

INALTERABILITY AS PRESPECIFICATION

SHARON INKELAS

University of California, Berkeley

YOUNG-MEE YU CHO

Stanford University

'Geminate inalterability' is the well-known phenomenon whereby a rule affecting singleton segments fails to alter comparable geminates. Past accounts have attributed inalterability to geminate-specific constraints on rule application. Two new generalizations point in a radically different direction. First, rules respecting inalterability are purely structure-filling (never structure-changing). Second, inalterability occurs also among singletons. We develop a new theory attributing inalterability to prespecification: geminate (and singleton) inalterability follows solely from the Elsewhere Condition. This explains not only the convergence of regular geminates and irregular singletons, but also the asymmetry among rule types sensitive to inalterability. Geminate-specific constraints on rule application are neither necessary nor sufficient to account for inalterability.*

1. INTRODUCTION. It has long been observed that geminates may surface in a position where, due to phonological rules or constraints of the language, featurally comparable singleton segments cannot appear. This resistance has been attributed to a general phenomenon of 'geminate inalterability' (Hayes 1986b):¹

(1) **GEMINATE INALTERABILITY:** Rules that otherwise apply to singleton segments systematically fail to apply to geminates.

Accordingly, attention has focused on representational properties that distinguish geminates from singletons. Unifying the geminate-specific explanations for inalterability (most notably Hayes 1986b, Schein & Steriade 1986, Selkirk 1990a,b) is the assumption that the unique, branching geometry of geminates is responsible for their ability to persist.

In this article we question this class of geminate-specific approaches at its foundation, contending that geminate inalterability is not a well-defined phenomenon. It is neither the case that all geminates are inalterable nor the case that all inalterable structures are geminate.

We argue for a radical redefinition of the corpus of effects to which inalterability theory must extend, offering two new generalizations to replace 1. The first is that all genuine inalterability effects involve STRUCTURE-FILLING rules, i.e. those affecting only unspecified targets. There is little evidence that gem-

* We are grateful to Jill Beckman, Gene Buckley, Laura Downing, Andrew Garrett, Bruce Hayes, Larry Hyman, Greg Iverson, Paul Kiparsky, Will Leben, John McCarthy, Orhan Orgun, Jaye Padgett, Alan Prince, Jim Scobbie, Lisa Selkirk, Donca Steriade, Charles Ulrich, Moira Yip, Karl Zimmer, and two anonymous reviewers for stimulating discussion and comments at (many) earlier stages of this work.

The following abbreviations are used in this paper: 1, first person; 2, second person; 3, third person; CAUS, causative; DAT, dative; DESID, desiderative; FEM, feminine; IMP, imperative; INDIC, indicative; MASC, masculine; MID, middle; NEG, negative; NEUT, neuter; NOM, nominalizer; OBJ, object; PART, participle; pl, plural; POSS, possessive; PRES, present; PTCL, particle; sg, singular; SUBJ, subject; TV, theme vowel; UR, underlying representation; VB, verbalizer.

¹ There is a separate phenomenon of 'geminate integrity', i.e. the inability of geminates to be split by epenthesis, about which we will have little to say here. We assume the correctness of past analyses of this phenomenon (e.g. Kenstowicz 1982, McCarthy 1986b, Hayes 1986a).

inates are ever specially protected from STRUCTURE-CHANGING rules. The second generalization is that co-existing with the well-known cases of geminate inalterability is a parallel phenomenon of SINGLETON inalterability. Though frequently characterized in other terms—such as ‘opacity’ or ‘exceptionality’—singleton resistance to phonological rules is widespread. What is more, the class of rules that singleton segments resist is the same class of rules with respect to which geminates are ‘inalterable’.

At the root of both generalizations is a deceptively simple explanation: by the Elsewhere Condition (Kiparsky 1982, 1993), prespecified structure is immune to structure-filling rules. Geminate ‘inalterability’ and singleton ‘exceptionality’ are thus complementary facets of the same phenomenon.

This argument is organized along the following lines. First, we present standard examples of inalterability (§1) and discuss representative past accounts (§2). Next, we argue for redefining the phenomenon of inalterability (§3). In §5 we catalog various types of prespecification and demonstrate their applicability to genuine cases of inalterability, basing our analysis on the assumptions laid out in §4. Section 6 argues for the exclusion of certain pseudo-inalterability effects from the body of data for which the theory must be held responsible. Section 7 presents evidence that, as predicted, both singletons and geminates are equally alterable by exactly that class of rules which the Elsewhere Condition cannot block. Section 8 discusses criteria for identifying rule (or alternation) types, and §9 provides concluding remarks.

To set the stage, we introduce three standard examples of geminate inalterability.

1.1. HAUSA. In Hausa, a historical change known as Klingenheben’s Law (2a), which sonorized coda obstruents, became the synchronic condition that only sonorants may appear in coda position (2b) (see e.g. Schuh 1972). Geminates are immune to the constraint (2c). (Hausa data in this article are presented in standard phonemic transcription.)

- (2) a. **sabro*: > *sáuró*: ‘mosquito’
 **biyad* > *bìyár* ‘five’
- b. [r] *bírní*: ‘city’ [l] *gúlmá* ‘mischief-making’
 [n] *àbíncí* ‘food’ [m] *gwámnáti* ‘government’
- c. [ww] *Hàwwá* (personal name) [bb] *dábbà*: ‘animal’
 [l] *sállà*: ‘prayer’ [gg] *gággá:wá*: ‘haste’
 [mm] *yámmá*: ‘afternoon’ [tt] *littá:fì* ‘book’

Whether Klingenheben’s Law is construed as a rule or a surface constraint on syllables, the fact that obstruents may appear in the coda only when geminate is considered (by Hayes 1986b:333–45) to be a genuine inalterability effect.

1.2. LATIN /l/ VELARIZATION. In Latin an allophonic alternation (diagnosed by concomitant effects on adjacent vowels; see Schein & Steriade 1986:705 and references cited therein) causes /l/ to surface as light [l] in the onset (a) but velar [ɫ] in the coda (b). Geminate /ll/ surfaces as light (c):

- (3) a. *velí:m* → *ve.lim* 'I should like'
 b. *vult* → *vułt* 's/he wants'
 c. *velle* → *vel.le* 'to want'

If we assume a rule velarizing /l/ in the coda (or rime, following Schein & Steriade 1986), geminates in Latin are clearly immune. Latin /l/ velarization is cited as an example of geminate inalterability by Schein & Steriade (1986: 704–8).

1.3. BERBER VOICING AND SPIRANTIZATION. In the central and northern Moroccan dialects of Berber (e.g. Tirifiyt and Tamaziyt), singleton consonants are spirantized (and, if pharyngealized, voiced; Saib 1974, 1977, Guerssel 1978). Geminates resist these effects, as shown by the following data from the Ait Ndhir dialect of Tamaziyt (Saib 1974:4):

(4)	ZERO	INTENSIVE	
	f:ff <i>enfeḍ</i>	<i>neffeḍ</i>	'to throb'
	β:bb <i>enβeš</i>	<i>nebbeš</i>	'to be nosy'
	θ:tt <i>efθel</i>	<i>fettel</i>	'to roll couscous'
	ḍ:dd <i>eβḍu</i>	<i>βeddu</i>	'to start'
	j:gg <i>erjem</i>	<i>reggem</i>	'to insult'
	ḍ:tṭ <i>erḍel</i>	<i>reṭtel</i>	'to loan'
	ɣ:qq <i>neɣ</i>	<i>neqqa</i>	'to kill'

One interpretation of these alternations is that geminates are inalterable by spirantization and voicing rules (Hayes 1986b:344, Churma 1988).

1.4. 'IMPOSTER' EFFECTS. Mere complementarity between geminates and singletons does not necessarily signal a genuine geminate inalterability phenomenon, as illustrated by the following example from Sanskrit. The Sanskrit Visarga rule (Whitney 1889:23, Allen 1962:78, Hale 1990:88, Steriade 1982:62) neutralizes word-final fricatives to the placeless [h]:

- (5) a. *nalas* → *nalah* 'Nala'
manuṣ → *manuḥ* 'man'
 b. *nalas kāmam* → *nalah* ... 'Nala at will'
yas parvatān → *yah* ... 'who [...] mountains'

Word-final fricatives that undergo (obligatory) assimilation to coronal stops (Coronal Assimilation; 6a) or (optional) Place Assimilation (6b) to the following consonant appear to escape the effects of Visarga neutralization:

- (6) a. *tatas ca* → *tataś ca* **tataḥ ca* 'and then'
pādas + ṭalati → *pādaṣ ṭalati* **pādaḥ ṭalati* 'the foot is
 disturbed'
 b. *nalas kāmam* → *nalax kāmam* ~ *nalah kāmam* 'Nala at will'
yas parvatān → *yaḥ parvatān* ~ *yah parvatān* 'who [...] mountains'

Steriade 1982 and Schein & Steriade 1986 attribute the absence of Visarga place delinking in 6 to the failure of Visarga to affect homorganic structures, i.e.

those with a ‘geminate’, or doubly linked, place node. The postulated rule interaction is illustrated below:

(7)	/yas pāpmanā/	/yas pāpmanā/	‘who by sin’
ASSIMILATION:	[ɸp]	—	
VISARGA:	—	[h]	
OUTPUT:	[yaɸ pāpmanā]	[yaḥ pāpmanā]	

However, Visarga is also in complementary distribution with Voicing Assimilation (Whitney 1889:56–61, Selkirk 1980:121, Cho 1990:75–77), as illustrated below:²

- (8) a. /manus gacchati/ → manur gacchati (*manuḥ...) ‘the man goes’
 b. /avis mama/ → avir mama (*aviḥ...) ‘my sheep’
 c. /dhenus iva/ → dhenur iva (*dhenuḥ...) ‘like a cow’

Since Visarga has nothing to do with laryngeal features, its sensitivity to shared voice specifications is puzzling under accounts which attribute inalterability to Visarga to multiple linking of place features (Steriade 1982:61).

We offer a different analysis of the data in 6 which extends to 8 and makes no direct appeal to inalterability. Following Pāṇini, we hypothesize that all three assimilation rules FOLLOW Visarga. Place Assimilation resupplies continuants with the place node delinked by Visarga; Voicing Assimilation, a very general rule, in turn supplies Visarga [h] with [+voice]. Subsequent default rules complete the [ḥ] ~ [r] alternation (Cho 1990).³

(9) INPUT:	/punar/	/dvār tat/	/manus/	/manus gacchati/
VISARGA:	punaḥ	dvāḥ tat	manuḥ	manuḥ gacchati
ASSIMILATION:	—	dvās tat	—	manur gacchati
	‘again’	‘that door’	‘man’	‘the man goes’

This analysis has the theoretical advantage of employing the unmarked order between neutralization and assimilation (Trubetzkoy 1939, Kiparsky 1965). What is more, the reordering eliminates all inalterability effects. The reason that assimilated structures appear to escape Visarga is that they do not exist at the stage of the derivation at which Visarga applies.

In what follows, we will distinguish cases like Visarga (and others, discussed in §6)—in which the geminate (doubly linked structure) fails to satisfy the rule environment—from genuine cases of geminate rule blockage, the main topic of the paper.

2. PAST ACCOUNTS OF GEMINATE INALTERABILITY. Past approaches to geminate inalterability have consistently taken the form of geminate-specific con-

² Ex. 8a is from Whitney (1889:59); exx. 8b,c are from Gonda (1966:16).

³ The input forms have already undergone a very general devoicing rule, unexpressed here, which feeds Visarga (see e.g. Whitney 1889).

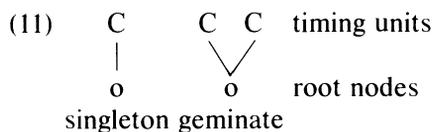
straints on rule application. Some focus on constraining rule inputs; others instead block rules when an unwanted output would result.

2.1. CONSTRAINING RULE INPUTS. The two best-known approaches to geminate inalterability, Hayes 1986b and Schein & Steriade 1986, take the position that inalterability results from the requirement of strong satisfaction of rule environments (Scobbie 1991, 1992). That is, under both proposals, a phonological rule fails to apply to geminate (doubly linked) phonological structure whenever the entities sharing that material do not all satisfy the structural description of the rule. For Hayes (1986b:331), the condition is as follows:

- (10) **LINKING CONSTRAINT:** Association lines in structural descriptions are interpreted as exhaustive.

According to the LC, a rule whose structural description includes the autosegmental association between two entities is prohibited from applying in any environment in which at least one of the corresponding entities bears a different number of association lines from that expressed in the rule.

On the assumption that geminate segments are represented by a single melodic element, as in 11, that element (generally assumed to be a root node) is doubly associated to the timing tier. (Analogous geometry is found in partial geminates, where the doubly linked entity is somewhere below the root node.) By the LC, a geminate entity is automatically exempted from any phonological rule whose structural description matches that entity to a SINGLE association line.



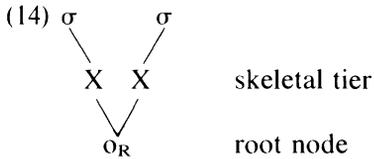
Accordingly, Hayes (1986:334) accounts for the Hausa data in 2 by including exactly one autosegmental link in the formulation of Klingenberg's Law:

- (12) **KLINGENHEBEN'S LAW:**
- $$[-\text{cont}] \rightarrow [+ \text{son}] / \text{---} \begin{matrix} C]_{\text{Syl}} \\ | \end{matrix}$$

Schein & Steriade (1986:727) propose a slightly different constraint, termed the Uniform Applicability Condition (UAC). It makes rules sensitive not to the number of association lines present, but rather to the syllable structure or linear adjacency properties of a geminate's component parts:

- (13) **UNIFORM APPLICABILITY CONDITION:** Given a node *n*, a set *S* consisting of all nodes linked to *n* on some tier *T*, and a rule *R* that alters the contents of *n*, a condition in the structural description of *R* on any member of *S* is a condition on every member of *S*.

Let us exemplify this constraint with respect to Klingenberg's Law, whose target occupies the syllable coda. (Schein & Steriade 1986 do not discuss this particular rule; our schematization conforms to their representations in general.) As shown in 14, only one—but not both—of the two timing units with which a geminate is associated meets this description.



The UAC thus blocks the application of Klingenberg's Law to geminates.

2.2. PROBLEMS FOR STRONG SATISFACTION. The UAC and the LC differ in a number of ways (see Schein & Steriade 1986 for some discussion). From our perspective, however, the two approaches are more similar than they are different, and we turn now to some problems common to both.

2.2.1. DIACRITIC RULE FORMULATION. A danger in attributing geminate inalterability to strong satisfaction requirements is the potential for diacritic inclusion of structural information in the rule description solely to induce geminate blockage.

Hayes 1986b acknowledges this problem for the LC, noting several examples (Berber Voicing and Spirantization, Lithuanian /o/-Lowering, Spanish Spirantization) in which the presence of an association line in the rule environment serves no function other than invoking the LC. To the best of our knowledge, the parallel explanatory problem for the UAC has not previously been observed. We illustrate it here with one example in which a rule must be formulated in an unnecessarily complex fashion solely to trigger the UAC.

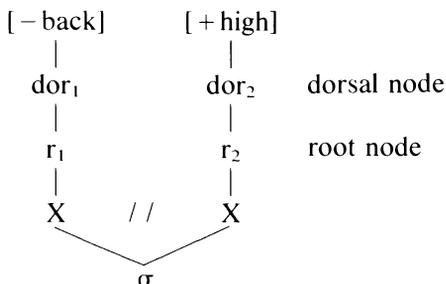
Schein & Steriade cite palatality alternations in Turkish velars as an example of geminate inalterability (1986:726). Their proposed rule of Velar Depalatalization (16b) removes the feature [–back] from palatalized velars in coda position (15a),⁴ but, as shown in 15c, exempts those velars whose palatality is derived by assimilation to a tautosyllabic vowel:

- (15) a. *infilak* 'explosion (NOM.sg)
 b. *infilak^yi* 'explosion (ACC.sg)
 c. *malik^y* 'owner (NOM.sg)
 d. *malikane* 'residence' (with *-ane* 'house')

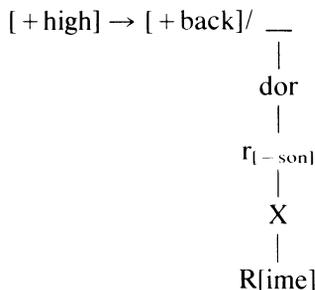
Schein & Steriade attribute the survival of the palatalized velar in 15c to geminate inalterability, based on the shared [–back] specification. That is, Palatalization (Pal; 16a) bleeds Depalatalization (Depal; 16b):

⁴ We are grateful to Orhan Orgun and Karl Zimmer for help with Turkish. Palatalization varies across speakers; except where noted, we use the data in Clements & Sezer 1982 (on which Schein & Steriade base their analysis).

