begin{bmatrix} +\text{syll} \\ +\text{high} \end{bmatrix}$$

if the following condition is established.

(13) *Class Complement Constraint* (a preliminary version) In a phonological rule the intervening material may be constituted only by those segments belonging to the complement of the class that consists of the focus and the determinant.

1.2. LATIN LIQUID DISSIMILATION

According to Jensen and Stong-Jensen [12] Latin has a rule of Liquid Dissimilation that 'converts / of the suffix *-dlis* to *r* if there is a lateral earlier in the word' [12:145]. For example,

- (14) a. *nava:dlis* 'naval' (na:vis 'ship')
 b. *milita:dlis* 'military' (milies 'soldier')
 c. *luna:dlis* 'lunar' (luna 'moon')
 d. *lupa:dlis* 'whorish' (lupa:na: 'brothel')

The rule requires a morphological conditioning, for it does not apply to other suffixes than the adjective-forming *-dlis*.

- (15) a. *text-dlis* 'woven' d. *ama:-dlis* 'loveable'
 b. *flex-dlis* 'flexile' e. *lauda:-dlis* 'laudable'
 c. *alt-dlis* 'fattened' f. *inexplicat:-dlis* 'inexplicable'

Now, interestingly enough, the rule does not allow liquids (including *r*) to intervene at all.

(16) *libera:dlis* 'liberal' (li:ber 'free')

In order to account for this fact Odden [23:293] suggests two possible statements of the rule:

$$(17) \text{ [+lat]} \rightarrow \text{[-lat]} / \text{ [+lat]} \left\{ \begin{array}{l} -\text{cons} \\ -\text{voc} \end{array} \right\}_0 \text{---}$$

$$(18) \text{ [+lat]} \rightarrow \text{[-lat]} / \text{ [+lat]} \left\{ \begin{array}{l} -\text{son} \\ -\text{cons} \\ +\text{nasal} \end{array} \right\}_0 \text{---}$$

However, the fact that liquids cannot intervene in such a rule should not be regarded as peculiar to Latin. English indeed has a rule quite similar to the Latin, as I argue in the next subsection.

1.3. ENGLISH LIQUID DISSIMILATION

As is pointed out by Chomsky and Halle [3:226, fn. 55] and also by Suiko [30:24], English also has a rule of Liquid Dissimilation, which is quite similar to the Latin rule in (1) that it applies only to the ad-

jective-forming suffix *-al* and (2) that it does not allow liquids to intervene. But in the case of English a special condition must be imposed on the variable X:

- (19) $al \rightarrow ar / [+lat]X$ —
 where the expansions with X containing more than one segment are minor rules.

Rule (19) expands into two cases:

- (20) $al \rightarrow ar / [+lat] [+seg]h$ — (major rule)
 (21) $al \rightarrow ar / [+lat] [+seg]_2$ — (minor rule)

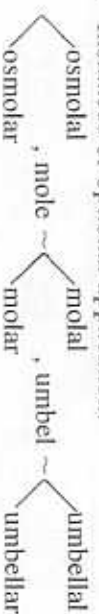
Let us first consider the following three subcases of rule (20):

- (22) $al \rightarrow ar / [+lat]$ —
 (23) $al \rightarrow ar / [+lat]C$ —
 (24) $al \rightarrow ar / [+lat]V$ —

Rule (22) has no exceptions. The examples in (26) are instances of its optional application.

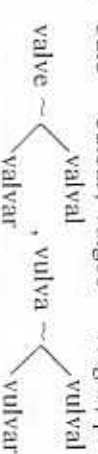
- (25) *simile* ~ *similar*, *table* ~ *tabular*, *style* ~ *stylar*, *vehicle* ~ *vehicular*, etc.

- (26) Instances of optional application:



Rule (23) seems to have only one exception (*palpus* ~ *palpal*); otherwise it applies regularly to any form meeting its structural description, as in

- (27) *bulb* ~ *bulbar*, *vulgus* ~ *vulgar*, *palm* ~ *palmar*, *ulna* ~ *ulnar*,



As for rule (24) there seems to be only one lexical exception (i.e., *filiate* ~ *filial*); all the remaining words meeting the SD of the rule regularly

undergo it as in

- (28) *cochlea* ~ *cochlear*, *trochlea* ~ *trochlear*, *atrabitious* ~ *atrabiliar*, *council* ~ *conciliar*, *folium* ~ *foliar*, *peculium* ~ *peculiar*,
 family ~ $\begin{cases} \text{familial} \\ \text{familiar} \end{cases}$, ganglion ~ $\begin{cases} \text{ganglial} \\ \text{gangliar} \end{cases}$, nucleus ~
 nuclear

However, notice that the eight forms of (30) whose stem-final syllables, unlike the corresponding syllables of forms like (29), contain front vowels and which, moreover, may take the suffix *-um*, are considered to constitute systematic exceptions to rule (24).

- (29) *folium* ~ *foliar*, *peculium* ~ *peculiar*
 (30) *epithelium* ~ *epithelial*, *endothelium* ~ *endothelial*, *mesothelium* ~ *mesothelial*, *mycelium* ~ *mycelial*, *pallium* ~ *pallial*, *promycelium* ~ *promycelial*, *prothallium* ~ *prothallial*, *telium* ~ *telial*

Next consider rule (21). It seems to apply to at most nine forms of (31); the other innumerable forms, of which the examples of (32) represent only a small sample, are never subject to the rule.

- (31) *column* ~ *columnar*, *plane* ~ *coplanar*, *lobe* ~ *lobar*, *lumbago* ~ *lumbar*, *lune* ~ *lunar*, *plantar*, *line* ~ $\begin{cases} \text{lineal} \\ \text{linear} \end{cases}$, *lamina* ~
 $\begin{cases} \text{laminial} \\ \text{laminar} \end{cases}$, *lacuna* ~ $\begin{cases} \text{lacunal} \\ \text{lacunar} \end{cases}$
 (32) *angel* ~ *angelical*, *discipline* ~ *disciplinal*, *cycloid* ~ *cycloidal*, *globe* ~ *global*, *dialect* ~ *dialectal*, *politics* ~ *political*, *element* ~ *elemental*, etc.

In short, it is clear from the above facts that rules (20) and (21) should be characterized as major and minor rules, respectively.

Now, our primary concern is the fact that as in the Latin case discussed above the English Liquid Dissimilation also disallows liquids (including *r*) to intervene between the determinant and focus. See, for

example, the following form:

(33) sepulcher ~ sepulchral

This fact seems to follow automatically from the very function of Liquid Dissimilation. That is, the rule has the function of avoiding repetitive occurrences of *l* by changing one *l* in a string of segments to *r* if another *l* precedes it anywhere in the same string. However, since in forms like (16) and (33) the SC element *r* already intervenes between the determinant *l* and the focal *l*, there are no repetitive occurrences of *l* found from the beginning, a fact that is sufficient to block Liquid Dissimilation from applying to such forms. That is why *rs* are not allowed to intervene in Liquid Dissimilation. In fact it seems to be a general characteristic of dissimilatory rules that SC elements cannot serve as an intervening material.

This restriction also holds for assimilatory rules such as the Menomini Mid Vowel Raising. For, according to either Howard's [8] theory of directional application or Anderson's [1] and Kenstowicz and Kisseberth's [13] theories of iterative application, the SC element of such a rule can be used as a determinant of its next application, as in (5). Therefore it is necessary to revise the Constraint (13) as follows:

(34) *Class Complement Constraint* (the final version)

In a phonological rule of the form:

$$\begin{array}{l} YCX \text{---} Z \\ A \rightarrow B / \text{ or} \\ Y \text{---} X CZ \end{array}$$

the variable X may be constituted only by those segments belonging to the complement of the class that consists of A (the focus), B (the structural change), and C (the determinant).

The revised Constraint says that only nonessentials segments can intervene in the sense that they must not correspond to the focus, the SC, or the determinant of a rule, i.e., to its essential constituents.

1.4. ENGLISH *r*-DISSIMILATION

American English has a rule of *r*-Dissimilation that optionally drops one of two (nonconsecutive) *rs* within a word. As a first approximation the *r*-dropping environments can be classified into the following five cases:

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(35) $r \rightarrow \emptyset / a \text{---} CXr$ (comforter)

(36) $r \rightarrow \emptyset / C \text{---} aXr$ (propriety)

(37) $r \rightarrow \emptyset / a \text{---} aXr$ (temperature)

(38) $r \rightarrow \emptyset / rXa \text{---} C$ (reservation)

(39) $r \rightarrow \emptyset / rXC \text{---} a$ (represent)

All of these rules should be regarded as minor rules on the following grounds. Let us first consider rule (35). In general, it does not apply to prefixes such as *after-* (*afterbirth*), *inter-* (*intercourse*), *per-* (*periscope*), *super-* (*supervisor*), and *under-* (*underchange*); there appear to be only four words in which *rs* may exceptionally drop (i.e., *afterward*, *interfere*, *perform*, and *perfumery*). In addition, the applicability of this rule cannot be determined on purely phonetic grounds. The following examples are near-minimal pairs with regard to the presence versus absence of *r*-dropping.

(40) Deleted	vs.	Retained
overture		coverture
aperture		evermore
furthermore		
liverwurst		wienerwurst
		liverwort
		setterwort
repertory		offertory
surveyor		purveyor
checkerboard		weatherboard
Knickerbocker		Whippersnapper
perfumery		perfumery

Next consider rules (36) and (39). These rules apply to a few words such as *perrogative* and *represent*, in which *p* immediately precedes the focal *r*, and to probably only three words of *infared*, *secretary*, and *Northrip*. The applicability of these rules also cannot be determined by purely phonetic considerations. Thus we find contrastive forms like:

(41) Deleted	vs.	Retained
proportion		proverbial
represent		reprehend

Let us next consider the rules of progressive dissimilation (38) and (39). They bear exactly the mirror-image relations to the regressive rules (36) and (35), respectively. However, the following rule, which might be expected to similarly correspond to rule (37), nonetheless seems to be nonoperative in English.

$$(50) \quad r \rightarrow \beta / rXa \text{ ______ } a$$

One reason for this might be that to the extent that rule (50) applied to words such as the following the Main Stress Rule of English would correspondingly become opaque.

$$(51) \quad \text{corroborant, auriferous, carboniferous, obstreperous}$$

The true reason for the nonoperation of this rule, however, seems to lie in the fact that the *r*-Dissimilation as a whole is a minor rule, and thus normally fails to apply. Thus no problems, whether theoretical or empirical, will arise if we set up rule (50) in order to capture a significant generalization that seems to underlie rules (38) and (39). That is, by following the same procedure as was taken in constructing rule (49), we can obtain a generalized rule of progressive dissimilation:

$$(52) \quad r \rightarrow \beta / rX \text{ - } \left[\begin{array}{c} + \text{syll} \\ \text{-- reduced} \end{array} \right] \text{ ______ } \text{ - } \left[\begin{array}{c} + \text{syll} \\ \text{-- reduced} \end{array} \right]$$

In short, since rules (49) and (52) evidently bear a mirror-image relation to each other they must be collapsed as follows¹:

$$(53) \quad r \rightarrow \beta \% \text{ - } \left[\begin{array}{c} + \text{syll} \\ \text{-- reduced} \end{array} \right] \text{ ______ } \text{ - } \left[\begin{array}{c} + \text{syll} \\ \text{-- reduced} \end{array} \right] Xr$$

(Optional minor rule)

In those dialects that show *r*-Dissimilation in the environment of immediate vicinity to nonreduced as well as reduced vowels it seems sufficient to restate the rule simply as follows:

$$(54) \quad r \rightarrow \beta \% \text{ [+ seg] ______ } Xr \quad \text{(Optional minor rule)}$$

¹ Notice that this formulation presupposes the order of (49) followed by (52), which is necessary to account for the fact that if there are two *rs* within a word, both of which fulfill the requirements for drop, then it is always the lefthand *r* that is actually susceptible to deletion (cf. *afterward, circumference, and so on*).