(16) a. VELAR PALATALIZATION



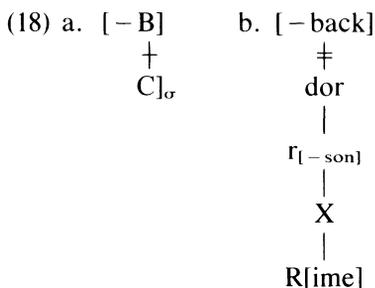
b. VELAR DEPALATALIZATION



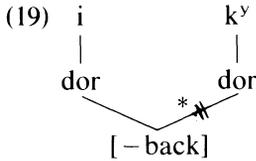
Because Depalatalization alters the contents of the dorsal node, the UAC prevents it from affecting the shared palatal specification of an /ik^y/ sequence derived by 16. The vowel, which would also be affected by Depalatalization, does not meet the description of a coda consonant. The postulated rule interactions are illustrated below:

(17)	INPUT	PAL	DEPAL	OUTPUT
a.	<i>infilak^yi</i> 'explosion (ACC.sg)'			<i>infilak^y</i>
b.	<i>infilak^y</i> 'explosion (NOM.sg)'	→	<i>infilak</i>	<i>infilak</i>
c.	<i>malikane</i> 'residence (NOM.sg)'			<i>malikane</i>
d.	<i>malik</i> 'owner (NOM.sg)'	→	<i>malik^y</i> BLOCKED	<i>malik^y</i>

One theoretical disadvantage of the proposed Depalatalization rule (16b) is the way it directly changes the specification [+back] into [-back]. A significant recent theoretical advance has been the strong claim in Poser 1982, Mascaro 1987, Steriade 1987, Cho 1990, and Kiparsky 1993 that powerful direct feature-changing rules are unneeded, and ought always to be decomposed into separate rules of delinking and insertion or spreading. This insight in fact underlies the earlier formulation in Clements & Sezer 1982 of Turkish velar depalatalization: the rule simply delinks [-back] from a palatalized velar in the coda (18a). Translating 18a into the feature-geometric model of Schein & Steriade 1986 yields 18b:



Though simpler, and reflecting more directly the marked status of $[k^y]$ with respect to $[k]$ (see §7.2), delinking does not work in an analysis assuming the UAC. Because delinking does not alter the contents of the feature $[-back]$ whose double linking is in question, the UAC would incorrectly permit a delinking version of Depalatalization to apply even to $\dots ik^y \dots$ sequences:



To avoid the ill-formed output in 19, the UAC forces a feature-changing analysis of depalatalization which is otherwise unmotivated and which uses more powerful theoretical machinery.

An alternative explanation is available which preserves the delinking formulation, generates the right results for $\dots ik^y \dots$ sequences, and does not rely on the UAC: transpose the order that Schein & Steriade (1986) hypothesize between Palatalization and Depalatalization. It should now follow straightforwardly that $/k^y/$ survives in *malik^y*: Palatalization derives $[k^y]$ only AFTER Depalatalization has had its chance to apply.

This feeding order between neutralization and assimilation, consistent with the proposal of Clements & Sezer, reflects the fact that underlying $/k^y/$ depalatalizes (*infilak^y* → *infilak*), while $[k^y]$ derived by the late, allophonic palatalization rule does not (*malik^y*).⁵ It is also the only order which correctly predicts the behavior of geminate velars. As reported in Orgun 1993, $/kk/$ palatalizes when followed by a front vowel: *tek^yk^ye* 'dervish lodge', *tak^yk^ye* 'hat'. This is a serious problem for the UAC, which predicts that structure-sensitive rules—such as tautosyllabic Palatalization—should leave geminates unchanged.⁶

Our main point in this section is, however, simply that accounts based on the UAC are subject to a certain degree of circularity. Insofar as the UAC is triggered by just a subset of the possible rules one could write to express the same observed alternation, the UAC makes few predictions about the susceptibility of a geminate to that phonological process.

2.2.2. LONG-DISTANCE LINKING. A second problem for both the LC and the UAC is long-distance linking. For example, it is well known that the behavior of geminate segments is not paralleled by tone. In Tonga, High Spreading and High Delinking apply to linked High tones regardless of the number of association lines present (Pulleyblank 1986:166), a problem for the LC. Similarly, Schein & Steriade (1986) note that the UAC incorrectly predicts inalterability

⁵ Harris (1983:50–55) makes a similar ordering argument in his analysis of Spanish palatalization.

⁶ Schein & Steriade (1986:416) note this prediction but, under the impression that Turkish lacks 'monosegmental' geminates, conclude it cannot be tested.

in two cases of long-distance linking of vowel features: Yokuts Lowering (Archangeli 1984) and Javanese Lowering (Kenstowicz 1985).⁷

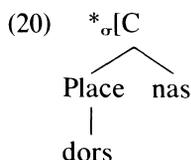
Schein & Steriade take no firm position on long-distance linking, leaving the matter for future research. Hayes adds a caveat to the LC that restricts it to ‘‘local’’ autosegmental linkings, such as those found in geminate consonants and long vowels’ (Hayes 1986b:n. 2).

Any asymmetry in the (in)alterability of local and long-distance multiple linking fundamentally weakens the LC and the UCA, as the basic structural properties to which Schein, Steriade, and Hayes attribute geminate inalterability are equally present in local and long-distance multiply-linked structures.

2.2.3. SYLLABLE PHONOTACTICS. Syllable-structure constraints obligatorily mention both structural and melodic information; it is rules of this kind to which geminates ought to be systematically immune. It thus follows from the LC and the UAC that geminates should violate syllable phonotactics across the board.

The prediction initially appears fruitful, as Itô (1986, 1989) successfully invokes the LC to explain the general immunity of geminate consonants in Japanese, Italian, Diola Fogany, and other languages to language-particular coda constraints. Klingenberg’s Law is, of course, another example of this kind. In most other domains, however, the prediction that geminates should be able to violate syllable phonotactics is incorrect. We touch here on three hypothetical cases of predicted geminate immunity which never occur.

The first involves onset constraints. Many languages prohibit certain segments from occurring in onset position. Consider, for example, Korean, which allows /ŋ/ only in the coda (*kaŋ* ‘river’ and *maŋc^{hi}* ‘hammer’, but **ŋa*). Within the framework assumed by Itô 1986, the relevant constraint is as follows:



Interpreted using the LC, this constraint predicts that geminates should be able to violate the onset constraint. Yet Korean, which otherwise allows geminates (e.g. *anni* ‘older sister’, *amma* ‘mom’), prohibits the sequence *...*aŋŋa*... just as surely as it rules out **ŋa*. Furthermore, we know of NO examples in which geminates systematically violate onset constraints. This contradicts the predictions of both the LC and the UAC: onset and coda constraints look alike to these constraints, and ought to be flouted in equal numbers by geminates.

Second, we find no cases in which a constraint against complex onsets or codas is systematically ignored by geminates. In Greek, only a subset of possible consonant sequences is permitted in the onset (e.g. Steriade 1982); for

⁷ Schein & Steriade cite Chaha (McCarthy 1986a) as a case in which long-distance inalterability may successfully be invoked to block devoicing of certain multiply-linked obstruents. However, the argument relies on the postulation of abstract geminates, which, though they have a historical basis, do not surface synchronically.

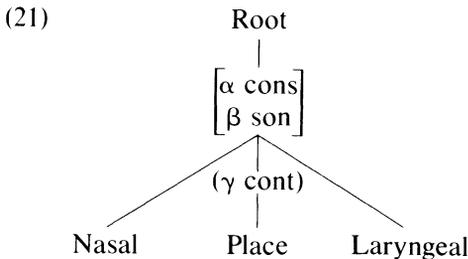
example, /tp/ is prohibited, though /pt/ is allowed. Geminates pose no exception to this constraint. Thus, ... *at.tpa*... is ungrammatical in Greek—even though one of the offending onset segments (*t*) is geminate. In Hausa, no tautosyllabic clusters are allowed, and again geminates are not given an exemption. No word such as *darbba*: or *dabbra*: is permitted to violate the CVX syllable maximum, an observation which is especially interesting in light of the fact that geminates DO override coda sonority constraints in Hausa.

Finally, geminates never violate sonority sequencing in languages which otherwise permit complex codas or onsets. Thus, Latin prohibits /...kl.l.../ sequences by the same means that it prohibits final /kl/ clusters: no coda, even one containing a geminate, may increase in sonority. Note that geminate /ll/ (ungrammatical in */...kl.l.../) does violate the generalization that all coda /l/s in Latin are dark (§1.2).

In sum, geminate violations of syllable structure constraints appear localized to one small area: coda sonority constraints. Neither the LC nor the UAC can explain this asymmetric exception to syllable phonotactics. We will return to these issues in §5.5.

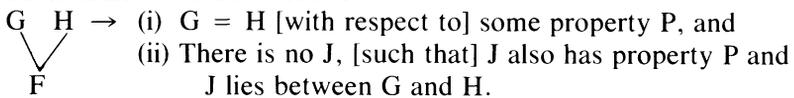
2.3. CONSTRAINTS ON RULE OUTPUTS. Rather than attributing geminate inalterability to constraints on the ability of a geminate to serve as input to a phonological rule, Selkirk (1990a,b) focuses instead on rule outputs, proposing that phonological rules alter geminates only when the output would be well-formed. The two relevant well-formedness constraints are the Place-Structure Dependency Principle (PSDP) and the Multiple Linking Constraint (MLC) (Selkirk 1990b).

The PSDP holds that the place node is a dependent of [cont]—or, in the absence of that feature, of the root node complex, which is composed of the features [son] and [cons]:



The MLC constrains the association between higher and lower structure:

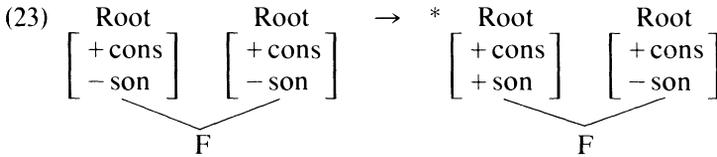
(22) MULTIPLE LINKING CONSTRAINT:



Under the assumptions that (a) 'F is a multiply linked dependent of heads G, H' and (b) 'no other element with property P intervenes between G and H', any rule altering features of G or H in the structure in 22 will violate the MLC.

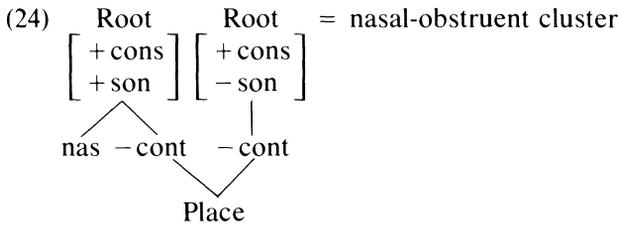
These principles interact with Selkirk's 1990a assumption that geminates

possess two root nodes, predicting geminate inalterability whenever a phonological rule would alter the contents of only one root node of a geminate. For example, Selkirk demonstrates that the MLC blocks Klingenberg's Law from affecting geminate obstruents in Hausa. Inserting [+son] on the first of two root nodes with shared dependents would introduce an asymmetry between the two heads, violating the MLC (23); thus the rule is blocked from applying (Selkirk 1990b):



Three problems with this approach may be identified. First, it appears that violations of the MLC are blocked (as in Hausa) in only some languages; in other situations, violations occur and are later repaired (as in Selkirk's analysis of Finnish Gradation). Only in the former type of case does inalterability result. Unless some criterion is developed to predict whether the MLC will block or repair violations, the MLC is not a predictor of geminate inalterability.

A second objection involves the representation of homorganic nasal-obstruent clusters, whose nonidentical root nodes share place features. As the MLC prevents direct linking between Place and Root in such clusters, Selkirk suggests that [-cont] specifications intervene (1990b):



Not only is the inclusion of [-cont] on nasals redundant; the theory also predicts that nasals never assimilate in place to fricatives, because a representation in which [+cont] and [-cont] segments share [place] would violate the MLC. Selkirk maintains that this prediction is correct, though evidence of derived homorganic nasal-fricative clusters in Spanish (Harris 1969:8–9, Hooper 1976: 181), Hausa (Abraham 1959a:154, 158, 160), Palauan (Josephs 1977:xxxviii), Kpelle (Welmers 1973:67) and Jita (Downing 1990:55) suggests that nasal-fricative assimilation does occur, albeit comparatively infrequently (see Padgett 1991:121–42 for extensive discussion of this issue).

The third objection is empirical: Selkirk's theory is limited to inalterability involving stricture features ([cons, son, cont]). But the corpus of geminate inalterability effects goes beyond this, including, for example, laryngeal features (as in Berber) and place features (as in Latin).

3. GENERALIZED INALTERABILITY. The theories of Hayes, Schein & Steriade, and Selkirk share the foundational assumption that inalterability is specific to

geminate, predicting that no parallel effects should occur with singleton segments. In this section we demonstrate that, although such cases may not previously have been described in these terms, singleton 'inalterability' is a widespread phenomenon.

3.1. HARMONY RULES. A particular focus of work on vowel and consonant harmony has been those segments which fail to undergo the harmony rules. Generally termed 'opaque' rather than 'inalterable', these segments are, like certain geminates, distinguished by their failure to alternate. We illustrate with examples from Turkish and Chumash.

As is well known, Turkish words undergo vowel harmony involving [back] and, for high vowels, [round]. Suffixes conform to the vocalic pattern of the root (data from Lewis 1967, presented here in phonemic transcription; distinctive vowel length, based on Avery et al. 1983 and checked with native speakers, has been marked on all Turkish examples cited in this article):

(25) a.	<i>ism-i</i>	'name-ACC'	<i>isim-ler</i>	'name-pl'
b.	<i>kiz-i</i>	'girl-ACC'	<i>kiz-lar</i>	'girl-pl'
c.	<i>gümüş-ü</i>	'silver-ACC'	<i>gümüş-ler</i>	'silver-pl'
d.	<i>pul-u</i>	'stamp-ACC'	<i>pul-lar</i>	'stamp-pl'
e.	<i>kanad-i</i>	'wing-ACC'	<i>kanat-lar</i>	'wing-pl'
f.	<i>ev-i</i>	'house-ACC'	<i>ev-ler</i>	'house-pl'
g.	<i>köy-ü</i>	'village-ACC'	<i>köy-ler</i>	'village-pl'
h.	<i>son-u</i>	'end-ACC'	<i>son-lar</i>	'end-pl'

A number of 'disharmonic' morphemes contain vowels which do not harmonize with preceding vowels:

(26) a.	<i>riya:ziyat</i>	'mathematics'
b.	<i>ru:hiyat</i>	'psychology'
c.	<i>gel-iyor-um</i>	'COME-PRESENT-1sg'
d.	<i>çocuk-ken</i>	'child-while.being'

But for their being singleton rather than geminate, the boldface nonalternating segments would be agreed by all to exhibit the properties of 'inalterability'.

A similar situation obtains in the California language Ineseño Chumash, where sibilants in the same word agree (Applegate 1972:118–20, Poser 1982). As shown in 27, a leftward assimilation process converts underlying /s/ to /š/, and underlying /š/ to /s/:

(27) a.	<i>ha-s-xintila</i>	→ <i>hasxintila</i>	'his Indian name'
	POSS-3.POSS-Ind.name		
b.	<i>ha-s-xintila-waş</i>	→ <i>hašxintilawaš</i>	'his former Indian name'
	former		
c.	<i>p-iš-al-nan'</i>	→ <i>pišanan'</i>	'don't you two go'
	2-du-2.NEG.IMP.-go		
d.	<i>s-iš-sili-ulu-aq-pey-us</i>	→ <i>sis^hiluleqpeyus</i>	'they two want to follow it'
	3.SUBJ-du-DESID-into-PTCL-stick.to-3.OBJ		

Sibilant assimilation interacts with Coronal Dissimilation, which converts a sibilant into a shibilant immediately before a nonstrident coronal (*t, l, n*).

- (28) a. *s-nan'* → *ʃnan'* 'he goes'
 b. *s-tepu?* → *ʃtepu?* 'he gambles'

The /ʃ/ resulting from Coronal Dissimilation triggers leftward sibilant harmony, but does not undergo it, as shown by 29:

- (29) a. *s-ti-yep-us* → *ʃtiyepus* 'he tells him'
 3.SUBJ-INTENTIONAL-tell-3.OBJ
 b. *s-is-tik-in* → *ʃiʃtik'in* 'he goes ahead, he is first'
 3.SUBJ-VB-point-VB

Poser's 1982 analysis is discussed in §5.1; for now, the crucial observation from 29 is that the segment derived by Coronal Dissimilation is 'inalterable' with respect to the subsequent leftward harmony rule—despite being, upon its derivation, a singleton segment.