The specification [+ seg] in the environment is necessary to guarantee that an *r*-drop never occurs word-initially or finally.

Of special interest for our discussion about phonological variables are the following two points. The first one is that consonants other than *r*, and of course vowels, can intervene in *r*-Dissimilation; specifically, the lateral *l* is allowed to intervene as in *catapultar, vetracular, particular*. The fact that the lateral liquid among other segments serves as an intervening material in these examples is not surprising, for the segment has nothing to do with the function of *r*-Dissimilation of attempting to avoid repetitive occurrences of *rs* by deleting one of a pair of *rs* within a word. The other point is that the rule applies regardless of distances between the determinant and focus. See, for example, the following forms with successively increasing distance: *surprise, comforter, circumference, thermometer*. This is of course a familiar important characteristic of variables. In fact, the two characteristics just discussed are automatic consequences of the Class Complement Constraint.

1.5. SIMPLICITY AND THE CLASS COMPLEMENT CONSTRAINT

Here it is necessary to make one important remark on the Class Complement Constraint. A sagacious reader will immediately notice that although the Constraint correctly prevents essential elements (i.e., the focus, the SC, and the determinant) from occurring in the variable *X*, yet it fails in itself to reject those unnatural rules in which some or all of those essential elements are explicitly specified in the position between the determinant and focus. It becomes possible, however, to reject such unnatural rules if the Constraint receives the aid of the evaluation measure of simplicity.² Thus rules obeying the Constraint always can (and must) be simplified by using variables, whereas in the case of those unnatural rules under consideration such simplifications are really impossible. Consequently, the former rules are always more highly valued by the simplicity measure, with the required result that the latter rules are rejected as implausible.

2. APPARENT COUNTEREXAMPLES

Many examples have been presented in the literature that appear to violate the Class Complement Constraint. The present section deals

² This point was suggested to me by Masaru Kajita.

with these apparent counterexamples and show that all of them must rather be viewed as supporting evidence for the Constraint.

2.1. RULES IN WHICH THE DETERMINANT = V AND THE FOCUS = V

2.1.1. Southern Agaw Vowel Lowering

Southern Agaw has vowel alternations such as the following, in which 'a mid vowel becomes high when the following syllable contains a high vowel' (Howard [8:17]).

- (55) a. muliqisi 'monk' moleqéská (pl.)
 b. dunizi 'potato' donezka (pl.)
 c. dikiti 'healthy' deketká (pl.)
 d. ligisimi 'long' leggesemká (pl.)

Accordingly, Howard assumes the following rule of Vowel 'Raising':

$$(56) \begin{bmatrix} +\text{syll} \\ -\text{low} \end{bmatrix} \rightarrow [+high] / \text{---} C_0 \begin{bmatrix} +\text{syll} \\ +\text{high} \end{bmatrix}$$

Now, the Class Complement Constraint predicts that this rule would allow not only consonants but also low vowels to intervene. But it is only consonants that actually can intervene. Thus the Constraint appears too weak.

Contrary to his account, however, a truly significant generalization that underlies such alternations is that a (high) vowel becomes nonhigh when the following syllable contains a nonhigh vowel. Thus, instead of 'Raising' (56), the following rule of Vowel Lowering should be postulated.

$$(57) [+syll] \rightarrow [-high] / \text{---} C_0 \begin{bmatrix} +\text{syll} \\ -\text{high} \end{bmatrix}$$

This reanalysis can be defended quite easily. In the first place rule (56) is counterintuitive in that it derives singular forms from the corresponding plurals. Second, rule (57) presupposes a more natural system of underlying vowels that contains the high vowels *i* and *u*, which are clearly less marked than the mid vowels *e* and *o*. Third, Vowel Lowering (57) has a simpler form than the other rule.

As a consequence, since in rule (57) high vowels constitute the focus, and mid and low vowels constitute the determinant the fact that the

rule disallows any vowel to intervene can be accounted for in terms of the Class Complement Constraint.

2.1.2. Woléaian Low Vowel Dissimilation

According to Howard [8:18-19] Woléaian has a rule that changes a low vowel to *e* if the following syllable also contains a low vowel, as in

- (58) a. [ma:t] /mata/ 'eye (indep. form)'
 b. [metaj] /mata + ji/ 1st sg.
 c. [metam^w] /mata + mu/ 2nd sg.
 d. [metaj] /mata + la/ 3rd sg.
 e. [metasj] /mata + ca/ 1st (inc.) pl.
 f. [matemam] /mata + mami/ 1st (exc.) pl.
 g. [metami] /mata + mi/ 2nd pl.
 h. [meta:r] /mata + jire/ 3rd pl.
 i. [tepaŋj] /tapaŋ + ija/ 'to help it'
 j. [xetapetaŋ] /xa + tapap = tapap/ 'to make help'

In order to account for these alternations he postulates the following rule:

$$(59) \begin{bmatrix} +\text{syll} \\ +\text{low} \end{bmatrix} \rightarrow \begin{bmatrix} -\text{back} \\ -\text{low} \end{bmatrix} / \text{---} C_0 \begin{bmatrix} +\text{syll} \\ +\text{low} \end{bmatrix}$$

According to the Class Complement Constraint this rule would allow not only consonants but also nonlow back vowels such as *u* and *o* to intervene between the determinant and focus. In other words, the Constraint would allow both of the following derivations:

$$(60) \text{ a. } \dots aC_0a \dots \rightarrow \dots eC_0a \dots$$

$$\text{ b. } \dots aC_0 \begin{bmatrix} u \\ o \end{bmatrix} C_0a \dots \rightarrow^* \dots eC_0 \begin{bmatrix} u \\ o \end{bmatrix} C_0a \dots$$

In view of the fact that the process in question should be regarded intrinsically as a lowness dissimilation, however, a phonetic output like (60b), because it does not exhibit an alternating pattern with respect to vocalic lowness as in (60a), is quite unnatural, and indeed does not exist in the language. Our Constraint, therefore, appears too weak.

But it can be shown that the specification [-back] in the SC of rule (59) is completely irrelevant to this dissimilation, and thus has to be

removed from the rule. In order to see why this is the case, let us then examine an assimilation rule of Wolofian, which according to [8:25-26] raises *a* to *e* between two high vowels as in (61).³

(61) a.	[ü:ɪ]	/ülüm/	'drinking object (indep. form)'
b.	[ülünej]	/ülüm-a-ji/	1st sg.
c.	[ülünem ^w]	/ülüm-a-mu/	2nd sg.
d.	[ülünam]	/ülüm-a-la/	3rd sg.
e.	[älünas]	/ülüm-a-ca/	1st (inc.) pl.
f.	[älünemam]	/ülüm-a-mami/	1st (exc.) pl.
g.	[älünemi]	/ülüm-a-mii/	2nd pl.
h.	[älüne:r]	/ülüm-a-jire/	3rd pl.

Although Howard does not give any explicit formulation of this rule, it is quite clear that he assumes a rule like the following:

$$(62) \left[\begin{array}{l} + \text{syll} \\ + \text{low} \end{array} \right] \rightarrow \left[\begin{array}{l} - \text{back} \\ - \text{low} \end{array} \right] / \left[\begin{array}{l} + \text{syll} \\ + \text{high} \end{array} \right] C_0 \text{---} C_0 \left[\begin{array}{l} + \text{syll} \\ + \text{high} \end{array} \right]$$

Since this process itself is a lowness assimilation the specification [-back] in the SC of rule (62) should be regarded simply as a secondary concomitant change. Now, as we have already seen, the same specification is repeated as a secondary change in the SC of rule (59). In this respect Howard's analysis must be said to be inadequate. Alternatively, rules (59) and (62) can be restated more simply as (63) and (64), respectively, while the subsidiary change repeated in the former two rules need only be stated once and for all as a rule of absolute neutralization like (65).

$$(63) \text{ Low Vowel Dissimilation:} \\ \left[\begin{array}{l} + \text{syll} \\ + \text{low} \end{array} \right] \rightarrow \left[\begin{array}{l} - \text{low} \\ \text{---} \end{array} \right] C_0 \left[\begin{array}{l} + \text{syll} \\ + \text{low} \end{array} \right]$$

$$(64) \text{ Vowel Raising:} \\ \left[\begin{array}{l} + \text{syll} \\ + \text{low} \end{array} \right] \rightarrow \left[\begin{array}{l} - \text{low} \\ \text{---} \end{array} \right] / \left[\begin{array}{l} + \text{syll} \\ + \text{high} \end{array} \right] C_0 \text{---} C_0 \left[\begin{array}{l} + \text{syll} \\ + \text{high} \end{array} \right]$$

³ Note, however, that the medial *r* of (61f) is a result of the above dissimilation rule, having nothing to do with the assimilation rule considered here.

(65) Absolute Neutralization:

$$\left[\begin{array}{l} + \text{syll} \\ - \text{low} \\ - \text{round} \end{array} \right] \rightarrow \left[\begin{array}{l} - \text{back} \end{array} \right]$$

Consequently, the fact that rule (63) disallows any vowel to intervene is guaranteed by the Class Complement Constraint, so that unnatural derivations like (60b) can be correctly rejected on a principled basis. Our Constraint, at the same time, explains why only consonants can intervene in Vowel Raising (64).

2.1.3. Tunica Vowel Assimilation

According to Odden [21] Tunica has a rule of Vowel Assimilation that 'changes *a* to *e*, if immediately preceded by one of the front vowels *e*, *i* or *ɛ*, and changes *a* to *ɔ* if preceded by one of the round vowels *o*, *u*, or *ɔ*' [21:181]. The following examples are reproduced from [21]:⁴

- (66) a. mîléni < mîli + âni (mîli 'it is red')
 b. tašléni < tašle + âni (tašle 'it is beautiful')
 c. lûpitéhéni < lûpitéhe + âni (lûpitéhe 'she will not die')
 d. molôni < môlu + âni (môlu 'full')
 e. môfɔhɔni < môfɔho + âni (môfɔho 'it is not full')
 f. ɔûwet 'on his part' < ɔûwi + at (ɔûwi 'him, -at' on . . . 's part')
 g. tânarakot 'on the snake's part' < tânaraku + at (tânaraku 'snake')

The Vowel Assimilation, furthermore, allows a glottal stop as an intervening material as in (67)⁵ while disallowing any other consonant to intervene (cf. (68)).

- (67) a. çûɔɔki 'she took' < çû + ɔɔki
 b. pôɔɔki 'she saw' < pô + ɔɔki
 c. mɛɔɔki 'she searched' < mɛ + ɔɔki
 d. hɛɔɔ 'today' (kâɔaɔ 'when, ɔaɔhhi 'day')
 e. ɔuhôhɔki 'she threw him' < ɔuhk + tôhu + ɔɔki (tôhu 'to throw')

⁴ Odden assumes that after being subject to Vowel Assimilation these forms further undergo the following rule of Vowel Truncation: V → ø / ___ V

⁵ In the last four examples in (67), not only Vowel Assimilation but also the following rule of Preglottal Deletion ordered after it are assumed to be applied: [+syll, -stress] → ø / ___ +

- f. hipʔaki 'she danced' < hipu + ʔaki
 g. ʔuhʔapʔeki 'she caught him' < ʔuhk + tãpi + ʔaki
 h. nãšʔeki 'she led' < nãši + ʔaki
- (68) a. hipuhkʔaki 'she is dancing'
 b. žuhkʔaki 'she is taking'
 c. ʔuruhʔaně 'when I swoop'
 d. yúsahkáyí 'yellow catfish'
 e. ʔihitra 'my cloth'
 f. yúkikhkéra 'you are cooking'

Odden correctly states the rule as (69), which explicitly refers to a glottal stop as an intervening material.

- (69) a → [around, aback] / [+syll., around, aback] (ʔ) _____

Now, the Class Complement Constraint again appears too weak, for in the very face of the examples of (68) it predicts that in addition to a glottal stop other consonants also could intervene in rule (69). However, from the point of view of a universal grammar it seems to be the case that every consonant can intervene in a rule like (69). For changes like (70) involving only a glottal stop as an intervening material are presumably less natural than those like (71) in which zero or more consonants of arbitrary nature are allowed to intervene, though the problem is clearly of empirical nature.

- (70) a. ... { i } { e } { e } { i }
 { e } { e } { e } { e }
 { u } { u } { u } { u }
 { ɔ } { ɔ } { ɔ } { ɔ } (ʔ)a ... → ... (ʔ)e ...
- b. ... { i } { e } { e } { i }
 { e } { e } { e } { e }
 { u } { u } { u } { u }
 { ɔ } { ɔ } { ɔ } { ɔ } (ʔ)a ... → ... (ʔ)ɔ ...
- (71) a. ... { i } { e } { e } { i }
 { e } { e } { e } { e }
 { u } { u } { u } { u }
 { ɔ } { ɔ } { ɔ } { ɔ } C_{0a} ... → ... C_{0ε} ...
- b. ... { i } { e } { e } { i }
 { e } { e } { e } { e }
 { u } { u } { u } { u }
 { ɔ } { ɔ } { ɔ } { ɔ } C_{0a} ... → ... C_{0ɔ} ...

Thus, the fact that only a glottal stop can intervene in rule (69) probably should be regarded as peculiar to Tunica. Any attempt to predict this

particular fact in terms of something like a universal principle, therefore, seems to be misguided from the start. The presumed difference in naturalness between the two rules (70) and (71) can be accounted for in such a way that the intervening glottal stop must be mentioned in the former rule itself while the intervening "C₀" of the latter rule is, in accordance with the Class Complement Constraint, replaced by a variable, which by principle does not contribute to the complexity of a grammar.

2.1.4. *Khalkha Mongolian Vowel Harmony and Rounding* *Harmony*

Recently there has been a controversy regarding the Vowel Harmony in Khalkha Mongolian. Odden [21, 23] claims that it should be formulated as a fronting rule, whereas Jensen and Stone-Jensen [12] assume a backing rule. Both of them, however, do consent to regard Vowel Harmony as a rule that assimilates the backness of a suffixal vowel to that of a root vowel as in (72)–(75).

- (72) The causative suffix *-u:lax*
- | | |
|----------------|------------------------------|
| a. a:šlu:lax | 'make behave in some manner' |
| b. baragdu:lax | 'cause to wear out' |
| c. xevtü:lex | 'cause to lay' |
| d. biyelü:lex | 'cause to fulfill' |
| e. oru:lax | 'make introduce' |
| f. bodu:lax | 'make think' |
| g. šuglu:lax | 'make gather' |
| h. mušgu:lax | 'make twist' |
| i. üzü:lex | 'show' |
| j. bültü:lex | 'make pop out' |
- (73) The ablative suffix *-a:s*
- | | | | |
|---------------|----------|-------------|--------|
| a. čama:s | 'you' | e. xur:ʔa:s | 'law' |
| b. gere:s | 'house' | f. ü:res | 'nest' |
| c. surgu:ʔa:s | 'school' | g. tü:ners | 'that' |
| d. exe:s | 'mother' | | |
- (74) The suffix *-u:l* forming verbs of permission or causation
- | | |
|------------|--|
| a. alu:l | 'allow or cause to kill' (<i>ala-</i> 'kill') |
| b. xelü:l | 'allow to say' (<i>xele-</i> 'say') |
| c. to:lu:l | 'allow to count' (<i>to:lo-</i> 'count') |
| d. bö:lu:l | 'allow to act as shaman' (<i>bö:l-</i> 'act as shaman') |

- (93) The ablative suffix *-a:s*
- | | |
|---------------------|-----------------------------|
| a. xoino:s 'behind' | d. xö:mi:ö:s 'fur on belly' |
| b. morino:s 'horse' | e. böxixö:s 'bowing' |
| c. sonino:s 'news' | f. öhmi:gö:s 'instep' |

But it must not apply across *u*.

- (94) The causative suffix *-u:lax*
- | |
|-----------------------------|
| a. oru:lax 'make introduce' |
| b. bodu:lax 'make think' |

- (95) The perfective participle suffix *-a:d*
- | |
|--|
| a. to:lor:d 'having counted' (<i>to:l-</i> 'count') |
| b. to:lu:la:d 'since he caused to count' (<i>-u:l-</i> 'causative') |
| c. bö:lö:d 'having acted as shaman' (<i>bö:l-</i> 'act as shaman') |
| d. bö:lä:le:d 'since he caused to act as shaman' |

In order to account for these facts Odden, and Jensen and Strong-Jensen too, assume the following rule:

- (96)
$$\begin{bmatrix} + \text{syll} \\ - \text{high} \end{bmatrix} \rightarrow \begin{bmatrix} + \text{round} \\ - \text{low} \end{bmatrix} / \begin{bmatrix} + \text{syll} \\ - \text{high} \\ + \text{round} \end{bmatrix} \langle C_0 \begin{bmatrix} + \text{syll} \\ + \text{high} \\ - \text{round} \end{bmatrix} \rangle \text{)}_0 C_0 \text{---}$$

Just as in the case of rule (87), however, the specification [-low] in the SC of rule (96) is irrelevant to Rounding Harmony. Furthermore, as is evident from the fact that Rounding Harmony does not apply to forms such as (97), it seems to apply only if both the focal and the determinant vowels agree in backness.

- (97) The past tense suffix *-j̄e:*
orxj̄e: 'forgot'

Therefore, rule (96) should be revised as follows:

- (98)
$$\begin{bmatrix} + \text{syll} \\ - \text{high} \\ \text{aback} \end{bmatrix} \rightarrow \text{I} + \text{roundI} / \begin{bmatrix} + \text{syll} \\ - \text{high} \\ + \text{round} \\ \text{aback} \end{bmatrix} \langle C_0 \begin{bmatrix} + \text{syll} \\ + \text{high} \\ - \text{round} \end{bmatrix} \rangle \text{)}_0 C_0 \text{---}$$

Outputs of this rule can be modified into the appropriate surface forms by undergoing the following rule of Vowel Raising:

- (99)
$$\left\{ \begin{array}{l} \text{æ:} \rightarrow \text{ö:} \\ \text{ɔ:} \rightarrow \text{o:} \end{array} \right\}$$

Now it is possible to make a unified statement of both rules (90b) and (99): "Make all low vowels other than *a* nonlow." If we utilize Zwicky's [37] Class Complement Notation once again, this generalization can be expressed as follows:

- (100)
$$\begin{bmatrix} + \text{syll} \\ + \text{back} \\ - \text{round} \end{bmatrix} \rightarrow \text{I} - \text{lowI}$$

Rule (100), incidentally, explains why the surface vocalic system of Khalkha Mongolian (101) has certain phonetic gaps in its series of low vowels.

- (101) i i: ü ü: u u:
e e: ö ö: o o:
a a:

Next consider rule (90a). It may as well be expected from the vowel system (101) that in addition to this rule the language will also have the following rule:

- (102) $\wedge(\cdot) \rightarrow e(\cdot)$

In fact rule (102) is necessary to account for some apparent counter-examples to Vowel Harmony (88), for example, such forms as those in (85b). If the past tense suffix *-j̄e:* is assumed to be represented underlyingly as */-j̄∧:/*, the forms of (85b) no longer are exceptional, but regularly undergo Vowel Harmony and later are converted by rule (102) into the correct surface forms. A similar account is also available for forms like those in (83)–(84) if we take the underlying forms of the accusative suffix *-ig* and the abstract noun formative *-lig* to be represented as */-i:ig/* and */-liḡ/*, respectively. Such mixed vowel roots as *j̄ia:* and *german* can be similarly derived from abstract representations like *j̄ia:!* and *german!*; the other type of mixed vowel roots such as *Dashdender* and *lager* also can be derived in a parallel fashion. Rules (90a) and (102) are collapsed as follows:

- (103)
$$\begin{bmatrix} + \text{syll} \\ - \text{round} \\ - \text{low} \end{bmatrix} \rightarrow \text{I} - \text{backI}$$

It follows from the above considerations that all the suffixes except the negative suffix *-gii* have back vowels in their underlying representations. Consequently, the fact that the suffix *-gii* exceptionally fails to undergo Vowel Harmony is perfectly predictable since it is the only front vowel suffix in this language. Moreover, once the nonlow back unrounded vowels *i* and \wedge are set up as basic abstract segments, the underlying vowel system clearly becomes more symmetrical.