3.2. LOCAL ASSIMILATIONS. Local assimilation also admits singleton inalterability. The data are, however, better known under the label of 'exceptionality' than 'inalterability'.

In Hausa, coronal obstruents /t, s, d, z/ palatalize (to /č, š, ʃ, ʒ/, respectively) before front vowels (/i, e/) (Abraham 1959b:16, Bagari 1986:70; see Newman 1973 and Parsons 1960–61 for discussion of Hausa verb grades):

- (30) a. *sà:t-á:* 'steal (-verb)'
sà:č-é: 'steal (-before pron. obj.)'
sà:č-í 'steal (-before noun obj.)'
 b. *či:z-á:* 'bite (-verb)'
či:ʃ-é: 'bite (-before pron. obj.)'
či:ʃ-í 'bite (-before noun obj.)'
 c. *fàns-á:* 'redeem'
fàns-é: 'redeem (-before pron. obj.)'
fàns-í 'redeem (-before noun obj.)'
 d. *gà:d-á:* 'inherit'
gà:ʒ-é: 'inherit (-before pron. obj.)'
gà:ʒ-í 'inherit (-before noun obj.)'

Coronals are pervasively palatal before tautomorphic front vowels as well (unglossed affixes mark verb grades, here and in 32–33):

- (31) a. *šìg-á* 'enter' b. *čí* 'eat' c. *ʒíkí:* 'body'
šè:karà: 'year' *čé:* 'say' *ʒè:f-á:* 'throw at'

Palatalization affects singletons and geminates, exhibiting no geminate inalterability effects (data here and in 33 are from Abraham 1946 and Cowan & Schuh 1976:281):

- (32) a. *fás-à:* 'break' *fàs-ášš-é:* 'broken one (m.)'
 b. *zánt-úkà:* 'conversation-pl' *zànc-é:* 'conversation'
 c. *ɓàt-àtt-ú:* 'lost one(s)' *ɓàt-áčč-íyá:* 'lost one (f.)'
 lose-PTCPL-pl lose-PTCPL-FEM

However, a number of coronals fail to palatalize (from Abraham 1946):⁸

- (33) a. *dé:nà:* 'cease doing'
 diddígá: 'remainder'
 b. *sittín* 'sixty'
 c. *té:kì:* 'large hide bag'
 tí:làstá: 'force someone to do something'
 d. *zé:té:* 'long, pointed'
 zilá:mà 'oppression'

While most nonalternating segments in 33 are singleton, some geminates also fail to palatalize. This 'inalterability' effect is clearly unrelated to quantity.

We turn next to a similar example from Malayalam. As shown by Mohanan & Mohanan (1984:586–87), intervocalic velar stops (/k, g/) in Malayalam palatalize following a phonologically front vowel (/i, e, a/), as in 34a. Palatalization fails in 34b because the relevant velars are not intervocalic. Note that not only singletons but also geminate intervocalic velars palatalize (34c):

- (34) a. *mikacca* → *mik^yacca* 'excellent'
 b. *wikramam* (**wik^yramam*) 'brave deed'
 awar-kkə (**awark^yk^yə*) 'they-DAT'
 c. *pu:cca-kkə* → *pu:ccak^yk^yə* 'cat-DAT'
 kuṭṭi-kky → *kuṭṭik^yk^yə* 'child-DAT'

Mohanan & Mohanan observe that there are numerous lexical exceptions to Palatalization, all involving velars which fail to palatalize even though they occur in the appropriate environment:⁹

- | (35) | NON-PALATALIZED VELAR | PALATALIZED VELAR |
|------|---------------------------|--------------------------------------------------|
| a. | <i>wikalam</i> 'broken' | <i>mik^yacca</i> 'excellent' |
| b. | <i>akam</i> 'inside' | <i>palak^ya</i> 'wooden board' |
| c. | <i>wikkan</i> 'stammerer' | <i>mik^yk^ya</i> 'most' |
| d. | <i>ṭikkə</i> 'crowd' | <i>aṭik^yk^yə</i> 'beat.IMP' |

Failure to palatalize is manifested both by singletons (a–b) and by geminates (c–d). As with coronal palatalization in Hausa, the phenomenon of 'inalterability' exhibited by certain Malayalam velar stops is unrelated to weight.

3.3. CODA SONORITY. The immunity of geminates to coda constraints is well known and, since Itô 1986, has generally been interpreted as a canonical geminate inalterability effect. However, coda constraint violations are not limited

⁸ Since nonpalatalizing segments occur in nonderived environments only, palatalization in Hausa could be classified as a 'derived-environment' rule. However, Kiparsky 1993 treats derived-environment effects as the failure of cyclic feature-filling rules to apply to prespecified material; we assume that derived-environment rules are just part of the more general phenomenon of 'elsewhere' rule blocking.

⁹ Exx. 35a,c,d are from Mohanan & Mohanan (1984:586); 35b is from Mohanan (1986:73). Schein & Steriade (1986:720) suggest that palatalization affects every postvocalic velar, but feeds coda depalatalization—from which geminates, due to the UAC, are protected. However, the fact that singleton [k^y] and [k] contrast following /i/ and /a/ (see 35) argues against a depalatalization rule, which would incorrectly neutralize the contrast.

to geminates. As we now show with data from Hausa and Italian, not all inalterable elements are geminates—just as not all geminates are inalterable.

The constraint known as Klingenberg's Law in Hausa (ex. 2) obtains in Italian as well (Itô 1986:36–37): codas must be sonorant (36a). As in Hausa, geminates in Italian systematically override this constraint (36b):¹⁰

- (36) a. *in.flessibile* [n] 'inflexible' b. *lab.bro* [bb] 'lip'
 al.tro [l] 'other' *grap.pa* [pp] 'brandy'
 bur.gravio [r] 'castle' *tut.to* [tt] 'all'

The relevant point for our immediate purposes is that both Hausa and Italian possess singleton coda obstruents—lexical exceptions to their common coda constraint. Ex. 37 contains data from Hausa (Abraham 1946, Newman & Newman 1977; the suffixes mark verb grades); the Italian forms in 38 are taken from Bullock 1991:

- (37) *Àbdùllá:hì* [b] (proper name)
 tábk-à: [b] 'do a lot of'
 fúskà: [s] 'face'
 gíft-à: [f] 'cross in front'
 káft-à: [f] 'dig ground up'
 dà:ráktà: [k] 'director'
 (38) *pek.tina* [k] 'fruit pectin'
 seg.mento [g] 'segment'
 naf.ta [f] 'naphthalene'
 ab.dikare [b] 'abdicate'
 kap.tare [p] 'to seek'

The singleton Hausa and Italian codas in 37 and 38 clearly pattern with geminates in their ability to violate coda conditions. Ideally, the explanation that holds for geminates in the unmarked case should be able to extend in the marked case to singletons as well. But such an analysis will require an understanding of inalterability which is independent of quantity.

4. BACKGROUND ASSUMPTIONS. A number of theoretical assumptions underlie the argumentation in the remainder of the paper, and it is appropriate to expose them at this juncture. First, we assume a theory of moraic phonology along the lines of Hyman 1985, McCarthy & Prince 1986, Zec 1988, Hayes 1989, Itô 1989, and Waksler 1990. We adopt a strong version of moraic licensing whereby all segments (even onsets) get morified before they undergo any (other) phonological rules.¹¹

Second, we adopt 'radical underspecification' theory (Kiparsky 1982, 1993,

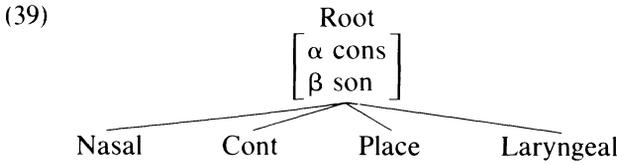
¹⁰ If Chierchia 1982 is correct in claiming that word-medial /sC/ clusters are heterosyllabic in Italian (see also Kaye et al. 1990), then /s/ will have to override the coda constraint as well. However, Vogel (1977:76) argues that such clusters are in fact complex onsets, noting that sC clusters occur word-initially while /s/ never occurs word-finally. Chierchia's argument is based on the length of the preceding vowel.

¹¹ For consistency, we formulate all of our analyses in terms of ordered rules. However, we have no real stake in the more general debate between rule-based and constraint-based models of phonology, nor in the question of whether a declarative model is superior to a derivational one

Archangeli 1984, Cho 1990). Features are generally assumed to be binary,¹² with only the marked feature value available at the early stages of the derivation. Insertion of default feature values at a later (conceivably phonetic) level results in full specification of all segments.

Third, we follow Poser 1982, Mascaró 1987, and Cho 1990 in prohibiting the use of powerful, direct feature-changing rules of the type $\alpha F \rightarrow -\alpha F$. Rather, all such alternations are decomposed into a rule of delinking and a rule of spreading, both independently needed rule types.

Fourth, we use McCarthy’s 1988 version of feature geometry, in which root nodes bear the features [sonorant, consonantal] directly, dominating place and laryngeal class nodes as well as the terminal features [continuant] and [nasal]:



Geminates are analyzed with a single root node.

5. INALTERABILITY, EXCEPTIONALITY, AND THE ELSEWHERE CONDITION. In this section we offer a new generalization about inalterability: what all examples of inalterability share is that the blocked rule in question is PURELY STRUCTURE-FILLING. Thus, whether the rule manipulates features or metrical units, whether it involves spreading or insertion, it always has the crucial property of being blocked by prespecified structure.¹³

(40) **GENERALIZED INALTERABILITY:** All inalterability effects result from the blocking by prespecified structure of purely structure-filling rules.

That is to say, we claim that inalterability is simply ‘elsewhere blocking’—a general phenomenon from which the complementary phenomena of ‘geminate inalterability’ and ‘singleton exceptionality’ follow as principled special cases. The sole constraint unifying inalterability effects is the Elsewhere Condition (Pāṇini [1962], Anderson 1969, Kiparsky 1973a,b,c). In §§5.1–5.7 we survey types of inalterability and show that they conform to the generalization in 40.

5.1. FEATURAL PRESPECIFICATION. The literature on vowel and consonant harmony is full of analyses attributing the exceptional failure of ‘opaque’ seg-

(see e.g. Lakoff 1987, Paradis 1988, Bird 1990, Scobbie 1991, Myers 1991, Prince & Smolensky 1991, Buckley 1992b, and Goldsmith 1992 for discussions of these issues). Any model which can express priority relations among rules (or their equivalents) should be able to capture the generalizations that we develop.

¹² The features [voice], [aspirated], [cont], and [nasal] have all been argued to be privative; see e.g. Mester & Itó 1989, Steriade 1991, Lombardi 1990, 1991, and Padgett 1991 (though Cohn 1991 argues on the basis of Sundanese that [nasal], at least, must be binary-valued). We do not assume privativity here, though we do assume strict underspecification, so that only the marked feature value is available to most phonological rules. Late, possibly phonetic rules can access both feature values.

¹³ ‘Prespecification’ is relative; we mean not only underlying structure but more generally any structure extant when a given rule applies.

ments to alternate to their prespecification for the harmonic feature in question. An early paper invoking this type of analysis is Clements & Sezer 1982. To handle the ‘disharmonic’ Turkish morphemes illustrated in 26 above, Clements & Sezer propose that the exceptional vowels are underlyingly specified for the feature [–back]. Since vowel harmony is attributed to a purely structure-filling spreading rule, any prespecified feature is predicted to block its progress.

A representative list of works espousing this approach to opacity in vowel-harmony systems includes Archangeli & Pulleyblank 1989, Clements 1976, 1977, Vago 1988, van der Hulst 1984, 1988, and (most explicitly) Kiparsky 1991, 1993. Prespecification is also the method employed in Poser 1982 to analyze Ineseño Chumash sibilant harmony (§3.1). Poser decomposes sibilant harmony into two operations: (a) delinking of [±dist] from all sibilants preceding another sibilant in the word, and (b) feature-filling spread of [±dist] from right to left. Coronal Dissimilation, which inserts [+dist], is ordered between the two. The result is that Coronal Dissimilation blocks the feature-filling spread of [–dist]:

(41) UR:	/s-ti-yep-us/	/s-iš-sili-ulu-aq-pey-us/	/ha-s-xintila-waš/
DELINKING:	—	<i>sissiliuluqaqpeyus</i>	—
INSERTION:	<i>štiyepus</i>	—	—
SPREADING:	—	—	<i>hašxintilawaš</i>

To any late feature-filling rule, underlying and derived features behave identically. Relative (as opposed to strictly underlying) prespecification is the operative characteristic of ‘inalterable’ segments.

This treatment of exceptions to long-distance effects extends naturally to local assimilation processes as well. To account for the palatalization facts seen earlier in Hausa and Malayalam (exx. 33–35), for example, we prespecify exceptional nonalternating segments with their surface value for the palatalizing feature ([anterior], following Lahiri & Evers 1991), for the Hausa coronals, [back] for the Malayalam velars). This prespecification blocks the expected spread of palatality from an adjacent front vowel, as shown in 42. This analysis is indebted to Kiparsky (1991, 1993), who makes a compelling general case for analyzing rule blocking—whether in derived or nonderived environments—in terms of prespecification blocking structure-filling rules.

(42)		HAUSA	
UR:	<i>teki</i>		<i>sat-e</i>
	<i>t e</i>		<i>t e</i>
	Cor		Cor
	[+ant] [–ant]		[–ant]
SPREADING:	—		<i>sat-e</i>
			Cor
			—
			—
			[–ant]
	[te:ki:]		[sa:çe:]

On our account, these nonalternating segments are simply underlyingly pre-specified for the features [+voice, +cont], thereby overriding the default rule which would otherwise fill in [-voice, -cont]. This is exactly the kind of exceptional effect expected within our underspecification analysis,¹⁵ in which inalterability is a direct consequence of prespecification.

5.2.2. KOREAN. The phoneme /l/ is subject to an allophonic alternation in Korean, surfacing as dental [l] when singleton (45a) but as palatal [ʎʎ] when geminate (45b):

- (45) a. *tal* → *tal* ‘moon’
 il → *il* ‘work’
 b. *kəllæ* → *kəʎʎæ* ‘rag’
 p'al-Ci → *p'aʎʎi* ‘fast’
 moll-a → *moʎʎa* ‘not know’

This alternation could be described as a geminate inalterability effect: if one were to posit an explicit /l/-dentalization rule for Korean, it would be necessary to stipulate geminates somehow as exceptions to the rule. We suggest an alternative: Korean possesses a geminate-specific rule palatalizing laterals (46a). All remaining laterals undergo the ‘elsewhere rule’ (46b):

- (46) a. GEMINATE TARGET: /l/ → [ʎʎ]
 b. ELSEWHERE: /l/ → [l]

The geminate-specific rule in 46a bleeds the more general rule in 46b, which applies by default to singletons only.

5.3. GEMINATE PRESPECIFICATION. If singleton and geminate (featural) inalterability are to be attributed to the same source, then the task of explaining geminate inalterability in particular involves predicting the circumstances under which geminates are more specified than singleton segments. One such circumstance is provided by rules triggered by segments occupying a particular syllabic position. Because a geminate consonant occupies onset and coda simultaneously, it will be subject to rules targeting either position (as well as to rules targeting both positions). By contrast, a given singleton will be subject either to rules targeting onsets or to rules targeting codas, but never to both. (Since we are rejecting principles of strong satisfaction, such as the Linking Constraint, there can be no rules specifically targeting singleton segments.) Thus, the branching structure of geminates may contribute to their inalterability, but only in an indirect fashion.

¹⁵ The data in 44 pose a problem for extrapolating to Berber the account that Scobbie 1991 offers for a related effect in Tigrinya. Scobbie’s explanation for the failure of postvocalic velar spirantization to affect Tigrinya geminates is a negative filter prohibiting geminate velar spirants. (See also Goldsmith [1990:335], who suggests that rule blockage results from ‘a failure of the [resulting] structure to satisfy word-level phonotactics’.) As far as we know, Tigrinya’s spirantization rule admits no lexical exceptions. Thus Tigrinya could be analyzed either as we have analyzed Berber or in terms of constraints. However, the forms in 44 make it impossible to sustain a surface filter against [+continuant] geminates in Berber.

- (47) Source of geminate inalterability effects:
- a. Geminates trigger a rule R_1 affecting a smaller (possibly null) set of singletons, and
 - b. R_1 , by inserting some feature αF , blocks the later insertion of $-\alpha F$ by another, more general, rule, R_2 .

Korean // Palatalization and Berber Voicing are clear examples of this sort. In each, a rule specifically targeting geminates inserts a particular feature, blocking a later default rule from filling in the opposite value. Another such case is Japanese Nasalization.