Finally, a brief comment must be made on ordering of the relevant rules. Fronting Rule (103) must be applied both after Vowel Harmony (88) and before Rounding Harmony (98), especially in order for Rounding Harmony to be prevented from applying in deriving forms such as *orxi:je*: (see (97)). Thus a typical derivation seems to proceed as follows:

- (104) /orxi + j \wedge / Underlying Form
 orxi + j \wedge : Vowel Harmony (88)
 orxi + je: Fronting (103)
 (N.A.) Rounding Harmony (98)
 (vacuous) Low Vowel Raising (100)
 [orxi:je:] Phonetic Form

To sum up, Vowel Harmony (88), whose focus is constituted by the natural class of all vowels, makes a unitary treatment of both the root and the suffix harmony. The fact that Vowel Harmony (88) allows only consonants to intervene is perfectly predictable in terms of the Class Complement Constraint. Rounding Harmony (98), on the other hand, allows, in addition to consonants, the neutral vowel *i* to intervene. In the next section we will consider exactly under what circumstances neutral vowels are allowed to intervene.

2.1.5. Eastern Cheremiss Vowel Harmony: A Subcondition on Vowel Harmony Rules

According to Odden [21] Eastern Cheremiss has a vowel harmony rule that allows a neutral vowel to intervene. He explains the rule as follows:

In Eastern Cheremiss, a vowel harmony rule assimilates *e* to *o* if it is preceded by *o* or *u*, and assimilates *e* to \bar{o} if it is preceded by \bar{o} or *u*, where any number of consonants and *s*'s can intervene (121: 183).

See the examples in (105)–(107). The examples of (106) are those in which *as* intervene. The forms in (107) indicate that none of the other vowels can intervene.

- (105) a. *šince* 'sit down' e. *tolžo* 'come'
 b. *aštalte* 'have made' f. *pörtö* 'turn'
 c. *bašalalte* 'be smeared' g. *küö* 'cook'
 d. *muško* 'wash'
- (106) a. *pörtal'ö* 'return' d. *todal'ö* 'break'
 b. *muškalto* 'wash one's self' e. *olmektal'ö* 'repair'
 c. *urmežo* 'howl'
- (107) a. *čumal'pe* 'kick'
 b. *optal'pe* 'pour'
 c. *tolneže* 'he wants to come'

Odden [23], moreover, points out that the Vowel Harmony rule applies only to word-final vowels, so that it naturally fails to apply to nonfinal vowels:

- (108) a. *šogem* 'I stand'
 b. *šoget* 'you (sg.) stand'
 c. *šogena* 'we stand'
 d. *šogeda* 'you (pl.) stand'
 e. *šogenam* 'I have stood'
 f. *šogen* 'he stood'
 g. *šogenam* 'I want to stand'
 h. *šogamet* 'you want to stand'
 i. *toles* 'he comes'

Accordingly, he proposes the following rule, in which *as* can serve as an intervening material.

- (109) Eastern Cheremiss Vowel Harmony:
- $$\left[\begin{array}{l} +\text{syll} \\ -\text{high} \\ -\text{back} \end{array} \right] \rightarrow \left[\begin{array}{l} +\text{round} \\ \text{aback} \end{array} \right] / \left[\begin{array}{l} +\text{syll} \\ +\text{round} \\ \text{aback} \end{array} \right] (C_0 \left[\begin{array}{l} +\text{syll} \\ +\text{back} \\ -\text{low} \\ -\text{round} \end{array} \right])_0 C_0 \text{---} \#$$

Let us here reproduce the Khalkha Mongolian Rounding Harmony as (110) for the sake of comparison with rule (109).

- (110) Khalkha Mongolian Rounding Harmony:
- $$\left[\begin{array}{l} +\text{syll} \\ -\text{high} \\ \text{aback} \end{array} \right] \rightarrow [+ \text{round}] / \left[\begin{array}{l} +\text{syll} \\ -\text{high} \\ +\text{round} \\ \text{aback} \end{array} \right] (C_0 \left[\begin{array}{l} +\text{syll} \\ +\text{high} \\ -\text{round} \end{array} \right])_0 C_0 \text{---}$$

Notice that a neutral vowel is *a* in the case of rule (109) while it is *i* in the case of rule (110). Thus neutral vowels differ from language to language, so that they must be specified as such in the grammars of particular languages. Now, the Class Complement Constraint predicts that rule (109) would allow as an intervening material the vowels of (111a), and rule (110) those of (111b).

- (111) a. Front high nonround (/i/)
 Back nonround (/a/) (neutral vowel), /æ/
 b. High vowels (/i/ (neutral vowel), /ü/, /é/, /u/)

As we have observed, however, it is only the neutral vowels that actually can intervene in these rules. But it is clearly undesirable to strengthen the Class Complement Constraint even more so that all vocalic segments except neutral vowels may universally be prevented from intervening in these vowel harmony rules. For the generalization seems to hold for almost all phonological rules that any element belonging to such a complement as is defined in the Constraint can intervene between the determinant and focus. It therefore seems necessary to establish the following condition as a collateral condition to our Constraint that seems to hold only for vowel harmony rules.

- (112) *A Subcondition on Vowel Harmony Rules*
 If a complement defined in the Class Complement Constraint contains a neutral vowel, then no vowels other than this may intervene between the focus and the determinant.

2.1.6. Votic Vowel Harmony

If a vowel harmony rule is found in which not only consonants but also a vowel can intervene when the latter is marked as both a focal and a contextual exception to it, then it may be regarded as independent evidence for the Class Complement Constraint. Battistella [2] in fact demonstrates that there is such a rule found in Hungarian. The present section attempts to show that the Vowel Harmony in Votic also has exactly the same nature.

According to Odden [23] the Votic Vowel Harmony can be characterized as follows:

Stems generally contain only front or only back vowels, with the exception that the vowel *i* freely cooccurs with both front and back vowels. Suffixal vowels generally assimilate to the backness of the preceding syllable [23: 282].

The following examples are all reproduced from [23].

- (113) The partitive suffix *-ta*
 a. *appa-ta* 'silver' c. *pä-tä* 'head'
 b. *sut-ta* 'wolf' d. *ület-tä* 'thieves'
- (114) The allative suffix *-le:*
 a. *ma-ta:* 'hand' c. *tö-le:* 'work'
 b. *naize-ta:* 'woman' d. *üvä-le:* 'good'
- (115) The nominalization suffix *-uz*
 a. *faka-uz* 'fatness'
 b. *pe:n-üz* 'smallness'
 c. *terve-üz* 'health'

The examples in (116) are those in which Vowel Harmony appears to be applied across the vowel *i*.

- (116) The partitive suffix *-ta*
 a. *opazi-ta* 'horses'
 b. *vasaroi-ta* 'hammer'
 c. *rikka:pi-ta* 'richer' (pl.)
 d. *lintui-ta* 'birds'
 e. *tüttäri-tä* 'daughters'
 f. *vävüi-tä* 'son-in-laws'

If only *i* is found in a stem, a suffix attached to it will invariably contain a front vowel, as in

- (117) The partitive suffix *-ta*
 a. *i:r-tä* 'mouse' d. *irt-tä* 'log'
 b. *pilli-tä* 'flute' e. *simis-sä* 'blue'
 c. *vimis-sä* 'last' f. *si:n-tä* 'mushroom'

Odden claims to state Vowel Harmony as a fronting rule on the following grounds. The ethnonymic suffix *-lain*, if attached to a back vowel stem, will regularly contain a back vowel, as in

- (118) The ethnonymic suffix *-lain*
 a. *viro* 'Estonian' d. *vad'd'a-lain* 'Votic'
 b. *viro-lain* 'Estonian person' e. *so:ma:* 'Finnish'
 c. *vad'd'a* 'stake' f. *so:ma-lain* 'Finn'

But if the same suffix follows a front vowel stem, it may contain either a back vowel or a front vowel:

- (119) a. venäi 'Russian'
 b. venä-lain 'Russian person'
 c. venä-läin 'Russian person'

Odden argues that forms like (119b), in which a front vowel stem is followed by a back vowel suffix, cannot be accounted for under a backing-rule assumption, but that if Vowel Harmony is stated as a fronting rule they can be derived by marking them as optional focal exceptions to that fronting rule. He, moreover, presents the following forms as further evidence for his fronting-rule assumption.

- (120) a. kase 'this' (nominative) d. kaze-la: (allative)
 b. kase-za (inessive) e. kaze-ta (adessive)
 c. kaze-ssa (relative) f. kaze-ta (ablative)

These forms indicate that if a case suffix is attached to the pronoun *kase* it invariably contains a back vowel. Odden argues that because the stem-final syllable of this pronoun contains a front vowel Vowel Harmony as a backing rule cannot account for the fact that case suffixes always contain back vowels. Alternatively, he assumes that these forms can be derived only by marking the stem-final front vowel as a contextual exception to Vowel Harmony as a fronting rule. Now, these considerations force him to state Vowel Harmony as (121), which clearly violates the Class Complement Constraint in that it allows the vowel *i* to intervene.

- (121) [+syll] → [-back] / $\left[\begin{array}{c} + \text{syll} \\ - \text{back} \end{array} \right] (C_0 \left[\begin{array}{c} + \text{syll} \\ - \text{round} \\ - \text{back} \end{array} \right])_0 C_0 \text{---}$

But rule (121) has precisely the same defects as those of Odden's rule of Vowel Harmony for Khalkha Mongolian discussed previously. First, in forms like (116) the stem-final vowel *i* can be matched with the determinant of that shorter expansion of rule (121), which does not include the parenthesized material, so that the following suffixal vowel will undesirably be changed to a front vowel. Second, rule (121) is intended to deal only with the suffix harmony despite the fact that the root and the suffix harmony generally behave alike in the language.

Alternatively, let us assume that Vowel Harmony applies freely

within roots as well as to suffixal vowels, and also that it must not apply across a stem-internal *i*. Then rule (121) can be generalized as follows:

- (122) [+syll] → [aback] / $\left[\begin{array}{c} + \text{syll} \\ \text{aback} \end{array} \right] C_0 \text{---}$

Note that if rule (122) applies to a stem-internal *i* preceded by a back vowel syllable, it produces *i* as an output. This vowel, of course, must be fronted by a late rule of absolute neutralization like the following:

- (123) $\left[\begin{array}{c} + \text{syll} \\ - \text{round} \\ + \text{high} \end{array} \right] \rightarrow [- \text{back}]$

Rule (123) indeed finds independent motivation. The following forms at first sight appear to violate Vowel Harmony (122), for in each of them the stem, which has the vowel *i* in its first syllable, nonetheless takes a back vowel suffix.

- (124) a. rikka:pi-ta (= 116c)
 b. lintu-ta (= 116d)
 c. viro-lain (= 118b)

However, if we assume that the first vowels of such stems are represented underlyingly as /i/, these apparent counterexamples can be accounted for in terms of rule (123).

Now in our alternative analysis forms like (119b) can be dealt with in the same way as in Odden's treatment, namely, by marking the ethnonymic suffix *-lain* as an optional focal exception to Vowel Harmony (122). In forms like those in (120), however, the stem-final vowel of the pronoun *kase* might apparently have to be marked as a focal as well as a contextual exception to rule (122). But if we accept the general principle that "any contextual exception is also a focal exception" (Battistella [2:113-114]),⁸ it will be clearly sufficient to mark the stem-final vowel of *kase* only as a contextual exception to rule (122).

It is important to note that since the stem-final vowel of *kase* forms

⁸ Battistella suggests this principle on the basis of his analysis of Hungarian Vowel Harmony. A similar principle is suggested by Phelps [25:100]. Notice, incidentally, that the same principle may follow from Howard's [8] directional theory of rule application, one of whose central hypotheses is that the SC of a rule can be used as a determinant of its next application.

a contextual exception to Vowel Harmony. Odden's rule (121) cannot apply to any suffix attached to this stem. As a consequence Odden is forced to conclude that the underlying form of the allative suffix contained in the form of (120d) would have to be represented as follows:

(125) /kase + la:/

But this underlying form seems unmotivated. For given only alternations such as those in (114) one usually assumes that the other less marked form *le:* should rather be postulated in the underlying representation:

(126) /kase + le:/

Once this underlying form is accepted, a suffixal vowel must be regarded as assimilating to the first back vowel of the pronoun *kase*, rather than to the final *-e*. Certainly rule (122) cannot apply across a vowel. But if this rule is simplified to (127), the final vowel of *kase*, because it forms a contextual (and also a focal) exception to Vowel Harmony, may be allowed to intervene in the variable X in accordance with the Class Complement Constraint.

(127) [+syll] → [aback] / $\left[\begin{array}{l} +\text{syll} \\ \text{aback} \end{array} \right] X \text{---}$

2.2. RULES IN WHICH THE DETERMINANT = V AND THE FOCUS = C

2.2.1. Karok *s-Palatalization*

According to Odden [21] and Jensen and Stong-Jensen [12] Karok has a rule that palatalizes *s* to *š* after *i* or *y*, as in (128)–(133). The rule can apply across a single consonant as in (130d, e), (131c), (132c), and (133b).

(128) a. mu-spuka 'his money' (*mu-* 'his')
b. i-špuka 'money'

(129) a. ʔá-skak 'he jumps' (*ʔa-* 'he')
b. i-škak 'to jump'

(130) a. -sip 'to start to'
b. ʔá:k-sip 'to raise one's hand' (*ʔak-* 'to do with one's hand')

c. išká:k-sip 'to jump up' (*škak-* 'to jump')
d. ikvrip-šip 'to start to run' (*kvrip* 'to run')
e. ivyí:h-šip '(pl.) to start off, to leave' (*vyih-* '(pl.) to go')
f. ipáčva:y-šip 'to raise up again'

(131) a. -sap 'closing up'
b. ikrup-sap 'to sew shut' (*krup-* 'to sew')
c. siv-šap 'to plug, seal up'

(132) a. im- 'to be, to be like, ...'
b. im-ʔa:x 'to be red' (*ʔa:x* 'blood')
c. im-širih 'to shine' (*širih* 'shiny')

(133) a. -sur 'off'
b. ʔárip-šur 'to cut a strip off' (*ʔarip* 'to cut a strip')

However, the rule must not apply across a syllable:

(134) ikpú:h-sip 'to start to swim' (*kpúh* 'to swim', *sip* 'to start to')
(*ikpú:h-šip)

The following forms are marked as exceptions to *s-Palatalization*,⁹

(135) a. sikspic 'six bits'
b. sɪmsim 'knife, metal'
c. tasín-sif 'to brush repeatedly' (*ásif* 'to brush')

The following two forms are optional variants:

(136) nani:ssára ~ nani-ššára 'my bread' (*nani-* 'my', *sára* 'bread')

In order to account for the above facts Jensen and Stong-Jensen assume the following rule:

(137) $\left[\begin{array}{l} +\text{cons} \\ -\text{syll} \\ +\text{cor} \\ +\text{strid} \\ +\text{cont} \end{array} \right] \rightarrow \left[\begin{array}{l} -\text{ant} \\ +\text{high} \end{array} \right] / \left[\begin{array}{l} -\text{cons} \\ +\text{high} \\ -\text{back} \end{array} \right] \left([+ \text{cons}] \text{---} \right)$
($s \rightarrow \dot{s} / \left\{ \begin{array}{l} i \\ y \end{array} \right\} \left([+ \text{cons}] \text{---} \right)$)

⁹ It is noteworthy that all these exceptional forms involve only one intervening consonant, in view of the fact that, as will be discussed later, such processes as palatalization normally seem to disallow any intervening material.

But this formulation does not work for at least two reasons. First, the rule cannot derive the right-hand variant of (136). That is, if one accepts Chomsky and Halle's [3] claim that the parenthesis notation defines disjunctive ordering, then, as the following derivation clearly shows, rule (137) would be blocked by the principle of disjunctive ordering from applying to the left element of the two successive *ss*.

(138) /nani-ssáara/ → *nani-ššára

Even if the left *s* can be prevented in accordance with the Class Complement Constraint from intervening in rule (137), the same rule would this time fail to apply to the right *s*, precisely because its determinant is limited to the nonconsonantal class of *i* and *y*:

(139) /nani-ssáara/ → *nani-ššára

Second, the feature specification [–ant] in the SC of rule (137) is irrelevant to *s*-Palatalization itself. For this specification can be provided at a certain appropriate stage in a derivation by certain marking conventions functioning as linking rules (cf. Chomsky and Halle [3: 419–435]). Thus the *s*-Palatalization rule should be characterized simply as having the following effect:

(140) $s \rightarrow s^y / \dots$

Let us then reformulate the rule of *s*-Palatalization so that its SC (s^y) can be used as a determinant for its next application. The result is the following:

(141)
$$\begin{bmatrix} -\text{syll} \\ +\text{cor} \\ +\text{strid} \\ +\text{cont} \end{bmatrix} \rightarrow [+high] / \begin{bmatrix} +\text{high} \\ -\text{back} \end{bmatrix} \text{ (C)} \text{---}$$

Now, the Class Complement Constraint commands that rule (141) must not apply across a focal *s*. As a result the rule can be applied iteratively to form the following correct derivation:

(142) /nani-ssáara/ → nani- s^y áara (→ nani-ššára) → nani-šš s^y ára (→ nani-šššára)

The Class Complement Constraint also predicts that a rule like (141) would allow certain nonconsonantal segments, say, back vowels to

intervene. However, this prediction is at once falsified by forms like (134). Thus the Constraint might appear too weak. But a careful examination of other similar examples will reveal that those processes which superimpose vowel features such as [high], [low], [back], and [round] onto the basic consonantal articulation (for example, palatalization, velarization, labialization, etc.) normally disallow any material to intervene. The English Velar Softening is a case in point; the word *activity*, for example, is in no dialect pronounced *[æstɪvəti]. Furthermore, if some material happens to be allowed to intervene in a rule of this type, it will be limited to at most one consonant. This fact clearly suggests a general restriction on possible distances between the determinant and focus of such a rule. In general, the problem of distance should be clearly distinguished from that of what kinds of material are allowed to intervene in a phonological rule. Thus, the distance restriction just observed must be stated independently in a general theory as a formal condition on rules of the type under consideration. It is under this formal condition that the Class Complement Constraint must be interpreted. Thus, the derivation in (142) can be constructed only if rule (141) meeting the required formal condition applies in accordance with the Class Complement Constraint. Processes like Karok *s*-Palatalization, therefore, cannot be used as evidence against our Constraint. Odden also discusses other similar processes:

- (143) a. Karok *x*-Labialization [21:185–186]
 b. Chinatpa Zoque Palatalization [23:284–285]
 c. Luiseno Deretroflexion [23:285]
 d. Choapun Zapotec Deretroflexion [23:285–286]
 e. Votic *l*-Velarization [23:286–287]

All of these processes involve at most one intervening consonant, and thus can be regarded as parallel to the Karok *s*-Palatalization.

As far as this kind of rules is concerned, it seems to be the case that rules that allow a consonant to intervene are more marked than those that disallow any intervening material. This difference in markedness can be explained in terms of the simplicity measure if we assume that a rule of the former type itself must refer to an intervening consonant.

2.2.2. Classical Mongolian Velar Lowering

In the preceding section I have argued that those rules that have a vocalic influence upon the consonantal articulation must be characterized as allowing no more than one consonant to intervene. However,

Odden [23] formulates Velar Lowering in Classical Mongolian in such a way that it may violate this formal condition. We must, therefore, make a careful examination of his formulation of Velar Lowering.

According to Odden Classical Mongolian has a rule that lowers a velar consonant to a uvular when it stands either before or after a back vowel.

- (144)
- | | |
|---------------|-------------------------------------|
| a. qara-qan | 'little black' |
| b. ulaya-qan | 'little red' |
| c. noyi-qan | 'little prince' |
| d. keŋ-ken | 'little child' |
| e. ine-ken | 'little this' |
| f. ala-yda | 'to be killed' |
| g. yabu-yda | 'to be gone to' |
| h. tayilu-yda | 'to be explained' |
| i. ūje-gde | 'to be seen' |
| j. jiru-y | 'picture' (<i>jiru-</i> 'to draw') |
| k. ide-g | 'brbe' (<i>ide-</i> 'to eat') |

Odden asserts that the rule can apply across a syllable containing the vowel *i*.

- (145)
- | | |
|--------------|--|
| a. biči-g | 'letter' (<i>biči-</i> 'to write') |
| b. būji-g | 'dance' (<i>būji-</i> 'to dance') |
| c. jori-y | 'intention' (<i>jori-</i> 'to intend') |
| d. qori-y | 'forbidden' (<i>qori-</i> 'to forbid') |
| e. bari-yda | 'to be seized' |
| f. biči-gde | 'to be written' |
| g. čēcэг-lig | 'flower garden' (<i>čēcэг</i> 'flower') |
| h. jimis-lig | 'orchard' (<i>jimis</i> 'fruit') |
| i. temür-lig | 'metal' (<i>temür</i> 'iron') |
| j. miqal-iy | 'compulence' (<i>miqan</i> 'flesh') |
| k. baya-iy | 'riches' (<i>bayan</i> 'rich') |

Accordingly, he postulates the following rule:

- (146)
$$\left[\begin{array}{c} + \text{cons} \\ + \text{back} \end{array} \right] \rightarrow \left[\begin{array}{c} - \text{high} \\ \% \end{array} \left[\begin{array}{c} + \text{syll} \\ + \text{back} \end{array} \right] (C_0 \left[\begin{array}{c} + \text{syll} \\ + \text{high} \\ - \text{round} \end{array} \right]) \right]$$

Clearly this rule violates the formal condition proposed in the preceding section. However, it can be shown to be wrong to regard Velar

Lowering as applicable across a syllable containing *i*. But before asking why this is the case we must examine the facts about Vowel Harmony in Classical Mongolian.