5.3.1. JAPANESE. The Japanese data in 48 (representative of verbal morphology, infixation, and reduced compounds, but excluding onomatopoeic words and the Sino-Japanese vocabulary) show that if either member of a consonant cluster is underlyingly voiced, the first consonant will surface as nasal and the second as voiced, as in 48a (McCawley 1968, Poser 1986). Nasalization does not affect a sequence of voiceless consonants (48b):

- (48) a. *tuk-dasu* → *tundasu* 'thrust out' (lit. 'stab-put.out')
yob-te → *yonde* 'call-GERUND'
hik-mekuru → *himmekuru* 'to peel' (lit. 'pull-rip.off')
tanom-te → *tanonde* 'eat-GERUND'
- b. *mat-ta* → *matta* 'wait-PAST'
huk-kakeru → *fukkakeru* 'blow on' (lit. 'blow-cover')
but-kom → *bukkomu* 'drive into' (lit. 'hit-be.full')

Underlyingly voiced geminates are unaffected by Nasalization:

- (49) *beddo* (**bendo*) < Eng. 'bed'
baggu (**bagu*) < Eng. 'bag'

To account for these facts, we propose a bidirectional rule spreading [+voice] throughout a consonant sequence,¹⁶ followed by a rule inserting [+nasal] on the first of two root nodes with shared laryngeal specifications (i.e. [+voice]). Because total geminates possess only one root node, they will not trigger nasalization.

- (50) GEMINATE TARGET:
-
- ```

 Root Root
 / \ / \
 / \ / \
 / \ / \
 [+nas] Lar
 |
 [+voice]

```

This analysis of nasalization extends naturally to the process of Intensive Infixation, which involves the insertion of a consonantal mora. As shown in 51, Nasalization occurs exactly when [+voice] is present in the environment of the inserted mora (51a vs. 51b). As our analysis predicts, the spread of [voice] to the new mora triggers Nasalization. The new nasals then undergo the general process of nasal place assimilation:

<sup>16</sup> Unidirectional left-to-right spreading of voice is proposed in McCawley 1968 and Itô & Mester 1986; we generalize it here to the data in 48 and 49. There are no examples in the relevant sectors of the vocabulary of consonant sequences which disagree in voice.

- (51) a.  $\begin{array}{cccc} \mu & & \mu & & \mu & \mu \\ \wedge & & | & & \wedge & \wedge \\ /to-[+cons]-garu/ & \rightarrow & togaru & \text{ 'to be pointed' } \end{array}$
- b.  $\begin{array}{cccc} \mu & \mu & & \mu & \mu \\ \wedge & / & | & \wedge & \wedge \\ /kara-[+cons]-kaze/ & \rightarrow & karakkaze & \text{ 'dry wind' } \end{array}$

Past accounts of nasalization (e.g. McCawley 1968, Itô & Mester 1986) have proposed a coda rule applying after assimilation, nasalizing the first half of a derived geminate (e.g. /Cg/ → gg → [ŋg]). However, such an analysis incorrectly predicts that underlying geminates, as in 49, should also nasalize. It is thus necessary to stipulate that [+Foreign] words such as those in 49 are exceptions to the rule (Itô & Mester 1991).

In Japanese, as in Berber and Korean, the special behavior of geminates originates with a geminate-triggered rule. In Japanese the geminate structures in question are identified on the laryngeal tier.

Rule-induced prespecification is not confined to rules which exclusively target geminates. Blocking also results when the earlier of two ordered rules targets the syllable onset,<sup>17</sup> as in Latin // Velarization (§5.3.2), and Orizaba Nahuatl Aspiration and Lateral Voicing (§5.3.3).

**5.3.2. LATIN.** As we have seen (§1.2), Schein & Steriade (1986:704) attribute the failure of // to velarize in the coda in a Latin word like *velle* ‘to want’ to geminate inalterability. From our perspective, however, Latin velarization is a prototypical example of an onset-specific rule bleeding a more general default rule (see Scobbie 1992 for a similar analysis). Height and backness are not contrastive for // in Latin, suggesting that // is underlyingly unspecified for these features. We posit the default rules in 52 to fill in the surface feature values:

- (52) a. ONSET TARGET: // → [–high –back] /<sub>σ</sub>[ \_\_\_\_  
 b. ELSEWHERE: // → [+high +back]

Because both singleton and geminate // occupy onset position, both will undergo the onset-specific rule in 52a. The ‘elsewhere’ darkening rule in 52b can thus affect only singleton codas.

One might object that this solution requires the unmarked value [–back] to be inserted before the marked value [+back], contrary to the usual expectation of underspecification theory (see e.g. Pulleyblank 1986:135). However, we note that in some sense both feature values are equally marked in cases like these, where neither feature value is active in the phonology. Confirming the late stage at which // velarization occurs is its insensitivity to the distinction between true (tautomorphemic) and fake (heteromorphemic) geminate //s; these

<sup>17</sup> Any rule inserting feature(s) on the coda is also predicted by our account to affect singletons and geminates equally. If such a rule should bleed a later default rule, the expectation is for the default rule to have an observable effect only on singleton onsets. So far we have found no such cases. This may be due to the fact that most coda rules are neutralizing, that is, delinking, rules (Cho 1990).

behave alike, suggesting that velarization follows fusion of heteromorphic geminates.

**5.3.3. ORIZABA NAHUATL ASPIRATION AND LATERAL VOICING.** The distribution of aspiration in Orizaba Nahuatl is predictable: plain stops are aspirated in onset position (53a) but not in coda position (53b)<sup>18</sup>. Geminates (53c) pattern with singleton onsets and aspirate (data from Goller et al. 1974):

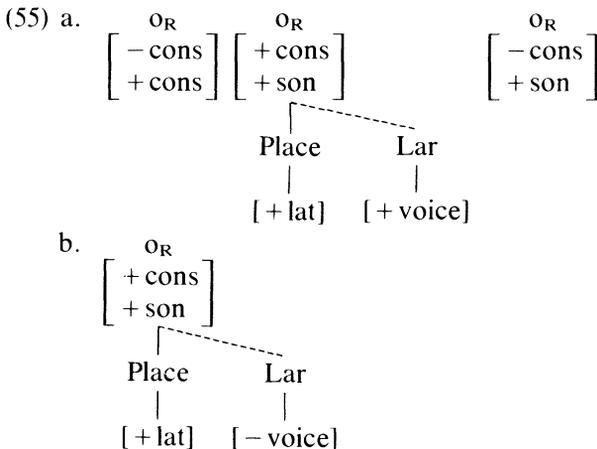
- (53) a. *kiššáloh* → *kʰiʃ.šá.loh* 'a container for wild greens'
- b. *šáyakʔe* → *šá.yak.ʔeʔ* 'face'
- c. *nikkahkayáwa* → *nik.kʰah.kʰa.ya.waʔ* 'I am deceiving him'

If we were to assume a coda rule of deaspiration, then geminates would have to be characterized as exceptions, evoking geminate inalterability. If, however, we more plausibly formulate aspiration using the marked feature value [+asp], then there is no need to exempt geminates: aspiration targets onsets, a structural description which geminates meet. If correct, this analysis supports our general claim that geminates undergo onset-particular rules and constraints.

Goller et al. (1974:127) describe a second allophonic voicing alternation in Orizaba Nahuatl: underlying /l/ surfaces as voiced ([l]) intervocalically (54a) and voiceless ([l̥]) elsewhere (54b).

- (54) *milaʃ* → *mí.laʃ* 'a spring in a cornfield'
- poyohlamátkeh* → *pʰo.yoh.ʃa.mát.kʰeh* 'hens'
- yólmej* → *yól.l.meh* 'hearts'
- ílfíʃ* → *í.l̥.fíʃ* 'fiesta'

We assume a rule inserting the allophonic feature [+voice] specifically on intervocalic laterals (55a) and a general elsewhere rule (conceivably a phonetic rule) which assigns [-voice] to all remaining underspecified laterals (55b).<sup>19</sup>



<sup>18</sup> Word-final codas are subject to a separate laryngeal alternation.

<sup>19</sup> In the few forms given with /l/ as a postconsonant onset, /l/ is voiceless, as expected, as in 'hens' in 54. (Goller et al. give no examples of /l/ after a syllable-final voiced consonant.)

Intervocalic geminate //l/ satisfies the environment of the earlier rule. As predicted by our analysis, it surfaces as voiced:

(56) *kallał* → *k<sup>h</sup>ál.lał* ‘water from the roof’

As in Latin, the geminate //l/ undergoes the more specific of two rules that fill in the value of a noncontrastive feature.

The point of these four examples is to show that, by satisfying the structural description of some phonological rule, geminates can get specified before the end of the default component, leading to ‘inalterability’ behavior with respect to very late default rules. In the Latin and Orizaba examples, geminates are not alone in this behavior; they pattern with certain singleton consonants.

**5.4. METRICAL PRESPECIFICATION.** Like their segmental counterparts, metrical rules have a tradition of failing to alter prespecified structure. Perhaps the least controversial instance involves cyclic stress assignment: analyses such as those in Hayes 1981, Kiparsky 1982, Prince 1985, Steriade 1987, Hammond 1989, Poser 1989, and Halle & Kenstowicz 1990 crucially assume preservation by structure-filling rules of stress feet assigned on an earlier cycle. The use of lexically prespecified feet for exceptions to stress rules is a natural extension of this approach; examples are collected in Kiparsky 1993 and can be found in many of the references just cited.

Syllable structure appears to behave in a similar manner. Such recent work as Itô 1986, Borowsky 1986, and Rice 1990 has argued that (often with the judicious use of extrametricality) the cyclic assignment of syllable structure can be treated as a purely structure-filling process which preserves pre-existing metrical structure (see also Harris 1985).

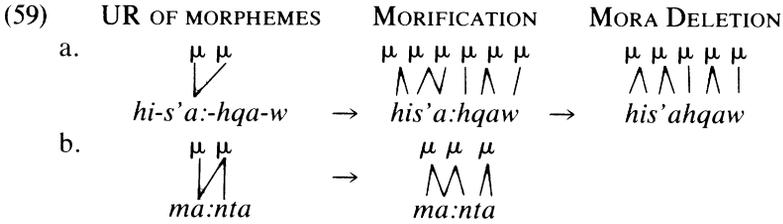
While there are very few analyses requiring prespecified syllable structure, contrastive underlying moraic structure has been invoked in treatments of exceptions (Hyman 1985:Ch. 5, Hayes 1989:302, Buckley 1992a). We examine here one case from Kashaya (Pomoan), as analyzed in Buckley (1992b:232–33). The maximal syllable in Kashaya is bimoraic. Because coda consonants contribute to weight, long vowels (57a) shorten in closed syllables (57b):

(57) a. *da-hwe:n-i* → *dahwe:ni* ‘shake your hand!’  
           *hi-s’a:ti* → *his’a:ti* ‘about to break’  
       b. *da-hwe:n-me?* → *dahwenme?* ‘shake your hands (pl)!’  
           *hi-s’a:(i)ns* → *his’ans* ‘might have broken’

However, certain loanwords violate the CVC maximum. Ex. 58 contains medial CV:C syllables whose long vowels, unlike those in 57, are not shortened.

(58) *ku:l.pa* ‘fault’ (Sp. *culpa*)  
       *?a.li:t<sup>h</sup>.ka* ‘turnip’ (Ru. *red’ka*)  
       *ma:n.ta* ‘clothing material’ (Sp. *manta*)  
       *ca:š.ka* ‘dishes’ (Ru. *čaška*)

Buckley encodes this prosodic exceptionality by prespecifying the unpredictable portion of surface structure. Compare the treatment of a regular, native word (59a, ‘cause to break’) to that of a loanword with prespecified moraic structure (59b, ‘clothing material’):



The pre-existing moraic structure is ‘inalterable’ with respect to the insertion of moras on unmodified segments. Note that this instance of inalterability is specific to singleton segments.

**5.5. MORIFICATION AND CODA SONORITY.** The crucial point of the preceding section is that the exceptional presence of moraic structure in underlying representation exempts singleton segments from (subsequent) rules of morification. Of course, underlying moraic structure is the ‘regular’ case for geminates, whose contrastive length is encoded in every version of moraic theory (Hyman 1985, Hayes 1989) by the underlying presence of some number of moras (though see Tranel 1991). These proposals make the common prediction that, just as featurally prespecified segments resist feature-filling rules, geminates are predicted to resist mora-assigning rules—and any associated effects. Our claim is that this predicted exceptionality is manifested in the form of a large, well-defined portion of ‘geminate inalterability’ effects: the systematic resistance of geminates to coda sonority constraints.

It is well known that syllables may impose a certain degree of sonority in the coda. Zec 1988 and Waksler 1990 attribute coda sonority constraints to the morification process; only consonants meeting a certain sonority minimum can be assigned a weak (nonhead) mora.<sup>20</sup> Sonority requirements are described in terms of the universal sonority hierarchy:

- (60) SONORITY HIERARCHY:  
 obstruents < nasals < liquids < glides < vowels

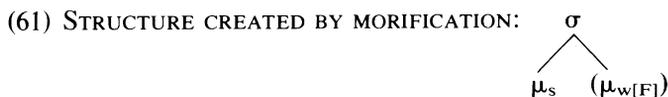
The consensus in the recent literature (e.g. Clements 1990, Zec 1988) is that [consonantal], [sonorant], and [approximant] are universal sonority features. In addition to these, [continuant] or [+constricted glottis]<sup>21</sup> may be invoked

<sup>20</sup> To make derivations more transparent, we will be using the template-based approach of Waksler 1990 rather than the rule-based approach of Zec 1988; see these works for discussion of the technical differences between the two approaches.

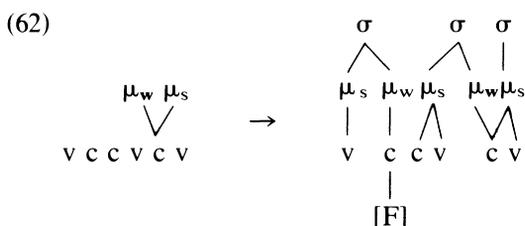
<sup>21</sup> The effect on sonority of [+constricted glottis] is controversial. In the case of the glottal stop the feature has a high sonority value, as shown by the number of languages that include [ʔ] in the restricted set of consonants permitted in the coda. In Chibcha (Moore 1962:273) and Cayapa (Lindskoog & Brend 1962), for instance, only nasals, continuants, and [ʔ] occur in the coda. In Usarufa (Bee 1973a, 1973b, Bee & Glasgow 1973), Cofan (Borman 1962), and Siona (Wheeler & Wheeler 1962), only [ʔ] occurs in the coda: even the highly sonorant nasals are prohibited. (One might try to attribute the felicity of [ʔ] in the coda solely to the absence of place features; however, Cohn 1987 demonstrates that [ʔ] patterns for sonority purposes with glides (which do have place features), confirming its high sonority ranking.) When it functions as a secondary feature, however, glottalization appears to REDUCE sonority. In Kwakwala, glottalized sonorants are less sonorous than plain sonorants, patterning with obstruents in their inability to bear weight (Bach 1978, Zec 1988).

on a language-particular basis to draw further distinctions in sonority ranking among segments.<sup>22</sup>

Ex. 61 shows how Waksler 1990 would accommodate sonority features (represented as [F]) into the syllabification and morification procedure:



If we make the natural assumption that underlying moras are untouched by structure-filling morification, then we predict inalterability effects exactly for these cases. This is illustrated by the derivation in 62, in which the template in 61 assigns moras to underlyingly nonmoraic material. Compare the boldface weak mora, present underlyingly, with the weak mora assigned by the regular process of morification. Only the latter imposes on its head consonant the sonority features contained in [F]:



We turn now to three case studies of coda sonority constraints, observing (in the latter two) the systematic failure of the morification algorithm to impose sonority features on (underlyingly morified) geminates.

**5.5.1. KIRIBATESE.** Kiribatese (Eastern Oceanic; Trussel 1986, Groves et al. 1985), which has the consonant inventory /b, t, k, m, n, ŋ, w, v, r/, permits all and only nasals in coda position, whether word-internal or word-final:

- (63) a. *karin* 'put them in'  
*akawam* 'your fishing'  
*kaonoboŋ* 'Saturday'  
 b. *kam no:ria* 'you saw.it'  
*kam kina:* 'you recognized'  
*e kan taraia* 'he wanted.to look.at.it'  
*naŋ kiro* 'to.be.about.to faint'

Although there are no alternations within the native vocabulary of Kiribatese to show that nonnasal codas are repaired,<sup>23</sup> nonnasal codas in English loanwords trigger epenthesis and end up as onsets:

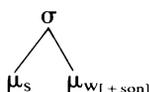
<sup>22</sup> Following recent literature, we assume (contra Steriade 1982 and Levin 1985) that the following are NOT sonority features: place of articulation (Zec 1988, Clements 1990), [voice] (Zec 1988, Cho 1991), and [nasal] (Clements 1990).

<sup>23</sup> Kiribatese has no morpheme-final obstruents at all (Groves et al. 1985:20–21), despite the existence of vowel-initial suffixes (ibid., p. 22) with which they could syllabify as onsets. The data in 63 and 64 are from Groves et al. 1985.