According to Odden [23] Classical Mongolian has a vowel harmony rule essentially identical to that of Khalkha Mongolian discussed previously. That is, the back vowels *a* and *u* appear in suffixes that follow back vowel roots and the front vowels *e* and *i* appear in suffixes that follow front vowel roots, as in

- (147)
- | | | |
|----------------|-----------------|--------------|
| a. aqa-dur | 'elder brother' | (dative) |
| b. qadam-dur | 'father in law' | (dat.) |
| c. dalai-dur | 'sea' | (dat.) |
| d. morin-dur | 'horse' | (dat.) |
| e. eme-dür | 'woman' | (dat.) |
| f. tölob-tür | 'pattern' | (dat.) |
| g. bičig-tür | 'letter' | (dat.) |
| h. aqa-luya | 'elder brother' | (comitative) |
| i. noqai-luya | 'dog' | (comit.) |
| j. ulus-luya | 'people' | (comit.) |
| k. keŋken-lüge | 'child' | (comit.) |
| l. bičig-lüge | 'letter' | (comit.) |
| m. aqa-yi | 'elder brother' | (accusative) |
| n. eme-yi | 'woman' | (acc.) |
| o. ulus-i | 'people' | (acc.) |

The forms in (147c, d, i) might appear to indicate that Vowel Harmony could apply across the vowel *i*. Suffixes that follow roots containing only *i* always contain front vowels as in (147g, l). The last three forms of (147) suggest that suffixes containing *i* do not alternate. Moreover, the following forms indicate that the roots *min-* and *čin-* exceptionally take back vowel suffixes.

- (148)
- | | |
|------------|----------------|
| a. sün-ü | 'milk' (gen.) |
| b. morin-u | 'horse' (gen.) |
| c. min-u | 'my' (gen.) |
| d. čin-u | 'your' (gen.) |

Odden argues that the forms in (148c, d) can be accounted for only by assuming that Vowel Harmony be formulated as a fronting rule and that the roots in question be marked as contextual exceptions to that fronting rule. Although Odden does not give such a rule, it seems obvious from the data presented above that he assumes the same rule as

f. wadɪ:k'	'falling down'
g. sandu:k'a:	'her box'
h. ʔabɪ:k'a:	'horse's necklace'
i. bane:t'a:	'hat'
j. maʃ:k'na:y	'miser'

In order to account for these facts he proposes the following rule:

$$(156) \begin{bmatrix} + \text{syll} \\ - \text{long} \end{bmatrix} \rightarrow [+ \text{back}] / \text{---} [+ \text{segment}]_0 \begin{bmatrix} + \text{cons} \\ \{ + \text{low} \\ + \text{glottal} \} \end{bmatrix}$$

But this rule involves at least two problematical points. First, because the determinant is specified inaccurately the rule fails to reveal the fact that the process in question is a backness assimilation. Strictly speaking, the class of pharyngeal and glottalized consonants must be defined as follows (cf. Ladefoged [16:243] and Chomsky and Halle [3:307]):

$$(157) \begin{bmatrix} + \text{cons} \\ + \text{low} \\ + \text{back} \end{bmatrix}$$

The specification [+cons] included in (157) is responsible for the fact that the glottal stop never conditions Backing Rule (cf. (155c)). If the determinant is defined in this way, it becomes possible to characterize the process in question as a natural assimilation rule that assigns the value [+back] of the determinant consonants to the input vowels.

Second, it seems highly implausible to assume that rules like Tigre Vowel Backing, in which one or more consonantal features are imposed on the vocalic articulation, could apply across arbitrary segments. For such rules generally seem to admit of no intervening material. In fact Tigre Vowel Backing can be restated in such a way that it does not allow any material to intervene. In order to see how such a restatement is possible we must, first of all, pay careful attention to Odden's following comment on the form in (154g).

The vowel *ä* also becomes *a* when followed in the next syllable by *a:* or *a* derived from *ä*, by an independently motivated rule. Thus, *ramač'* derives from *rämäč'* by application of this vowel harmony rule" [23:289, fn. 11].

Thus, for this form he assumes the following derivation:

(158) /rämäč'/	Underlying Form
rämäč'	Vowel Backing
ramač'	Vowel Harmony
[ramač']	Phonetic Form

However, notice that while he has recourse to Vowel Harmony in order to account for the first back vowel of this particular form, he at the same time assumes that Vowel Backing would have to be responsible for the first back vowels of such forms as those in (155). Consequently, it must be said that his analysis misses a generalization.

Alternatively, assume that the first back vowels of the forms of (155) are instead derived by Vowel Harmony just as in (158), and that Vowel Backing also applies to the front vowels in the second syllable of such forms as (155d-f, h-j). Then Vowel Backing can be so formulated that it no longer allows any material to intervene:

$$(159) \text{ Vowel Backing: } [+ \text{syll}] \rightarrow [+ \text{back}] / \text{---} \begin{bmatrix} + \text{cons} \\ + \text{low} \\ + \text{back} \end{bmatrix}$$

As for Vowel Harmony, it may be stated simply as follows:

$$(160) \text{ Vowel Harmony: } [+ \text{syll}] \rightarrow [\text{aback}] / \text{---} C_0 \begin{bmatrix} + \text{syll} \\ \text{aback} \end{bmatrix}$$

(The forms in (154d, e) must be marked as exceptions to Vowel Harmony.) Vowel Backing applies to *i:* of such forms as (155d-f) to change it to *i*, which directly conditions Vowel Harmony. Similarly, Vowel Backing applies to the front vowels in the second syllable of such forms as (155h-j) to produce *i* and *u*; which, after vacuously undergoing Vowel Harmony, account for the occurrence of back vowels in the first syllable. These abstract back vowels are later modified into the correct surface sounds by an absolute neutralization rule:

$$(161) \text{ Fronting: } \begin{bmatrix} + \text{syll} \\ - \text{low} \\ - \text{round} \\ + \text{long} \end{bmatrix} \rightarrow [- \text{back}]$$

In general, it seems to be the case that those assimilation rules, including fairly abstract rules like Tigre Vowel Backing, which add certain consonantal features to the input vowels never allow any material to intervene. Other more transparent examples are rules such as English Vowel Nasalization (162) and Chatino Vowel Devoicing (163). The latter accounts for alternations like those in (164), drawn from Schane [27:51].

- (162) English Vowel Nasalization:
 [+syll] → [+nasal] / — [+nasal]
 (*sēn*, *cān*'r, etc.)

- (163) Chatino Vowel Devoicing:

$$\left[\begin{array}{l} +\text{syll} \\ -\text{stress} \end{array} \right] \rightarrow [-\text{voice}] / \left[\begin{array}{l} -\text{syll} \\ -\text{voice} \end{array} \right] \text{ — } \left[\begin{array}{l} -\text{syll} \\ -\text{voice} \end{array} \right]$$
- (164)
- | | | | | | |
|----|-------|----------|-----|-------|-----------------|
| a. | tiyéʔ | 'lime' | vs. | tihí | 'hard' |
| b. | kinó | 'sandal' | vs. | kisú | 'avocado' |
| c. | suwí | 'clean' | vs. | süʔwá | 'you send' |
| d. | laʔá | 'side' | vs. | taʔá | 'fiesta' |
| e. | ngutá | 'seed' | vs. | kútá | 'you will give' |
| f. | kʔ | 'fire' | vs. | kítá | 'you will wait' |

Thus, the fact that such rules do not admit of any intervening material must be stated independently of the Class Complement Constraint as a general condition on the form of rules of this type, just as in the case of those rules that superimpose vowel features onto the basic consonantal articulation.

Now, a little digression may not be altogether futile. As is generally known, various theories of concrete phonology have been advocated, such as the theory referred to as Natural Generative Phonology by Hooper [7] and Vennemann [34], and Stampe's [28, 29] Natural Phonology. But Dresher [4-6] quite convincingly argues against such concrete theories from the point of view of whether they can contribute to the enrichment of a universal grammar at all; he concludes that they are in effect assuming a very impoverished theory of universal grammar. In fact, in accounting for many apparent counterexamples to the Class Complement Constraint I have depended upon the abstract analyses including absolute neutralization rules. Clearly it is not until such abstract theories are assumed that it becomes possible to postulate the Constraint and the two conditions on the forms of rules. Furthermore, the absolute neutralization rules included in some of the abstract rean-

alyses I have presented above, not only have internal justifications but are for the most part postulated in the languages with vowel harmony rules. Indeed, many phonologists, such as Vago [31-33], Jensen [9, 11], Phelps [25], Battistella [2], and Dresher [5], have pointed out that vowel harmony languages characteristically contain absolute neutralization rules.

2.3.2. Cochabamba Quechua Vowel Lowering

In Cochabamba Quechua 'r' and *u* are lowered to *e* and *o* before *q*, *nq*, and *rq*' (Odden [23:287]), where *q* stands for a uvular consonant. For example:

- (165)
- | | | |
|----|-------------------------|-----------------------|
| a. | wasipi | 'at home' |
| b. | wasipeqa | 'at home' (topic) |
| c. | ninku | 'they say' |
| d. | ninko-qa | 'they say' (topic) |
| e. | n-n | 'he says' |
| f. | ne-nqa | 'he will say' |
| g. | ne-rqa | 'he said' |
| h. | hamu-n | 'he comes' |
| i. | hamo-nqa | 'he will come' |
| j. | hamo-rqa | 'he came' |
| k. | 'ank-a-n | 'he works' |
| l. | 'ank-a-nqa | 'he will work' |
| m. | 'ank-a-rqa | 'he worked' |
| n. | parlaku-sqa | 'that we are talking' |
| o. | mik ^h -u-riy | 'please eat!' |

Odden proposes the following rule, which can apply across *r* and *n*.

- (166) [+syll] → [-high] / — ($\left[\begin{array}{l} +\text{son} \\ +\text{cor} \end{array} \right] \left[\begin{array}{l} +\text{cons} \\ +\text{back} \end{array} \right] \text{ — } [-\text{high}]$)

This rule violates the formal condition on vowel-to-consonant assimilation rules proposed in the preceding section, in that it allows the sonorant consonants to intervene. But no problems will arise if we are able to assume that the alleged intervening sonorants have already assimilated to the following *q* to change themselves to uvular consonants as in

- (167) a. $mq = [Nq]$
 b. $rq = [ʁq]$

Unfortunately, because of my lack of knowledge about Quechua it is difficult to see whether it might have the uvular fricative [ʁ]. But Ladefoged [16:142] points out that the language does have the uvular nasal [N]. Thus, if the plausible assumption of (167b) can be confirmed, rule (166) can be restated as (168) without any intervening material.