- (64) *katitam* < 'customs (office)' [st] = [tt]  
*ko:ti* < 'goat' [t#]  
*biraoki* < 'frog' [fr] = [br], [g#] = [k#]

We assume that the morification algorithm in Kiribatese imposes [+son] on weak moras. Subsequent default rules associate [+nas] with [+son] segments.<sup>24</sup>

- (65) KIRIBATESE MORIFICATION: Map segments to following template:



**5.5.2. HAUSA AND ITALIAN.** In using epenthesis to accommodate the conditions imposed by the algorithm in 65, Kiribatese differs minimally from Hausa and Italian. In fact, all three employ the same morification algorithm. In Hausa [+son] appears to have unified with obstruents, converting them directly into sonorants. In Italian, however, coda obstruents do not become sonorants, instead assimilating completely to a following consonant (Saltarelli 1970:85–86):

- (66) *dek-t-o* > *detto* 'said'  
 say-PART-MASC/NEUT  
*čiv-ta* > *čitta* 'city'  
 city-NOM.FEM

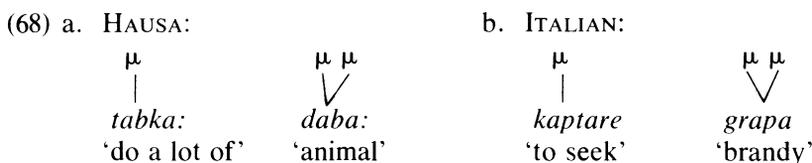
The different responses of Hausa, Italian, and Kiribatese to the same coda constraint confirms the observations of Itô 1986, 1989 and Waksler 1990 (see also Yip 1982, in a slightly different context) that languages employ a variety of strategies to deal with unification failure between the metrical template and the segmental string. Some, like Hausa, alter the features of the segment to accommodate those imposed by the template. Others, like Kiribatese, epenthesize a new segment which unifies with the morification template. Still others, like Italian, delete an ill-formed segment (including the sonority features imposed on it by morification) if its features and that of the template do not unify. The inserted, emptied mora is refilled by spreading from an adjacent (already morified) segment, resulting in total assimilation:

- (67)
- |                 |   |                                                                                                                                      |   |                                                                                                                     |   |              |
|-----------------|---|--------------------------------------------------------------------------------------------------------------------------------------|---|---------------------------------------------------------------------------------------------------------------------|---|--------------|
| <i>čiv + ta</i> | → | $  \begin{array}{c}  \mu \quad \mu \quad \mu \\  \wedge \quad \wedge \quad \wedge \\  \check{c}ivta \\    \\  [+son]  \end{array}  $ | → | $  \begin{array}{c}  \mu \quad \mu \quad \mu \\  \wedge \quad \wedge \quad \wedge \\  \check{c}iCta  \end{array}  $ | → | <i>čitta</i> |
|                 |   | Morification                                                                                                                         |   | Stray erasure                                                                                                       |   | Assimilation |

**5.6. SINGLETON INALTERABILITY AND MORAIIC EXCEPTIONALITY.** Equipped with the knowledge that underlying moraic structure blocks 'elsewhere' assignment

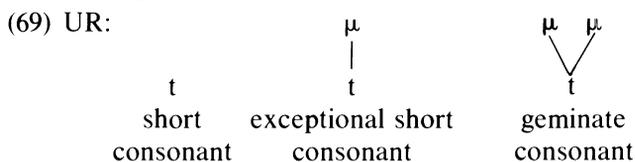
<sup>24</sup> The phonemes /w/ and /r/ are not subject to nasalization in coda position. We assume that this is due either to their continuant status (see e.g. Cohn 1991 and Padgett 1991:124–43 for discussion of the rarity of nasalized continuants), or to their possible underlying status as obstruents (note that /w/ alternates with /v/).

of moras, we return at last to the topic of singleton inalterability and exceptionality (§3), in particular to the exceptions to coda sonority in Hausa and Italian in exx. 37–38 above. Given that geminates are prespecified with the number of moras with which they surface, and that these two moras block further morification, all we need to say for exceptional singletons is that they, too, are prespecified with the moraic structure with which they surface: a single mora. Underlying moraic structure on long vowels is omitted here for notational simplicity:



Premorified singleton obstruents thus pattern with geminate obstruents, not in quantity but in their inalterability with respect to sonority constraints.

Insofar as the underlying presence of single moras is reserved for exceptionally moraic singleton segments, a three-way distinction is required in underlying representation among regular singleton consonants, exceptionally moraic but nongeminate consonants, and geminates:



In reserving singleton underlying moras for exceptional short consonants, this system differs from previous proposals (Hyman 1985, Hayes 1989). Supporting evidence comes from the Kashaya example discussed earlier. The single underlying mora with which Buckley 1992b encodes the moraic exceptionality of singleton consonants in Kashaya is crucially distinct from the underlying representation for geminates (which occur elsewhere in the language).<sup>25</sup>

In conclusion, we account for sonority-related inalterability effects in exactly the same manner as non-sonority-related effects: the Elsewhere Condition causes prespecified geminates to forgo structure-filling default rules. Moreover, we relate geminate and singleton resistance to sonority constraints by assigning all resistant segments the same type of representation. The reason that geminate inalterability to sonority constraints is systematic, while singleton inalterability

<sup>25</sup> Noting that the singleton consonants we prespecify in Hausa (and Italian) all precede consonants, several readers have suggested reducing the number of underlying moraic contrasts allowed in the theory to two. Assuming, following Hayes 1989, that underlyingly morified consonants geminate only when a vowel follows, we could assign a single underlying mora to both singleton and geminate /b/ in the Hausa words *tábkà:* and *dábbà:*. However, this possible analysis of Hausa does not prove general; Buckley 1992a shows for Kashaya, for example, that a single underlying mora is needed to represent the exceptional moraic behavior of certain singleton ONSETS. Kashaya has geminates, which require a distinct underlying moraic representation. Thus, the three-way moraic contrast in 69 appears necessary.

is exceptional, is simply that only geminates systematically possess the relevant prespecified structure, namely, moras in underlying representation.

**5.7. EXCEPTIONALITY BY PRESPECIFICATION.** One traditional approach to exceptionality has involved the use of features specifying individual morphological forms as exceptions to individual rules (e.g. Chomsky & Halle 1968, Lakoff 1970, Zonneveld 1978, Lightner 1972, Kiparsky 1973c, Harris 1977a,b, Ringen 1982). Here, however, we follow Hayes 1981, Levergood 1984, McCarthy 1984, Harris 1985, McCarthy & Prince 1991, Poser 1984, Pulleyblank 1986, Ringen 1988, and others in handling exceptionality by prespecifying the unexpected structure with which exceptional forms surface. This latter approach rejects the use of rule features (e.g. 'does not undergo rule 47') on grounds that it is both insufficiently powerful and insufficiently restrictive; even where they are descriptively adequate, rule features lack the explanatory force of prespecification.<sup>26</sup>

First, prespecification can block only a subset of the rules that negative rule-exception features can block, and it therefore predicts the existence of a more restrictive set of exceptions. Prespecification can never block delinking or deletion, because such rules simply feed on prespecified structure. By contrast, rule-exception features can target a delinking rule as easily as a feature-filling rule. Furthermore, prespecification blocks a structure-filling rule only by offering MORE SPECIFIC STRUCTURE in place of what that rule would assign. Since the absence of structure can never be directly encoded, prespecification will never be able to block general parsing rules such as prosodic licensing; by contrast, rule-feature theory is quite capable of assigning the diacritic rule feature [– syllabification]. The apparent universality of prosodic licensing (Itô 1986) strongly supports this aspect of prespecification theory.

Second, prespecification theory is more flexible than rule-feature theory regarding the domain of exceptionality. While rule features are generally limited to the morpheme (as in *SPE*, Chomsky & Halle 1968) or to morphologically identifiable derived units such as the stem (Harris 1977a) or word (Harris 1977b), prespecification theory targets PHONOLOGICAL CONSTITUENTS such as the segment, mora, syllable, or foot. This is consistent with overwhelming evidence that exceptionality is generally localized to a particular phonological constituent within a morpheme.

Third, prespecification theory predicts that, if a string is exceptional with respect to more than one rule, the set of rules will be a natural class. All effects associated with morification will be blocked as a group by premorification; all default rules filling in vowel features will be blocked by a fully specified vowel.

<sup>26</sup> Excluded here are sublexical segregations such as  $\pm$  Latinate (in English), Sanskrit/Dravidian (in Malayalam), or Yamato/Sino-Japanese (in Japanese). These broad divisions, which involve more than one rule, should be treated as subgrammars rather than in terms of idiosyncratic rule exceptionality.

We are aware of additional cases of exceptionality, e.g. the Piro vowel deletion rule discussed in Kisseberth 1970, which appear to be beyond the scope of a prespecification analysis. In Piro, exceptionality takes the form of failure to trigger, rather than failure to undergo, a rule. Insofar as the rules in such cases are truly phonological (rather than morphological) in character, they remain a problem for us until they can be resolved in a representational fashion.

By contrast, we have no reason to expect rule-exception features to cluster in any natural way. This aspect of prespecification theory has the advantage of introducing at least a degree of falsifiability, since potentially many rules can act as a check on the proliferation of underlying structure.

Finally, as observed in Harris 1985, prespecification is a much more economical theory of exceptionality. In employing only independently motivated (generally surface-true) phonological structure, it requires no special theoretical apparatus to distinguish exceptional from regular forms. By contrast, exception-feature theory requires an alphabet separate from that used in the regular phonology, composed of diacritics with no function other than the immediate blockage or inducement of particular rules. By prespecifying only phonological structure which ultimately surfaces (at least in some contexts), prespecification theory avoids the pitfalls of diacriticness discussed in Kiparsky 1973c.

In sum, the prespecification treatment of exceptions—assuming that it proves to be general—is superior to rule-exception theory on both descriptive and explanatory grounds. By using a limited inventory of ‘exception features’ (those phonological structures independently motivated in the language), it predicts that exceptions will occur with respect only to a principled subset of phonological rules. Not coincidentally, this is exactly the subset of rules with respect to which we also find geminate inalterability effects.

**6. PSEUDO-INALTERABILITY.** As mentioned in §1, the mere survival of a geminate in a language which has a rule that in principle could affect that geminate does not necessarily mean that a genuine case of geminate blocking has occurred. Nonetheless, several such cases of geminate survival have been analyzed as instances of geminate inalterability. In this section we examine several cases which, if not reanalyzed, would pose problems for our theory. They involve, on the one hand, geminates which do not satisfy the structural description of the rule in the first place (§6.1) and, on the other hand, rules which apply before the geminate in question has been derived (§6.2).

**6.1. INALTERABILITY BY ABSENCE OF ENVIRONMENT.** Many phenomena classified as geminate inalterability can instead be characterized as cluster conditions (Yip 1991, Clements 1990)—rules or constraints triggered by sequences which geminates, by virtue of being monosegmental, never provide. Of particular interest in this regard are delinking effects: since the prespecification theory of geminates predicts that delinking should never be blocked, it is important to establish that reported cases of inalterability effects involving delinking rules can in fact be reinterpreted as cluster rules.

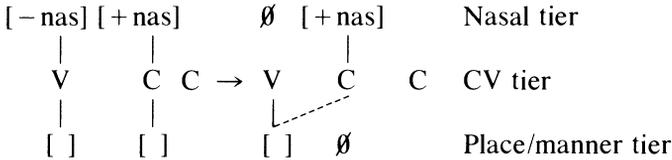
**6.1.1. CHICKASAW NASAL PLACE DELINKING.** In Chickasaw (Western Muskogean; Munro & Ulrich 1985), nasal codas delink, nasalizing a tautosyllabic vowel (70b). Neither homorganic (70c) nor geminate (70d) nasals participate in the alternation:<sup>27</sup>

<sup>27</sup> Data are from Munro & Ulrich 1985, Hayes 1986b, Charles Ulrich (personal communication, 1991), and Pam Munro (personal communication, 1992). Nasalized vowels are all phonetically long, but as the length is noncontrastive, the convention is not to mark it (Pam Munro, personal communication, 1992). (Length is contrastive on oral vowels). We are grateful to Pam Munro and Charles Ulrich for discussion of Chickasaw.

| (70) | INPUT                                                           | PLACE ASSIMILATION                   | NASALIZATION                             | GLOSS                                  |
|------|-----------------------------------------------------------------|--------------------------------------|------------------------------------------|----------------------------------------|
| a.   | <i>im-oka?</i><br>DAT-water<br><i>homi-či</i><br>be.bitter-CAUS |                                      |                                          | 'his water'<br><br>'make bitter'       |
| b.   | <i>im-nita?</i><br><i>im-şoloş</i>                              |                                      | → <i>ĩnita?</i><br>→ <i>ĩşoloş</i>       | 'his bear'<br>'his shoe'               |
| c.   | <i>im-tali?</i><br><i>on-başli</i><br>on-cut                    | → <i>intali?</i><br>→ <i>ombaşli</i> | (* <i>ĩtali?</i> )<br>(* <i>õbaşli</i> ) | 'his rock'<br>'cut on'                 |
| d.   | <i>homma</i><br><i>hómmi?-či</i>                                |                                      | (* <i>hõma</i> )<br>(* <i>hõmi?çi</i> )  | 'be red'<br>'make bitter<br>(g-grade)' |

Munro & Ulrich (1985:3) and Hayes (1986b) attribute the failure of nasalization in 70c–d to the double linking of root or place node in total and partial geminates, respectively. Assuming a rule description that mentions singly-linked place and root nodes (71), the LC (Linking Constraint) correctly blocks nasalization in 70c–d.

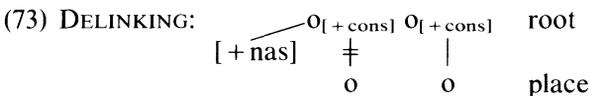
(71) WESTERN MUSKOGEAN NASALIZATION [Hayes 1986b:338]:



However, shared place features are not a NECESSARY condition for nasal delinking to fail. The postnasal C slot in 71 has the specific function of blocking nasal delinking of word-final nasals (except those belonging to an object case marker or a different-subject switch-reference marker; see Munro & Ulrich 1985). Though they share no place features with another consonant, word-final nasals neither delete nor nasalize a tautosyllabic vowel (Munro & Ulrich 1985).

- (72) a. *čotkan* (\**čotkā*) 'spider'  
*işkin* (\**işki*) 'eye'  
 b. *apa-ta-m* (\**apatā*) 'eat-Q-past'

On Hayes's account, the two environments in which nasal delinking fails are unrelated. We offer an alternative account that collapses these two environments into one: as shown in 73, Nasal Place Delinking can be reformulated as a cluster rule, according to which the place node of a nasal delinks whenever another place node immediately follows:



Geminates fail to undergo this rule by not satisfying (even weakly) the environment in the rule: they have only a single place node.<sup>28</sup> Assimilation bleeds (root) delinking; there is no genuine geminate inalterability phenomenon.

<sup>28</sup> Final consonant extrametricality could also explain the word-edge effects; see §8(v) below.

**6.1.2. KIRIBATESE EPENTHESIS.** In Kiribatese (Groves et al. 1985:8–14), coda consonants induce epenthesis when another consonant follows (74a). However, epenthesis fails to break up homorganic nasal-consonant clusters (74b) and those whose first member is /m/ (74c):

- (74) a. *tan-mai* → *tanimai* ‘turn toward me’  
*taian-bo:ki* → *taiani boki* ‘some books’  
*ta:n-koikoi* → *ta:ni koikoi* ‘graters (agents)’  
*aŋ-maeao* → *aŋi maeao* ‘wind from the west’  
*taj-taj* → *tajitaj* ‘complain’
- b. *an nako* ‘turn away from me’  
*ta:n roko* ‘the people arriving’  
*naŋ kiro* ‘to be about to faint’
- c. *kam no:ria* ‘you saw it’  
*kam kina:* ‘you recognized’  
*am ta:ra* ‘your towel’

We argue that this failure stems from a cluster-specific formulation of epenthesis as breaking up sequences of consonantal place nodes:

$$(75) \emptyset \rightarrow R_{[-\text{cons}]} / R_{[+\text{cons}]} \text{ — } R_{[+\text{cons}]}$$

|  
[i]

Homorganic clusters possess only one place node and do not trigger the rule. (The special behavior of /m/ can be explained by treating it as the default nasal, lacking a place node.)

Support for this account of Kiribatese comes from the fact that domain-final nasals, although they occupy coda position and are singletons, do not induce epenthesis (63a): final nasals also possess only a single place node, and the environment for epenthesis is not met. This is exactly parallel to the preservation of place features in word-final Chickasaw nasals.

Prince 1984, Clements 1990, and Yip 1991 have argued that many apparent coda constraints reduce to the restriction that consonant clusters must share place features. Delinking of the place node (as in Chickasaw) is one means of adhering to this constraint; epenthesis is another, as attested in Kiribatese.

**6.1.3. USARUFA PLACE DELINKING.** Usarufa (East New Guinea Highland Stock; Bee 1973a,b, Bee & Glasgow 1973), which has the consonant inventory /p, t, k, ʔ, m, n, r, w, y/, permits only [ʔ] as a singleton coda. As shown in 76a–b, consonants which surface as nasal or /r/ when in the onset are neutralized to [ʔ] in coda position. Ex. 76c shows that [ʔ] neutralization fails to affect geminates (data from Bee 1976b:198–231):

- (76) a. *anon-e* ‘big-INDIC’  
*anoʔ-ko-ma* ‘big-STAT-INDIC’
- b. *ka:yar-e* ‘two-INDIC’  
*ka:yaʔ-ko-ma* ‘two-STAT-INDIC’
- c. *arumma* (\**aruʔma*, \**aruʔʔa*) ‘his liver’  
*annama* (\**aʔnama*, \**aʔʔama*) ‘vine’

At first glance, these facts are amenable to a sonority-based morification

analysis along the lines of coda conditions in Hausa and Kiribatese. However, several obstacles arise. First (assuming a bimoraic syllable maximum), coda consonants are weightless, as shown by the existence of CVVC syllables (Bee & Glasgow 1973:198, 7a; Bee 1973a:246, 7; and Bee 1973b:199,231, 7b,d):<sup>29</sup>

- (77) a. *a:ʔme* 'to carry in mouth'  
 b. *wa:ʔ-ko-ma* 'noise-STAT-INDIC'  
 c. *ma:nnama* 'this'  
 d. *paya:mma* 'pandanus tree'

Morification imposes sonority features only on the segment HEADING the weak mora (Waksler 1990). Yet [ʔ] formation affects all codas in Usarufa, regardless of their contribution to syllable weight.

A second problem is that imposing [+son] on codas, which is sufficient in the analyses of Hausa, Italian, and Kiribatese, would not fully account for Usarufa [ʔ] formation, which alters (already [+son]) nasals. Deriving [ʔ] by morification would require the direct insertion of [+constricted glottis] as well. But [+constricted glottis] is a problematic sonority feature at best (see n. 21); its inclusion in a morification algorithm would weaken the universality of the approach.

Given these considerations, we conclude that Usarufa coda constraints are best handled by a simple rule delinking all features from the first of two consecutive consonants. On the plausible assumption that [ʔ] is the default consonant in Usarufa, its appearance in the coda follows straightforwardly. Geminate fail to undergo [ʔ] formation because they do not possess the two place nodes required in the structural description of the rule.

**6.1.4. TOBA BATAK.** Hayes (1986a,b) describes a rule of Glottal Formation in Toba Batak which neutralizes preconsonantal voiceless noncontinuant obstruents to [ʔ] (1986a:481):

- (78) *ganup taɔn* → *ganu[ʔ t]aɔn* 'every year'  
*dɔhɔt lali i* → *dɔhɔ[ʔ l]ali i* 'and the hen harrier'  
*halak kɔrea* → *hala[ʔ k]ɔrea* 'Korean person'

Glottal Formation fails to alter any consonant sharing place (or laryngeal; see §6.2.3 below) features with the following consonant, whether the shared material is underlying (79a) or derived (79b–c). Geminate arise in two ways: /h/, which lacks place features, assimilates in place to any preceding consonant (79b),<sup>30</sup> and /n/ assimilates totally to any following consonant (79c).

<sup>29</sup> Note that the representation accorded to geminate like those in 77c–d, in which the first half of the geminate consonant does not head a mora, is indistinguishable from that of an 'ambisyllabic' consonant. Our use of the term 'geminate' is broad enough to include ambisyllabicity.

<sup>30</sup> The rule of /h/ assimilation is triggered by underlying obstruents and nasals, but not by /r/ or /l/. Hayes 1986a characterizes the triggers as [–son], assuming that a prior rule of Denasalization (see §6.2.3) converts nasals into obstruents. However, an equally plausible way of dividing obstruents and nasals from liquids is the presence of a place node, which only liquids, by hypothesis, lack. We prefer to characterize /h/ assimilation as a general place-driven process.

- (79) a. *lɔppa* ‘cook’  
           *pittu* ‘door’  
           *sukkup* ‘adequate’  
       b. *manipak hiraġġan i* → *manipa[k k]iraġġan i* ‘kick the basket’  
           *modom halak i* → *modo[p p]alah i* ‘the man is sleeping’  
       c. *manan baa an* → *mana[b b]aa an* ‘that man is eating’  
           *baaa an peddek* → *baaa a[p p]eddek* ‘that man is short’

Hayes assumes that the double linking resulting from assimilation induces the LC to block Glottal Formation. However, an alternative explanation is that geminates possess only a single place node. If we interpret Glottal Formation as another cluster simplification rule, delinking the first of two adjacent consonantal place nodes, the desired results follow without appealing to geminate blockage. As in Usarufa, [ʔ] is the default realization of a placeless noncontinuant. In support, the cluster-based analysis of Toba Batak Glottal Formation explains a condition that is only accidental under the LC account: as shown in 79, Glottal Formation fails to apply to word-final obstruents.

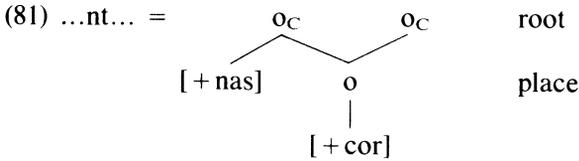
To sum up this section, we have examined four sets of data that initially appeared problematic for our account. Each involved an alternation which should in principle be able to affect a geminate: delinking (in Chickasaw, Usarufa, and Toba Batak) and epenthesis within heteromorphemic consonant clusters (in Kiribatese). Closer inspection, however, shows that each example can be analyzed in terms of a prohibition on consonantal place-node clusters. Because they possess only a single place node, geminates do not contain the cluster environment and are immune from the associated ‘repair’ rules. Rather than being cases of inalterability, these are all cases of nonenvironments for cluster conditions.

**6.2. ‘INALTERABILITY’ BY COUNTERFEEDING.** In this section we discuss rules whose structural descriptions—unlike those discussed in §6.1—are indeed contained in geminates, but whose effects certain geminates nonetheless appear to evade. Though cited in the literature as examples of inalterability, these cases have a much simpler explanation. In each case, the relevant geminates are derived; and, we claim, the rules putatively exhibiting inalterability effects apply BEFORE the relevant gemination process. No genuine geminate blockage occurs.

**6.2.1. SANSKRIT.** The Sanskrit Ṇati rule retroflexes /n/ when /ʃ/ or /r/ precedes in the word (80a). Partial geminates, i.e. homorganic nasal-obstruent clusters, are ‘immune’ to the rule (80b); however, total geminates undergo Ṇati as a unit (80c):

- (80) a. *iṣ-nā-* → *iṣṇā-* ‘send-PRES’  
           *kṛp-a-māna-* → *kṛpamāṇa-* ‘lamenting’ (lament-TV-MID.PART’)  
       b. *ṛd-(n)-te* → *ṛntte* ‘splits’ (‘split-PRES-3sg.MID’)  
           *puṣ-ya-anti* → *puṣyanti* ‘thrives’ (‘thrive-PRES-3pl.INDIC’)  
       c. *kṣud-na* → *kṣunna* → *kṣuṇṇa* ‘crushed’ (‘crush-PASSIVE.PART’)  
           *chrd-na* → *chṛnna* → *chṛṇṇa* ‘ejected’

Schein & Steriade (1986:717–18) assume that *Ṇati* applies after partial geminates are derived, attributing the inapplicability of *Ṇati* to partial geminates to the fact that the second half of the doubly linked structure is not nasal.



By contrast, since total geminates are entirely nasal, both ‘halves’ meet the structural description of the rule.

An alternative explanation is suggested by the fact that in Sanskrit ALL nasal-obstruent clusters are homorganic in the lexical phonology. Following Cho 1990, we assume that nasals lose their place features when an obstruent follows and subsequently undergo a productive assimilation rule, surfacing as homorganic.

If we hypothesize that *Ṇati* applies at the stage at which nasals have lost their place features, then we can easily explain its failure to affect homorganic nasals: pre-obstruent nasals, being entirely placeless, lack coronal features. Thus they do not meet the environment for the *Ṇati* rule in the first place. In the illustrative example below, ‘N’ represents a placeless nasal:

| (82) INPUT        | PLACE DELINKING    | <i>ṆATI</i> | PLACE ASSIMILATION |         |
|-------------------|--------------------|-------------|--------------------|---------|
| <i>tr-n-t-te</i>  | → <i>trNtte</i>    | —           | → <i>trntte</i>    | ‘split’ |
| <i>kṣubh-anti</i> | → <i>kṣubhaNti</i> | —           | → <i>kṣubhanti</i> | ‘quake’ |

Under this analysis, the ‘immune’ segments are singletons. The illusion of geminate inalterability vanishes once *Ṇati* is ordered before assimilation.

**6.2.2. KOREAN.** A parallel interaction obtains in Korean between the rules of assimilation and coda neutralization. Korean has a set of rules that neutralize /s/ and /c/ into [t] in coda position (83a). Yet derived geminate [ss] and [cc] do occur on the surface, a possible indication that neutralization has failed to apply to them (83b).

|         |                           |                                  |                   |
|---------|---------------------------|----------------------------------|-------------------|
| (83) a. | <i>kas</i>                | → <i>kat</i>                     | ‘a kind of plant’ |
|         | <i>nac</i>                | → <i>nat</i>                     | ‘day’             |
|         | <i>k’oc<sup>h</sup></i>   | → <i>k’ot</i>                    | ‘flower’          |
| b.      | <i>kat<sup>h</sup>-so</i> | → <i>kasso</i> (* <i>katso</i> ) | ‘is the same’     |
|         | <i>kāt-c</i>              | → <i>kācco</i> (* <i>kātco</i> ) | ‘let’s uncover’   |

The geminates in 83b are derived by a very productive rule that spreads the place features of a consonant onto a preceding dental (Cho 1990), illustrated further in 84:

|      |                |                 |                 |
|------|----------------|-----------------|-----------------|
| (84) | <i>pat-ko</i>  | → <i>pakko</i>  | ‘receive-and’   |
|      | <i>han-kaŋ</i> | → <i>haŋkaŋ</i> | ‘the Han river’ |

A standard ‘geminate inalterability’ account might assume that assimilation

and coda neutralization stand in a bleeding relationship, coda neutralization being blocked by the doubly-linked structures created earlier by assimilation. However, an equally straightforward account places the two rules in a feeding relationship. We propose that coda neutralization applies before assimilation, delinking place features from /s/ and /c/. Assimilation then fills in place features on the unspecified codas, which would otherwise surface with default dental features.

Not only is a feeding order between neutralization and assimilation compatible with the alternations in 83b; it is also the ONLY order that can account for the alternation in 85:

(85) INPUT            NEUTRALIZATION    ASSIMILATION  
*k'oc<sup>h</sup>-s'i* →        *k'ots'i*            →        *k'oss'i*        'flower seed'

Assuming, as we do for Korean and many other languages (cf. e.g. Kiparsky 1985, Cho 1990), that spreading will take place only if the target is unspecified for the spreading feature(s)—here, place—assimilation would fail to apply to *k'oc<sup>h</sup>-s'i* had coda neutralization not already occurred.

**6.2.3. TOBA BATAK.** As discussed by Hayes (1986a:480–81), singleton obstruents derived from underlying (nasal) sonorants flout the rule of Glottal Formation:

(86) *mañinum tuak* → *mañinu[p t]uak* (\*[ʔt]) 'drink palm wine'  
*manañ pulpen* → *mana[k p]ulpen* (\*[ʔt]) 'or a pen'

Hayes attributes the inapplicability of Glottal Formation in 86 to the prior rule of Denasalization, which spreads [–voice] from a voiceless obstruent onto a preceding nasal. By the LC, double linking of [–voice] blocks Glottal Formation.

We suggest an alternative which does not rely on the linking status of [–voice]: [+nasal] delinks preceding a voiceless obstruent. If delinking is ordered AFTER Glottal Formation, then the facts in 86 follow as a case of counterfeeding. As in Sanskrit or Korean, no direct appeal to inalterability is necessary.

**6.3. SUMMARY.** Many of the examples in this section on pseudo-inalterability effects involve the interaction between assimilation and delinking rules. In some cases, delinking feeds assimilation, as in Sanskrit and Korean. Yet elsewhere, assimilation bleeds delinking, as seen in Chickasaw and Toba Batak. There is only one other logically possible interaction between assimilation and delinking: assimilation can feed delinking. This ordering is attested as well, although it produces 'alterability' rather than 'inalterability' effects (see §7). The point is that, from an analytical perspective, examples in which a geminate survives the derivation do not necessarily involve any uniform phenomenon of geminate inalterability. They follow instead from independent principles of rule interaction, i.e. from regular feeding and bleeding relations that pay no special attention to geminate structure.

7. ALTERABILITY EFFECTS. Thus far we have shown that, for genuine inalterability effects to occur, the following situation is required: a rule R inserting structure S is blocked by the prespecification of S. In this section we examine the other side of the coin, namely those types of rules for which inalterability effects NEVER occur. There are two logically possible explanations for the absence of such effects: (a) rule R inserts some type of structure S which, for principled reasons, cannot be prespecified, or (b) rule R does not insert structure at all. We examine cases of the latter type first.

7.1. DELINKING RULES. Because we predict blocking effects only when existing structure blocks a later structure-filling rule, it follows that no inalterability effects will be directly associated with rules of feature delinking.<sup>31</sup>

In Ineseño Chumash sibilant harmony, for example, [–dist] delinking applies to geminates as well as singletons (Applegate 1972:122, Poser 1982).

|                |                                   |                         |
|----------------|-----------------------------------|-------------------------|
| (87) UR:       | /s-iš-sili-ulu-aq-pey-us/         | /s-šay'/                |
| DELINKING:     | <i>SiSSiliuluqaqpeyus</i>         | <i>Sšay'</i>            |
| SPREADING:     | <i>sissuluqaqpeyus</i>            | <i>ššay'</i>            |
| (later rules): | <i>sis<sup>h</sup>uluqaqpeyus</i> | <i>š<sup>h</sup>ay'</i> |
|                | 'they two want to follow it'      | 'his daughter'          |

Although the geminates in this example are not underlying, and thus do not provide the exact test case we are seeking, they do conform to expectation by showing no signs of inalterability.

A second example in which geminates feed rather than block delinking rules comes from Carib. According to Hoff (1968:40–41), consonants and consonant clusters palatalize immediately following [i]:

- (88) a. *a:sin* → *a:siñ* 'heat'  
 b. *aima:ra* → *aim<sup>y</sup>a:ra* 'species of fish'  
 c. *taiwo* → *taiw<sup>y</sup>o* 'sign'  
 d. *pisu:ru* → *piš<sup>y</sup>u:ru* 'species of fish'  
 e. *iŋga:na* → *iñ<sup>y</sup>a:na* 'behind him'  
 f. *ixpori:ri* → *iḡp<sup>y</sup>ori:ri* 'creek'  
 g. (...*imb*... → ...*imb<sup>y</sup>*...)

Though lacking total geminates, Carib does have homorganic nasal-obstruent clusters. Ex. 88e shows that these partial geminates palatalize as expected.

Palatalization apparently fails when the consonant (cluster) is immediately FOLLOWED by [i]:

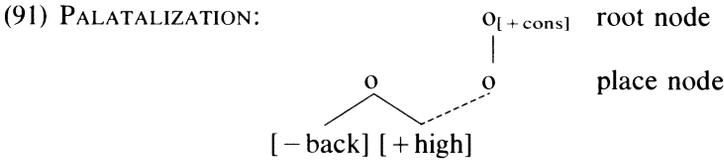
- (89) a. *tosi:pi* (\**tosi:p<sup>y</sup>i*) 'dish'  
 b. *imimbi* (\**imimb<sup>y</sup>i*) 'small'

There is one systematic exception: as Hoff reports, '[In] the sequences [x + C] ... the second consonant is not palatalized, but the first is' (1968:40).

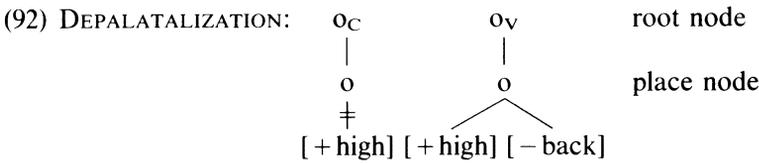
- (90) a. *iḡki:rīḡpa* (\**iḡk<sup>y</sup>i:rīḡpa*, \**iḡki:rīḡpa*) 'not yellow'  
 b. *pīḡpisi* (\**pīḡp<sup>y</sup>isi*, \**pīḡpisi*) 'species of bird'

<sup>31</sup> Selkirk 1990b generates this same prediction in a different framework.