- (168) $[+syll] \rightarrow [-high] / \begin{matrix} + \text{cons} \\ + \text{back} \\ - \text{high} \end{matrix}$

2.4. RULES IN WHICH THE DETERMINANT = C AND THE FOCUS = C

2.4.1. The Problem of Distance

2.4.1.1. *Navaho Strident Assimilation.* I have argued that the distance between the focus and the determinant of a rule must be universally stipulated if it is either a consonant-to-vowel assimilation rule or a vowel-to-consonant assimilation rule. Those rules whose focus and determinant are both constituted by consonants, however, are not necessarily subject to such distance restrictions. Thus the rule of Navaho Strident Assimilation, for example, has no such restrictions.

According to Jensen [10] Navaho has a regressive rule of Strident Assimilation by which "strident obstruents within a word agree in anteriority" [10:683]. For example:

- (169) a. $\text{ši} + \text{má} \rightarrow \text{šimá}$ 'my mother' (no change)
 b. $\text{ši} + \text{ziiz} \rightarrow \text{siziiz}$ 'my belt'

Jensen asserts that Strident Assimilation can apply across segments other than strident obstruents and regardless of distances between the determinant and focus, as in

- (170) a. hasisliḥ '1 am old'
 b.

Sg.	Pl.
1. $nšišniš$	$nšiliḥ$
2. $nšiniḥ$	$nšooḥniš$
3. $naašniš$	$naašniš$

 (where /s/ is the perfective aspect marker, /š/ the first person singular marker, /h/ a classifier, and /niš/ 'to work' a verb root.)

Notice that these facts are exactly what the Class Complement Constraint predicts. Thus Strident Assimilation may be formulated simply as follows:

- (171) $[+strid] \rightarrow [aant] / \begin{matrix} X \\ \text{aant} \end{matrix} \begin{matrix} + \text{strid} \\ \text{aant} \end{matrix}$

2.4.1.2. *Tshiluba l-Nasalization and Kikuyu k-Dissimilation.* Some rules that exercise a consonantal influence upon consonants seem to obey language-particular distance restrictions. Thus, as we have observed, Latin Liquid Dissimilation (172) applies in accordance with the Class Complement Constraint across any number of syllables, while English Liquid Dissimilation (173), though quite similar to the Latin rule, requires the special restriction that it must function as a minor rule if the variable contains more than one segment.

- (172) Latin Liquid Dissimilation:
 $[+lat] \rightarrow [-lat] / [+lat]X \text{---}$

- (173) English Liquid Dissimilation:
 $al \rightarrow ar / [+lat]X \text{---}$
 where the expansions with X containing more than one segment are minor rules.

In this section I take up two other rules that also seem to require such language-particular distance restrictions. The first one is the rule referred to as Tshiluba l-Nasalization, which, according to Howard [8] and Odden [21], changes /l/ to /n/ after a nasal consonant as in

- (174) a. ku-kwat-a 'to take'
 b. u-kwač-ile 'the took'
 c. ku-kwač-il-a 'to take' (benefactive)
 d. u-kwač-id-ile 'he took' (benefactive)
 e. $\text{ku-d}^y\text{im-a}$ 'to cultivate'
 f. $\text{u-d}^y\text{im-ine}$ 'the cultivated'
 g. $\text{ku-d}^y\text{im-in-a}$ 'to cultivate' (benefactive)
 h. $\text{u-d}^y\text{im-in}^y\text{-ine}$ 'he cultivated' (benefactive)

Since the rule applies across vowels both Howard and Odden formulate it as follows:

- (175) $[+lat] \rightarrow \begin{matrix} + \text{nasal} \\ - \text{lat} \end{matrix} / [+nasal]V \text{---}$

The other rule is what Howard [8] and Odden [21] refer to as Kikuyu *k*-Dissimilation. That is, according to them Kikuyu has a dissimilation rule that changes *k* to the voiced velar fricative γ when the next consonant in the word is a voiceless stop, as in

- (176)
- | | | |
|----|-----------|-----------------|
| a. | yo-tegera | 'to run' |
| b. | yo-te | 'to throw away' |
| c. | yo-ceera | 'to discuss' |
| d. | yo-cina | 'to burn' |
| e. | yo-kena | 'to be glad' |
| f. | ko-nina | 'to finish' |
| g. | ko-tuya | 'to cook' |
| h. | ko-oria | 'to ask' |
| i. | ko-hota | 'to be able' |

As the intervening material is again restricted to vowels Odden assumes the following rule:

- (177)
- $$\begin{bmatrix} + \text{cons} \\ + \text{high} \\ + \text{back} \end{bmatrix} \rightarrow \begin{bmatrix} + \text{voice} \\ + \text{cont} \end{bmatrix} / \text{---} V_0 \begin{bmatrix} - \text{voice} \\ - \text{cont} \end{bmatrix}$$

Now, notice that in either of rules (175) and (177) the subscript zero is attached to the intervening V. Actually, however, sequences like */... ml... / and */... kt... / with no intervening material do not become inputs to these rules. Thus, under the assumption that a long vowel is interpreted as one segmental unit, these rules must be reformulated so as to require that a single vowel intervene:

- (178) a. $[+ \text{lat}] \rightarrow \begin{bmatrix} + \text{nasal} \\ - \text{lat} \end{bmatrix} / [+ \text{nasal}] V \text{---}$
- b. $\begin{bmatrix} + \text{cons} \\ + \text{high} \\ + \text{back} \end{bmatrix} \rightarrow \begin{bmatrix} + \text{voice} \\ + \text{cont} \end{bmatrix} / \text{---} V \begin{bmatrix} - \text{voice} \\ - \text{cont} \end{bmatrix}$

The Class Complement Constraint predicts that rules like (178a, b) would allow any number of vowels and certain consonants to intervene. As far as these rules are concerned, however, this prediction is wrong. Yet, it is undesirable to strengthen the Constraint so that it may predict the fact that only a single vowel intervenes in these rules. For, if such modifications were made to the Constraint, many generalizations would be missed. Thus, as we have observed, the Constraint as it stands

correctly predicts that such rules as Navaho Strident Assimilation and English *r*-Dissimilation will allow any number of vowels together with certain consonants to intervene.

In fact there is an important difference between rules like Navaho Strident Assimilation and English *r*-Dissimilation on the one hand, and those like Tshiluba *l*-Nasalization and Kikuyu *k*-Dissimilation on the other; rules of the former type apply regardless of distances between the determinant and focus, whereas those of the latter type do obey certain language-specific distance restrictions. Thus, the fact that rules (178a, b) require that only a single vowel stand between the determinant and focus can be ascribed to a language-particular distance restriction to the effect that they each require only a single segment to intervene. Since these languages seem to have a phonotactic restriction that prohibits a sequence of more than one consonant from occurring in a word, that single intervening segment is automatically constrained so as to correspond to a vowel, and not to a consonant. Strictly speaking, then, rules (178a, b) must be reformulated, respectively, as follows:

- (179) a. Tshiluba *l*-Nasalization:
- $$[+ \text{lat}] \rightarrow \begin{bmatrix} + \text{nasal} \\ - \text{lat} \end{bmatrix} / [+ \text{nasal}] + \text{seg} \text{---}$$
- b. Kikuyu *k*-Dissimilation:
- $$\begin{bmatrix} + \text{cons} \\ + \text{high} \\ + \text{back} \end{bmatrix} \rightarrow \begin{bmatrix} + \text{voice} \\ + \text{cont} \end{bmatrix} / \text{---} [+ \text{seg}] \begin{bmatrix} - \text{voice} \\ - \text{cont} \end{bmatrix}$$

The Class Complement Constraint predicts that besides a vowel a certain consonant could also be selected as a single intervening [+seg] element. But this possibility is actually rejected by a language-specific phonotactic restriction.

2.4.2. A Language-Particular Restriction on the Variable X: The Case of Sanskrit *n*-Retroflexion

Jensen [10] and Jensen and Stong-Jensen [12] and Odden [21-23] have disagreed about the formation of the rule called Sanskrit *n*-Retroflexion. In the case of Sanskrit, Odden [22, 23] seems to make the most satisfactory observation.¹¹

¹¹ A rather detailed account of the rule in question is also given in Ogihara [24].

Odden accounts for the rule as follows:

... dental *n* becomes retroflex *ṇ* if preceded by *r*, *ṛ*, or *r̄*; any number of labials, velars, vowels, and glides can intervene between the determinants and focus [22:141].

The following examples illustrate this rule.

- (180) a. *vā:ri:ṇa:m* 'water' (with gen. pl. *-na:m*)
 b. *pitṛ:ṇa:m* 'father'
 c. *re:pha:ṇa:m* 'letter *r*'
 d. *saṛga:ṇa:m* 'ocean'
 e. *kara:ṇa:m* 'doer'
 f. *bha:ṣa:ṇa:m* 'language'
 g. *priya:ṇa:m* 'lovely'
 h. *kriyāma:ṇa* 'being done' (with *-ma:na*, pass. prtc.)
 i. *kar-ṇa* 'killing'
 j. *abrahmaṇyā* 'not favorable to Brāhmins'
 k. *sena:na:m* 'army'
 l. *deva:na:m* 'god'

[The last two forms of (180) are simply those that lack determinant elements.] On the other hand, if coronal and/or palatal consonants intervene, as in (181)–(182), the rule is blocked from applying.

- (181) a. *prada:na* 'giving, bestowal'
 b. *vi:rasṭha:na* 'place or condition of a hero'
 c. *pratinam* 'to bow or incline towards'
 d. *adhiṣṭha:na* 'standing by'
- (182) a. *arjuna* 'white, clear'
 b. *durjana* 'a bad man'
 c. *parajana* 'a stranger'
 d. *pravacana* 'speaking'
 e. *vairocana* 'solar'
 f. *kṛṣa:na:m* 'weak'

In short, the elements of (183a) can serve as an intervening material but those of (183b) cannot.