Our analysis is that Carib possesses an iterative Palatalization rule spreading [+high] rightward to any adjacent consonantal place node:



Palatalization feeds a subsequent rule of Depalatalization (92), which delinks [+high] from an onset consonant immediately followed by [i]:



Since homorganic (nasal-obstruent) clusters share a single place node, Depalatalization treats them just like singleton consonants. By contrast, since nonhomorganic clusters ([xC]) do not share a place node, delinking [+high] from the second member of an [x̣C<sup>y</sup>] cluster which has undergone Palatalization ought not to affect the palatality of the first member.<sup>32</sup> This is indeed correct:

| (93) INPUT        | PALATALIZATION                   | DEPALATALIZATION    |                   |
|-------------------|----------------------------------|---------------------|-------------------|
| <i>ixki:rixpa</i> | → <i>ix̣k<sup>y</sup>i:rixpa</i> | → <i>ixki:rixpa</i> | ‘not yellow’      |
| <i>pixpisi</i>    | → <i>pix̣p<sup>y</sup>isi</i>    | → <i>pixpisi</i>    | ‘species of bird’ |

Neither Depalatalization nor Palatalization can be characterized as an ‘elsewhere’ rule. Depalatalization is a delinking rule, while Palatalization spreads the noncontrastive feature [+high] to consonants at a stage in the phonology where [-high] is not yet present. Our analysis correctly predicts that both should apply equally to singletons and to geminates. Carib palatalization provides examples of geminate ALTERABILITY.

In summary, our account predicts that delinking rules should consistently be able to apply to geminates. In contrast, the analyses of Hayes 1986b and Schein & Steriade 1986 predict inalterability effects for delinking rules which mention a specific number of association lines or delink material shared by heads which do not both meet the structural description of the rule. Thus far, no clear cases of this kind have been brought forward.

**7.2. INSERTING αF IN ABSENCE OF –αF.** The second type of rule that cannot be blocked by prior structure, and for which we consequently predict no in-

<sup>32</sup> The only other heterorganic cluster in Carib is [ʔC], whose first member is never subject to Palatalization in any environment. As an anonymous referee points out, these facts are also amenable to an analysis whereby the Obligatory Contour Principle blocks palatalization if it would result in adjacent identical feature specifications. Note that [xk] is technically homorganic, but phonologically patterns as a heterorganic cluster. This may be due to the widespread prohibition on homorganic clusters that differ in continuancy (see e.g. Padgett 1991 for extensive discussion).

alterability effects, is the initial insertion of some type of structure (call it S) into the derivation. One example would be initial morification in a language lacking geminates or exceptionally moraic singletons; this category also includes rules inserting the marked value ( $\alpha$ ) of a feature F before the stage at which the unmarked value ( $-\alpha F$ ) is available to block it. These latter rules include the traditional 'phonemic' rules or, in more contemporary terms, those operating while Structure Preservation (Kiparsky 1982, 1985) is still in effect. Individual allophonic rules may also fall into this category.

We have already seen several relevant examples. In Turkish, for instance, singletons and geminates are both subject to the palatalization rule spreading [ $-\text{back}$ ] from a vowel onto tautosyllabic velar stops. This rule is essentially forced to apply to geminates: the only feature which could block its spread, namely [ $+\text{back}$ ], is not contrastive for velars, and thus is unavailable to early phonological rules. The ensuing prediction that no velar should exceptionally fail to palatalize is correct. Clements & Sezer (1982:233) note the existence of exceptionally palatalized, presumably underlyingly [ $-\text{back}$ ], velars before back vowels in words such as *k'ar* 'profit'. However, no velars are contrastively [ $+\text{back}$ ]. This is explained by the absence of [ $+\text{back}$ ] in the phonology (except, perhaps, at a very late stage): there are no exceptions to palatalization, just as there is no geminate inalterability to palatalization.

A similar point can be made for Orizaba Nahuatl, where, as we have seen, plain singleton and geminate stops aspirate in onset position. The feature [ $+\text{asp}$ ] is the marked feature value in Orizaba; [ $-\text{asp}$ ] is not available to block it.

As a final example, consider the Korean rule of Tensification, which inserts [ $+\text{constricted glottis}$ ] on the second of two adjacent obstruents (Cho & Inkelas 1992):

- (94) a. *kak-ca* → *kakc'a* 'each' (lit. 'each-person')  
           *maktæ* → *makt'æ* 'stick'  
       b. *aka* → *aga* 'baby'  
           *æti* → *ædi* 'where'  
       c. *mu-kuk* → *mukkuk* → *mukk'uk* 'radish soup'  
           *namu-pæ* → *namuppæ* → *namupp'æ* 'wooden boat'

Tensification, though a skeleton-sensitive rule, affects geminates (94c) as well as singletons (94a). (The geminates in 94c have their source in the morphological process of subcompounding; Cook 1987.) The feature inserted by Tensification is contrastive; some singleton consonants possess [ $+\text{constricted glottis}$ ] ([ $+\text{c.g.}$ ]) in underlying representation, while others are unspecified, receiving [ $-\text{c.g.}$ ] by default late in the phonology. Crucially, [ $-\text{c.g.}$ ] is never present in lexical representation. Because Tensification is a lexical rule, [ $-\text{c.g.}$ ] is thus never available to block it. This correctly predicts that Tensification applies to any obstruent meeting the structural description of the rule. It yields neither to singleton exceptionality nor to geminate inalterability.

In Turkish, Orizaba Nahuatl, and Korean, singletons and geminates together undergo rules inserting features in a particular structural context. Although they are expected under our account, these effects are unexplained in inalter-

ability theories based on the LC or the UAC. Neither of these conditions distinguishes the insertion of ‘blockable’ features (such as sonority features) from the insertion of ‘nonblockable’ features. Thus they cannot explain the difference between, say, Klingenheben’s Law, which exhibits inalterability, and Korean Tensification, which does not.

**8. CRITERIA FOR CHOOSING AMONG POSSIBLE ANALYSES.** In this section we address the analysis of coda neutralization, an area of potential indeterminacy in our theory. Coda neutralization can have any one of several sources:

- (95) a. Feature deletion, or feature insertion;
- b. Rule targets coda, or first member of consonant cluster;
- c. Insertion by morification algorithm, or by (other) phonological rule.

Much hinges on which of these options is employed in any given analysis, as each makes different predictions regarding (geminate) inalterability. For example, we predict that rules targeting codas, but not rules targeting clusters, will affect geminates. In a number of analyses (e.g. Chickasaw, Usarufa, and Toba Batak) we have opted for cluster rules over coda rules, a decision which has the desired result of exempting geminates.<sup>33</sup>

But what principle justifies the choice of cluster over coda rule, especially in languages where all clusters are heterosyllabic? Furthermore, assuming that a coda target is indicated, what determines whether the morification algorithm or some later rule is involved? To the extent that it is possible to analyze a given effect using either of two rules, depending on whether or not inalterability effects are desired, then the theory of (geminate) inalterability is correspondingly weakened. It is thus important to be able to justify the choice between competing analyses on grounds other than the behavior of geminates.

To this end, we offer five criteria for helping to determine the analysis of potentially ambiguous cases. The first three isolate morification-based alternations; the last two distinguish coda-based from cluster-based rules.

(i) **SONORITY FEATURES.** If (and only if) sonority features are solely implicated in a given alternation or constraint, then the morification algorithm is responsible. This excludes a number of otherwise possible analyses. It has been argued in recent work that [voice] does not contribute to sonority (Zec 1988, Cho 1990, Clements 1990). Place features, though they figure prominently in coda constraints (Prince 1984, Goldsmith 1990, Yip 1991), also fall outside the set of sonority features (Zec 1988, Clements 1990). Thus, whenever [voice], [place], [asp], [c.g.], or even [nasal]<sup>34</sup> figures in a given coda-based alternation, a rule other than morification must be at work.

<sup>33</sup> We have had difficulty finding a strictly coda delinking rule whose effects on geminates can be tested. For example, coda delinking occurs in Korean coda depalatalization, but as there is no evidence that geminates are ever palatal to begin with, there is no way to determine the effects of the rule on a geminate.

<sup>34</sup> Some languages (e.g. Axininca Campa; Itô 1989) permit only nasals in the coda even though [+cont] sonorants (i.e. liquids, which are more sonorous) exist in the inventory. The special privilege of nasals must be due to an additional constraint beyond the requirement of [+son] in the coda.

(ii) **WEIGHT.** A fundamental assumption underlying the moraic theories of Zec and Waksler is that sonority constraints are imposed only on heads. Thus, if morification is responsible for a given consonantal alternation, that consonant must bear weight. This criterion underlies certain foregoing analyses. In Hausa and Italian, where codas are weight-bearing, coda effects were attributed to morification. In Usarufa, where codas are apparently weightless, Glottal Formation (a rule affecting codas) was analyzed as cluster simplification.

The criterion also has consequences for onset rules. From the widely held view that onsets never contribute to weight, the prediction follows that no language shall impose sonority constraints on onsets. This is consistent with the fact that, as observed in §2.2.3, there is no pattern of geminate resistance to onset constraints to match the attested resistance of geminates to coda constraints.

(iii) **ORDER.** As part of prosodic licensing, morification must occur before any (other) phonological rules apply. Therefore, if some rule must precede a particular coda effect, that coda effect cannot be ascribed to morification directly.

(iv) **SINGLETON INALTERABILITY.** If there exist singleton exceptions to some rule, then that rule cannot be a cluster simplification rule. The reason is that, insofar as singleton inalterability is due to prespecification, insertion rules are expected to respect singleton inalterability, whereas delinking rules are not. Cluster simplification rules always involve delinking.

(v) **DISTRIBUTION.** If a condition holds in medial but not word-final position, then, following Yip 1991, we assume it to be cluster-based rather than coda-based. This criterion is, of course, compromised by the fact that word-final extrametricality provides an alternative account of medial/final asymmetries (see e.g. Itô 1986); we can only suggest that appeal to extrametricality be restricted to cases in which more than one phonological rule supports the invisibility of final consonants.

These criteria are only partially deterministic, and are complemented by what we propose to be the default analyses of ambiguous coda conditions: when sonority features are involved, the null hypothesis is that morification is responsible; when nonsonority features are involved, assume (absent positive evidence for a coda-based rule) that the relevant environment is a cluster.

**9. CONCLUSION AND IMPLICATIONS.** Geminate inalterability effects arise from three distinct sources. The first two involve genuine rule blocking, while the third yields only the superficial appearance of inalterability:

- (96) a. Underlyingly morified geminates block morification algorithm (§5.5).
- b. Structure-specific rule inserting  $\alpha F$  blocks later insertion of  $-\alpha F$  (§5.2).
- c. Geminate structure does not contain structural description of rule (§6).

Type (a) effects involve phonemic sonority restrictions on codas and are systematic for underlying geminates. By contrast, type (b) effects are not sonority-

related, and occur only in the fortuitous circumstance that a geminate undergoes the first of two disjunctively ordered rules. As type (b) effects rely on the interaction between opposite values of the same feature, they generally involve postlexical or allophonic rules.

Because type (a) effects are systematic while type (b) effects are, by comparison, arbitrary,<sup>35</sup> type (a) inalterability effects may be considered the unmarked type. This conclusion provides solid footing for Churma's 1988 observation, echoed in Selkirk 1990a,b, that inalterability effects involve 'weakening' rules (those whose output outranks the input in sonority). We have, of course, motivated the expansion of the phenomenon of inalterability beyond sonority features, and even beyond geminates. Yet insofar as the unmarked type of inalterability effects in our theory stems from the resistance of underlyingly morified material to sonorizing morification rules, we still retain the basic insight that weakening rules and geminate inalterability go hand in hand.

The proposed analysis involves no geminate-specific principles, relying solely on principles of underspecification theory (Kiparsky 1982, Archangeli 1984) and on the Elsewhere Condition, which is needed elsewhere in, and even beyond, phonology. Its aim is to unify geminate inalterability with singleton exceptionality, integrating two potentially isolated subphenomena into phonological theory. Geminate-specific constraints on rule application are neither necessary nor sufficient to account for inalterability.

#### REFERENCES

- ABRAHAM, ROY C. 1946. *Dictionary of the Hausa language*. London: University of London Press.
- . 1959a. *Hausa literature and the Hausa sound system*. London: University of London Press.
- . 1959b. *The language of the Hausa people*. London: University of London Press.
- ALLEN, W. SIDNEY. 1962. Sandhi: The theoretical, phonetic, and historical bases of word-juncture in Sanskrit. 'S-Gravenhage: Mouton.
- ANDERSON, STEPHEN R. 1969. *West Scandinavian vowel systems and the ordering of phonological rules*. Bloomington: Indiana University Linguistics Club.
- APPLEGATE, RICHARD B. 1972. *Ineseño Chumash grammar*. Berkeley: University of California dissertation.
- ARCHANGELI, DIANA. 1984. *Underspecification in Yawelmani phonology and morphology*. Cambridge, MA: MIT dissertation.
- , and DOUGLAS PULLEYBLANK. 1989. Yoruba vowel harmony. *Linguistic Inquiry* 20.173–217.
- AVERY, C. ROBERT; S. BEZMEZ; and M. YAYLAH. 1983. *Çağdaş Türkçe–İngilizce sözlüğü [Contemporary Turkish–English dictionary]*. İstanbul: Redhouse Yayınevi.
- BACH, EMMON. 1978. *Long vowels and stress in Kwakiutl*. Amherst: University of Massachusetts, MS.

---

<sup>35</sup> Although they are phonologically arbitrary under our analysis, certain of the allophonic alternations involving geminates have a plausible phonetic basis. For example, the fact that voicing is harder to maintain over longer durations might motivate the distribution of [voice] in Berber (§1.3, §5.2.1) and West Greenlandic (Fortescue 1984), in which singletons but not geminates are voiced.

- BAGARI, DAUDA MUHAMMAD. 1986. *Bayanin Hausa: Jagora ga mai koyon ilimin bayanin harshe*. Rabat: Imprimerie El Maarif al Jadida.
- BEE, DARLENE. 1973a. Usarufa distinctive features and phonemes. In McKaughan, 204–24.
- . 1973b. Usarufa: A descriptive grammar. In McKaughan, 225–323.
- , and KATHLEEN BARKER GLASGOW. 1973. Usarufa tone and descriptive phonemes. In McKaughan, 190–203.
- BIRD, STEVEN. 1990. *Constraint-based phonology*. Edinburgh: University of Edinburgh dissertation.
- BORMAN, M. B. 1962. Cofan phonemes. In Elson, 45–59.
- BOROWSKY, TONI. 1986. *Topics in English phonology*. Amherst: University of Massachusetts dissertation.
- BUCKLEY, EUGENE. 1992a. Kashaya laryngeal increments, contour segments, and the moraic tier. *Linguistic Inquiry* 23.487–96.
- . 1992b. *Theoretical aspects of Kashaya phonology and morphology*. Berkeley: University of California dissertation.
- BULLOCK, BARBARA. 1991. *The mora and the syllable as prosodic licensors in the lexicon*. Newark: University of Delaware dissertation.
- CHIERCHIA, GENNARO. 1982. An autosegmental theory of *radoppiamento*. *North Eastern Linguistic Society* 12.
- CHO, YOUNG-MEE YU. 1990. *Parameters of consonantal assimilation*. Stanford, CA: Stanford University dissertation.
- . 1991. Voicing is not relevant for sonority. *Berkeley Linguistics Society* 17.69–80.
- , and SHARON INKELAS. 1992. *Post-obstruent tensification in Korean and geminate inalterability*. Paper presented at the International Conference on Korean Linguistics, Washington, DC: George Washington University.
- CHOMSKY, NOAM, and MORRIS HALLE. 1968. *The sound pattern of English*. New York: Harper & Row.
- CHURMA, DONALD. 1988. *On geminates*. State University of New York, Buffalo, MS.
- CLEMENTS, G. N. 1976. *Vowel harmony in nonlinear generative phonology*. Bloomington: Indiana University Linguistics Club.
- . 1977. The autosegmental treatment of vowel harmony. *Phonologica* 1976, ed. by Wolfgang Dressler and Oskar E. Pfeiffer, 111–19. Innsbruck: Institut für Sprachwissenschaft der Universität Innsbruck.
- . 1990. The role of the sonority cycle in core syllabification. *Papers in laboratory phonology: Between the grammar and physics of speech*, ed. by John Kingston and Mary Beckman, 283–333. Cambridge: Cambridge University Press.
- , and ENGIN SEZER. 1982. Vowel and consonant disharmony in Turkish. *The structure of phonological representations, Part 2*, ed. by Harry van der Hulst and Norval Smith, 213–55. Dordrecht: Foris.
- COHN, ABIGAIL. 1987. *A survey of the phonology of the feature [± nasal]*. Los Angeles: UCLA, MS.
- . 1991. On the status of nasalized continuants. *Nasals, nasalization, and the velum*, ed. by Marie Huffman and Rena Krakow. San Diego: Academic Press, to appear.
- COOK, EUNG-DO. 1987. Sai-sios is a geminated consonant. *Harvard Studies in Korean Linguistics* 2.360–66.
- COWAN, RONAYNE, and RUSSELL SCHUH. 1976. *Spoken Hausa*. Ithaca: Spoken Language Services.
- DOWNING, LAURA. 1990. *Problems in Jita phonology*. Urbana-Champaign: University of Illinois dissertation.
- ELSON, BENJAMIN FRANKLIN (ed.) 1962. *Ecuadorian Indian languages 1*. Norman: Summer Institute of Linguistics, University of Oklahoma.
- FORTESCUE, MICHAEL. 1984. *West Greenlandic*. (Croom Helm descriptive grammars series.) London: Croom Helm.
- FUJIMURA, OSAMU (ed.) 1973. *Three dimensions in linguistic theory*. Tokyo: TEC.