- (183) a. vowels, glides, labials, velars
 b. *coronals, *palatals

Odden observes that the elements of (183b) can be characterized as nongrave consonants, and proposes the following rule:

$$(184) \left[\begin{array}{c} +nas \\ +cor \end{array} \right] \rightarrow [-ant] / \left[\begin{array}{c} +cont \\ +cor \\ -ant \end{array} \right] ([+grave])([-cons])_0 \text{---} \\ [+son]$$

It goes without saying that the intervening material of rule (184) represents the elements of (183a). But it seems wrong to specify such elements in a rule like this because the fact that they can serve as an intervening material follows from the Class Complement Constraint. Moreover, the same Constraint predicts that palatals and certain coronal consonants also could intervene. This prediction is certainly incompatible with the facts. But notice that the Constraint simply states that any element belonging to a class complement it defines *may* intervene. Obviously this does not mean that all such elements must intervene. In short, the fact that the elements of (183b) cannot serve as an intervening material should not be regarded as universally predictable but as peculiar to Sanskrit. Thus it seems necessary for rule (184) to be replaced by the following:

$$(185) \left[\begin{array}{c} +nas \\ +cor \end{array} \right] \rightarrow [-ant] / \left[\begin{array}{c} +cont \\ +cor \\ -ant \end{array} \right] X \text{---} [+son]$$

where $X \neq \left[\begin{array}{c} +cons \\ -grave \end{array} \right]$

2.5. ON CERTAIN UNIVERSAL RULES

Finally I must touch briefly upon rules such as Voicing Assimilation (186a) and Nasal Assimilation (186b).

$$(186) \text{ a. } [+obst] \rightarrow [avoice] / \text{---} \left[\begin{array}{c} +obst \\ avoice \end{array} \right]$$

$$\text{ b. } \left[\begin{array}{c} +cons \\ +nasal \end{array} \right] \rightarrow \left[\begin{array}{c} ant \\ Bcor \\ \vdots \end{array} \right] / \text{---} \left[\begin{array}{c} +cons \\ ant \\ Bcor \\ \vdots \end{array} \right]$$

Since these and other similar rules are not only phonetically natural but also almost ubiquitous in human languages, it seems that they must be looked upon as universal rather than language-specific rules. Now, from our point of view such rules can be said to be natural for the very reason that they disallow any intervening material. In order to account for this fact, by invoking Stampe's [28, 29] well-known distinction between "rule" and "process," Jensen [10:684-685] claims that Voicing Assimilation and the like correspond to innate processes, and suggests what he calls the Strict Adjacency Condition, whose purpose is to disallow "ANY intervening material between determinant and focus in processes" [10:685]. But in the first place Stampe's concepts of rule and process cannot be said to be well-defined. Moreover, I would hesitate to say that no processes would allow intervening material. Thus, although rules like (186a, b), whose naturalness is strikingly affected by the presence or absence of intervening material, must probably have in common some characteristics that may distinguish them from other rules, this point must be left as an open question. To say the least, however, it seems certain that there are some universal rules that disallow any intervening material.

3. COMPARISON WITH OTHER THEORIES

3.1. THE RELEVANCY CONDITION

Jensen [10] proposes a constraint that he refers to as the Relevancy Condition:

- (187) Only IRRELEVANT segments may intervene between focus and determinant in phonological rules. The class of segments defined by the features common to the input and determinant of a rule is the class of segments RELEVANT to that rule, provided at least one of the common features is a major class feature. If there is no common major class feature, then ALL segments are relevant ([10:680]).

This Condition must be rejected on the following grounds. First, it defines the class of possible rules too narrowly. Thus the following rules cannot be subsumed under the Relevancy Condition.

(188) a. Karok *s*-Palatalization (section 2.2.1)

This rule allows a single consonant to intervene. This fact is, however, immediately denied by the Relevancy Condition because the determinant and focus have no major class features in common.

- b. Menomini Mid Vowel Raising (section 1.1)
Since there are no other features than [+syll] common to the determinant and focus the Relevancy Condition predicts that only consonants can intervene. But actually the rule allows, in addition to consonants, certain vowels to intervene.
- c. Eastern Cherokees Vowel Harmony (section 2.1.5)
Since there are no features except [+syll] common to the determinant and focus the Relevancy Condition cannot account for the fact that the neutral vowel /ə/ can serve as an intervening material.
- d. Votic Vowel Harmony (section 2.1.6)
Since there are similarly no features except [+syll] common to the determinant and focus the Relevancy Condition prohibits vowels from intervening in this rule. But as we have observed the stem-final front vowel of the pronoun *kase*, marked as a contextual exception to Vowel Harmony, must be allowed to intervene.

Now, while admitting that there are some counterexamples to the Relevancy Condition, Jensen and Stong-Jensen [12] propose to modify it as follows:

- (189) Up to this point, we have been implicitly regarding the Relevancy Condition as an absolute condition on rules. Another interpretation is to regard it as a measure of the markedness of a rule. To the extent that rules conform to the condition, they are unmarked. . . . To the extent that rules deviate from the condition, they are marked. However, this deviation is not an all or none matter. There *are* degrees of deviation . . . [12:152].

The last phrase "degrees of deviation" of (189) they define as shown in the following table:

Degree of deviation	Interpretation
0	Conforms to Relevancy Condition
1	One intervening relevant consonant or vowel
2	More than one intervening relevant consonant or vowel
3	One intervening syllable consisting of relevant segments
4	More than one intervening syllable consisting of relevant segments

But if the Relevancy Condition were modified into such a relative condition, almost all rules that violate it would become "possible rules." Consequently, it becomes impossible to falsify the Condition.

Lastly, as Odden [21, 23] rightly points out, the Relevancy Condition, by its nature, can be maintained (and then just barely) only by adding redundant features to determinant and/or focus. The Condition, therefore, is incompatible with the evaluation measure of simplicity. Odden calls this the "overspecification problem." Thus, consider Latin Liquid Dissimilation (191) once again (see section 1.2).

(191) [+lat] → [-lat] / [+lat]X_____

If one decided to account in terms of the Relevancy Condition for the fact that rule (191) disallows liquids to intervene, one would have to complicate it, by utilizing the device of overspecification, into either (192a) or (192b).

(192) a.
$$\begin{bmatrix} +\text{cons} \\ +\text{voc} \end{bmatrix} \rightarrow [-\text{lat}] / \begin{bmatrix} +\text{cons} \\ +\text{voc} \\ +\text{lat} \end{bmatrix} X______$$

b.
$$\begin{bmatrix} -\text{syll} \\ +\text{cons} \\ -\text{obst} \\ -\text{nas} \end{bmatrix} \rightarrow [-\text{lat}] / \begin{bmatrix} -\text{syll} \\ +\text{cons} \\ -\text{obst} \\ -\text{nas} \\ +\text{lat} \end{bmatrix} X______$$

In short, the Relevancy Condition fails to meet the requirement that it, or for that matter conditions on rule application in general, be stated so as not to conflict with an evaluation measure. All the above problems seem to result from the fact that the Relevancy Condition does not express a true generalization as to how phonological rules behave.

3.2. THE CROSSOVER CONSTRAINT

Howard [8] suggests two possible statements of his Crossover Constraint:

(193) a. *Weak version:*

No segment may be matched with an element in a rule other than the focus or determinant if that segment can also undergo the rule [8:94].

b. *Stronger version:*

No segment may be matched with an element other than the focus or determinant of a rule if that segment meets the internal requirements of the focus of the rule [8:95].

Howard claims that an empirical difference between the two versions typically lies in the following fact. That is, the weak version rejects rules like (194a), but admits of those like (194b). The stronger version, on the other hand, rejects both rules.

(194) a. [+syll] → [+nasal] / _____([+syll])[+nasal]

b. [+syll] → [+nasal] / _____[+syll][+nasal]

Howard asserts that the stronger version should be regarded as a correct condition because "we do not expect nasalization to affect a more distant vowel without affecting less distant vowels" ([8:94]).

Certainly the stronger version correctly rejects both of the above rules. But the same version would accept unnatural rules such as the following, which allows obstruents to intervene.

(195) [+syll] → [+nasal] / _____[+obst][l+nasal]

It is in fact utterly absurd to attempt to reject such unnatural rules as (194)–(195) in terms of a constraint for predicting intervening material. The reason why such rules do not exist in natural languages is no more than that, as we have observed, those rules that assimilate vowels to consonants generally admit of no intervening material. Thus it is nonsensical to argue about what elements can intervene in rules that disallow any intervening material.

Which of the two versions of the Crossover Constraint should be selected must be decided in terms of rules that do allow some intervening material. Thus consider the rule of Votic Vowel Harmony discussed in section 2.1.6. There it was shown that the stem-final front vowel of the pronoun *kase*, marked as a focal as well as a contextual exception, must be allowed to intervene in Vowel Harmony. This fact can be accounted for only by recourse to the weak version (193a).

But for all that it is not the case that the Crossover Constraint can be maintained as a correct condition. For the Constraint is too broadly restricted in that it cannot account for the fact that certain elements must be systematically excluded from the set of intervening material of a phonological rule. Thus consider the following cases:

- (196) a. Memonini Mid Vowel Raising (section 1.1)
The Constraint fails to account for the fact that the determinant elements of short high vowels cannot intervene.
- b. Tunica Vowel Assimilation (section 2.1.3)
Similarly it fails to account for the fact that the determinant vowels cannot intervene.
- c. Latin Liquid Dissimilation (section 1.2)
For this rule it fails to account for the fact that the SC element *r* cannot intervene.

Thus the Crossover Constraint has the effect of unnecessarily broadening the scope of possible rules, and so must be said to allow an extremely low degree of falsifiability.

3.3. THE MINIMAL DISTANCE CONSTRAINT

Battistella states this Constraint as follows:

- (197) No segment S may intervene in a variable X of some rule R, if S can itself condition the application of the rule [2:110].

A few examples suffice to show that the Constraint is also too weak:

- (198) a. Latin Liquid Dissimilation (section 1.2)
The Constraint fails to account for the fact that the SC element *r* cannot intervene.
- b. Karok *s*-Palatalization (section 2.2.1)
It fails to account for the fact that the focal element *s* cannot intervene.
- c. Memonini Mid Vowel Raising (section 1.1)
Similarly it fails to account for the fact that the focal elements of long mid vowels cannot intervene.

It is quite easy to enumerate other similar examples. Therefore the Constraint must also be said to allow an extremely low degree of falsifiability.

In conclusion, it follows that it is the Class Complement Constraint that is neither too strongly nor too weakly restricted and is, moreover, compatible with the evaluation measure of simplicity.

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Ungrammatical Notes 2: Doubling Trouble and the Peccable British

from the editor

To double or not to double? That is just one of the formidable questions that we as misspellers of English must confront. Suppose we are asked to suffix *-ing*, *-ed*, and *-er* to the following stems.

(1) label, cancel, travel

Then there are two common results, which are listed under columns I and II below.

	I	II
(2) label	labeling	labelling
	labeled	labelled
	labeler	labeller
cancel	cancelling	cancelling
	cancelled	cancelled
	canceler	canceller
travel	traveling	travelling
	traveled	travelled
	traveler	traveller

Before reading on, circle the examples under columns I and II that you prefer; and, please, do not use a dictionary.

If you are British (in the wide-sense, with all due apologies to the Irish), chances are you circled all the examples under column II. If you are a Yankee (in the wide-sense, with all due apologies to Southerners, but Canadians must be excluded), there is a good chance you hemmed and hawed before making your decision. You may have aped the British and circled all the examples under column II, or you may have exulted in your rugged individualism and circled all of the examples under column I. You may even have played the clever game and circled all the examples under both columns with the contention that all are legitimate spellings. After all, Yankee dictionaries often give both; aren't dictionaries supposed to be authorities? Finally, you may have evinced a discerning eclecticism and chosen some examples