- GOLDSMITH, JOHN. 1990. *Autosegmental and metrical phonology*. Cambridge: Basil Blackwell.
- . 1992. Using networks in a harmonic phonology. *Chicago Linguistic Society* 28, to appear.
- GOLLER, THEODORE R.; PATRICIA L. GOLLER; and VIOLA G. WATERHOUSE. 1974. Phonemes of Orizaba Nahuatl. *International Journal of American Linguistics* 40.126–31.
- GONDA, JAN. 1966. *A concise elementary grammar of the Sanskrit language*. Tr. by Gordon D. Ford, Jr. University, AL: University of Alabama Press.
- GROVES, TERAB'ATA R.; GORDON W. GROVES; and RODERICK JACOBS. 1985. *Kiribatese: An outline grammar and vocabulary*. (Pacific Linguistics series D, 64.) Canberra: Department of Linguistics, Research School of Pacific Studies, The Australian National University.
- GUERSSEL, MOHAMED. 1978. A condition on assimilation rules. *Linguistic Analysis* 4.225–54.
- HALE, MARK. 1990. Preliminaries to the study of the relationship between sandhi and syntax in the language of the Rigveda. *Münchener Studien zur Sprachwissenschaft*, vol. 61, ed. by Bernhard Forssman, Karl Hoffmann, and Johanna Narten, 77–96. München: R. Kitzinger.
- HALLE, MORRIS, and MICHAEL KENSTOWICZ. 1990. The free element condition and cyclic versus noncyclic stress. *Linguistic Inquiry* 22.457–501.
- HAMMOND, MICHAEL. 1989. Lexical stresses in Macedonian and Polish. *Phonology* 6.9–38.
- HARRIS, JAMES. 1969. *Spanish phonology*. Cambridge, MA: MIT Press.
- . 1977a. Remarks on diphthongization in Spanish. *Lingua* 41.261–305.
- . 1977b. Spanish vowel alternations, diacritic features and the structure of the lexicon. *North Eastern Linguistic Society* 7.99–113.
- . 1983. *Syllable structure and stress in Spanish*. Cambridge, MA: MIT Press.
- . 1985. Spanish diphthongization and stress: A paradox resolved. *Phonology Yearbook* 2.31–44.
- HAYES, BRUCE. 1981. *A metrical theory of stress rules*. Bloomington: Indiana University Linguistics Club. [Also a 1980 MIT dissertation.]
- . 1986a. Assimilation as spreading in Toba Batak. *Linguistic Inquiry* 17.467–500.
- . 1986b. Inalterability in CV phonology. *Lg.* 62.321–52.
- . 1989. Compensatory lengthening in moraic phonology. *Linguistic Inquiry* 20.253–306.
- HOFF, BEREND J. 1968. *The Carib language*. The Hague: Martinus Nijhoff.
- HOOPER, JOAN. 1976. *An introduction to Natural Generative Phonology*. New York: Academic Press.
- HYMAN, LARRY M. 1985. *A theory of phonological weight*. Dordrecht: Foris.
- ITÔ, JUNKO. 1986. *Syllable structure in prosodic phonology*. Amherst: University of Massachusetts dissertation.
- . 1989. A prosodic theory of epenthesis. *Natural Language and Linguistic Theory* 7.217–60.
- , and ARMIN MESTER. 1986. The phonology of voicing in Japanese. *Linguistic Inquiry* 17.49–73.
- , —. 1991. *Core and peripheral lexical domains*. University of California at Santa Cruz, ms.
- JOSEPHS, LEWIS S. 1977. *New Palauan–English dictionary*. Based on Palauan–English dictionary, by Fr. Edwin G. McManus, S.J. Honolulu: University of Hawaii Press.
- KAYE, JONATHAN; JEAN LOWENSTAMM; and JEAN-ROGER VERGNAUD. 1990. Constituent structure and government in phonology. *Phonology* 7.193–232.
- KENSTOWICZ, MICHAEL. 1982. Gemination and spirantization in Tigrinya. *Studies in the Linguistic Sciences* 12.103–22.
- . 1985. Multiple linking in Javanese. *North Eastern Linguistic Society* 15.230–48.
- KIPARSKY, PAUL. 1965. *Phonological change*. Cambridge, MA: MIT dissertation.

- . 1973a. Elsewhere in phonology. A Festschrift for Morris Halle, ed. by Stephen R. Anderson and Paul Kiparsky, 93–106. New York: Holt, Rinehart & Winston.
- . 1973b. Phonological representations: Abstractness, opacity and global rules. In Fujimura, 56–86.
- . 1973c. Phonological representations: How abstract is phonology? In Fujimura, 5–56.
- . 1982. Lexical morphology and phonology. *Linguistics in the morning calm*, ed. by Im-Seok Yang, 3–91. (Linguistic Society of Korea.) Seoul: Hanshin.
- . 1985. Some consequences of lexical phonology. *Phonology Yearbook* 2.85–138.
- . 1991. In defense of the number two. Paper presented at the Organization of Phonological Features Workshop, Santa Cruz, CA.
- . 1993. Blocking in non-derived environments. *Studies in lexical phonology*, ed. by Sharon Hargus and Ellen Kaisse. San Diego: Academic Press, to appear.
- KISSEBERTH, CHARLES. 1970. The treatment of exceptions. *Papers in Linguistics* 2.44–58.
- LAHIRI, ADITI, and VINCENT EVERS. 1991. Palatalization and coronality. *Phonetics and phonology*, vol. 2: The special status of coronals, ed. by Carole Paradis and Jean-François Prunet, 79–100. San Diego: Academic Press.
- LAKOFF, GEORGE. 1970. Irregularity in syntax. New York: Holt, Rinehart, & Winston.
- . 1987. *Women, fire and dangerous things*. Chicago: University of Chicago Press.
- LEVERGOOD, BARBARA. 1984. Rule governed vowel harmony and the strict cycle. *North Eastern Linguistic Society* 14.275–93.
- LEVIN, JULIETTE. 1985. *A metrical theory of syllabicity*. Cambridge, MA: MIT dissertation.
- LEWIS, G. L. 1967. *Turkish grammar*. Oxford: Clarendon Press.
- LIGHTNER, THEODORE. 1972. Remarks on exceptions and on co-existent systems in phonology. *The Slavic word*, ed. by Dean S. Worth, 426–42. The Hague: Mouton.
- LINDSKOOG, JOHN N., and RUTH M. BREND. 1962. Cayapa phonemics. In Elson, 31–44.
- LOMBARDI, LINDA. 1990. The nonlinear organization of the affricate. *Natural Language and Linguistic Theory* 8.375–425.
- . 1991. Laryngeal features and laryngeal neutralization. Amherst: University of Massachusetts dissertation.
- MASCARÓ, JOAN. 1987. A reduction and spreading theory of voicing and other sound effects. Barcelona: Universitat Autònoma de Barcelona, ms.
- MCCARTHY, JOHN. 1984. Theoretical consequences of Montañes vowel harmony. *Linguistic Inquiry* 15.291–318.
- . 1986a. Lexical phonology and nonconcatenative morphology in the history of Chaha. *Revue québécoise de linguistique* 16/1.209–28.
- . 1986b. Gemination and antigemination. *Linguistic Inquiry* 17.207–63.
- . 1988. Feature geometry and dependency. *Phonetica* 43.84–108.
- , and ALAN PRINCE. 1986. *Prosodic morphology*. Amherst & Waltham, MA: University of Massachusetts & Brandeis University, ms.
- , —. 1991. *Prosodic morphology course handout*, Linguistic Institute, Santa Cruz, CA.
- MCCAWLEY, JAMES D. 1968. *The phonological component of a grammar of Japanese*. The Hague: Mouton.
- McKAUGHAN, HOWARD (ed.) 1973. *The languages of the Eastern family of the East New Guinea Highland Stock*. Seattle: University of Washington Press.
- MESTER, ARMIN, and JUNKO ITÔ. 1989. Feature predictability and underspecification: Palatal prosody in Japanese mimetics. *Lg.* 65.258–93.
- MOHANAN, K. P. 1986. *The theory of lexical phonology*. Dordrecht: Reidel.
- , and TARA MOHANAN. 1984. Lexical phonology of the consonant system in Malayalam. *Linguistic Inquiry* 15.575–602.
- MOORE, BRUCE R. 1962. Correspondences in South Barbacoan Chibcha. In Elson, 270–89.

- MUNRO, PAMELA, and CHARLES ULRICH. 1985. Nasals and nasalization in Western Musogean. Los Angeles: UCLA, ms.
- MYERS, SCOTT. 1991. Persistent rules. *Linguistic Inquiry* 22.315–44.
- NEWMAN, PAUL. 1973. Grades, vowel-tone classes and extensions in the Hausa verb system. *Studies in African Linguistics* 4.297–346.
- , and ROXANA MA NEWMAN. 1977. *Modern Hausa-English dictionary*. Ibadan: University Press Limited.
- ORGUN, C. ORHAN. 1993. Alterable geminates and the release node. Paper presented at the LSA Annual Meeting, Los Angeles.
- PADGETT, JAYE. 1991. *Stricture in feature geometry*. Amherst: University of Massachusetts dissertation.
- PAṆINI. [1962.] *The Aṣṭādhyāyī of Pāṇini*, vols. I and II. Tr. by Srisa Vasu. Delhi: Motilal Banarsidass.
- PARADIS, CAROLE. 1988. On constraints and repair strategies. *The Linguistic Review* 6.71–97.
- PARSONS, FREDERICK W. 1960–61. The verbal system in Hausa. *Afrika und Übersee* 44.1–36.
- POSER, WILLIAM. 1982. Phonological representation and action at-a-distance. The structure of phonological representations, Part I, ed. by Harry van der Hulst and Norval Smith, 121–58. Dordrecht: Foris.
- . 1984. *The phonetics and phonology of tone and intonation in Japanese*. Cambridge, MA: MIT dissertation.
- . 1986. *Syllables*. Stanford, CA: Stanford University, ms.
- . 1989. The metrical foot in Diyari. *Phonology* 6.117–48.
- PRINCE, ALAN. 1984. Phonology with tiers. *Language sound structure*, ed. by Mark Aronoff and Richard Oehrle, 234–44. Cambridge, MA: MIT Press.
- . 1985. Improving tree theory. *Berkeley Linguistics Society* 11.471–90.
- , and PAUL SMOLENSKY. 1991. *Optimality theory: Constraint interaction in generative grammar*. New Brunswick, NJ, & Boulder: Rutgers University & University of Colorado, ms.
- PULLEYBLANK, DOUGLAS. 1986. *Tone in lexical phonology*. Dordrecht: Reidel.
- RICE, KEREN. 1990. Predicting rule domains in the phrasal phonology. The phonology-syntax connection, ed. by Sharon Inkelas and Draga Zec, 289–312. Stanford, CA, & Chicago: Center for the Study of Language and Information & University of Chicago Press.
- RINGEN, CATHERINE. 1982. Abstractness and the theory of exceptions. *Linguistic Analysis* 10.191–202.
- . 1988. Underspecification theory and binary features. In van der Hulst & Smith, 145–60.
- SAIB, JILALI. 1974. Geminatization and spirantization in Berber: Diachrony and synchrony. *Studies in African Linguistics* 5.1–27.
- . 1977. The treatment of geminates: Evidence from Berber. *Studies in African Linguistics* 8.299–316.
- SALTARELLI, MARIO. 1970. *A phonology of Italian in generative grammar*. The Hague: Mouton.
- SCHEIN, BARRY, and DONCA STERIADE. 1986. On geminates. *Linguistic Inquiry* 17.691–744.
- SCHUH, RUSSELL G. 1972. Rule inversion in Chadic. *Studies in African Linguistics* 3.379–98.
- SCOBIE, JAMES M. 1991. *Attribute value phonology*. Edinburgh: University of Edinburgh dissertation.
- . 1992. Licensing and inalterability in Tiberian Hebrew. *Chicago Linguistic Society* 28, to appear.
- SELKIRK, ELISABETH O. 1980. Prosodic domains in phonology: Sanskrit revisited. *Juncture*, ed. by Mark Aronoff, 107–29. Saratoga, CA: Anma Libri.

- . 1990a. A two-root theory of length. University of Massachusetts Occasional Papers 14, ed. by Elaine Dunlap and Jaye Padgett, 123–71. Amherst: Graduate Linguistics Association.
- . 1990b. On the inalterability of geminates. *Certamen phonologicum: Papers from the Second Cortona Phonology Meeting*, ed. by Pier Marco Bertinetto and Michele Loporcaro, 187–209. Torino: Rosenberg & Sellier.
- SHLONSKY, UR. 1985. *Issues in the phonology of Tamazight Berber*. Cambridge, MA: MIT, MS.
- STERIADE, DONCA. 1982. *Greek prosodies and the nature of syllabification*. Cambridge, MA: MIT dissertation.
- . 1987. Greek accent: A case for preserving structure. *Linguistic Inquiry* 19.271–314.
- . 1991. *Closure, release and nasal contours*. Los Angeles: UCLA, ms.
- TRANEL, BERNARD. 1991. CVC light syllables, geminates and moraic theory. *Phonology* 8.291–302.
- TRUBETZKOY, NIKOLAI S. 1939. *Grundzüge der Phonologie*. Prague: *Travaux du Cercle Linguistique de Prague* 7. [Tr. by Christiane A. M. Baltaxe as *Principles of phonology*, Berkeley & Los Angeles: University of California Press, 1969.]
- TRUSSEL, STEPHEN. 1986. *Kiribati communication and culture handbook*. (Peace Corps language handbook series.) Brattleboro, VT: The Experiment in International Living.
- VAGO, ROBERT. 1988. Finnish word games. In van der Hulst & Smith, 185–205.
- VAN DER HULST, HARRY. 1984. Vowel harmony in Hungarian. *Advances in nonlinear phonology*, ed. by Harry van der Hulst and Norval Smith, 267–303. Dordrecht: Foris.
- . 1988. The geometry of vocalic features. In van der Hulst & Smith, 77–125.
- , and NORVAL SMITH (eds.) 1988. *Features, segmental structure and harmony processes, Part 2*. Dordrecht: Foris.
- VOGEL, IRENE. 1977. *The syllable in phonological theory with special reference to Italian*. Stanford, CA: Stanford University dissertation.
- WAKSLER, RACHELLE. 1990. *A formal account of glide/vowel alternation in prosodic theory*. Cambridge, MA: Harvard University dissertation.
- WELMERS, WILLIAM. 1973. *African language structures*. Berkeley & Los Angeles: University of California Press.
- WHEELER, ALVA, and MARGARET WHEELER. 1962. Siona phonemics. In Elson, 96–113.
- WHITNEY, WILLIAM DWIGHT. 1889. *Sanskrit grammar*. Cambridge, MA: Harvard University Press.
- YIP, MOIRA. 1982. Reduplication and C-V skeleta in Chinese secret languages. *Linguistic Inquiry* 13.637–61.
- . 1991. Coronals, consonant clusters, and the coda condition. *Phonetics and phonology, vol. 2: The special status of coronals*, ed. by Carole Paradis and Jean-François Prunet, 61–78. San Diego: Academic Press.
- ZEC, DRAGA. 1988. *Sonority constraints on prosodic structure*. Stanford, CA: Stanford University dissertation.
- ZONNEVELD, WIM. 1978. *A formal theory of exceptions in generative phonology*. Lisse: Peter de Ridder.

Sharon Inkelas  
 Department of Linguistics  
 University of California  
 Berkeley, CA 94720

[Received 13 July 1992;  
 accepted 20 October 1992.]

Young-mee Yu Cho  
 Department of Asian Languages  
 Stanford University  
 Stanford, CA 94305-2150