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Résumé de l'article

Cet article examine un problème de la phonologie historique du Chaha, une langue sémitique de l'Éthiopie, dans la perspective de la théorie de la phonologie lexicale et de la morphologie non concaténative. Il sera démontré que les exceptions systématiques au dévoisement des obstruents géminées sont explicables par l'interaction des principes de l'Inaltérabilité des géminées, de la cyclicité stricte et du télescopage des niveaux (« tiers »).

LEXICAL PHONOLOGY AND NONCONCATENATIVE MORPHOLOGY IN THE HISTORY OF CHAHA

John J. McCarthy

The most conspicuous phonological developments in Semitic languages can be found in the Central Western Gurage group of Ethiopia¹. Of these languages, one of the best described and most interesting is Chaha, which is the subject of a grammatical sketch (Leslau 1950), a lexicon (Leslau 1979), and numerous other studies (Leslau 1966, Hetzron 1977, Johnson 1975).

Despite the sometimes extreme phonological differences between Chaha and the more familiar Semitic languages, it retains all the important characteristics of Semitic morphological systems, in particular the segregation of consonantal roots, vowel melodies, and prosodic skeleta onto separate tiers (McCarthy 1983). Therefore Chaha provides a valuable testing ground for the study of the interaction of phonological processes with nonconcatenative morphological structure, an issue that has been closely investigated for other languages in recent work (Younes 1983, McCarthy 1986).

In this article I will treat one particular sound change in the history of Chaha, devoicing of geminate obstruents, and will show how it interacts with morphological structure and phonological rule typology. This article, then, has two goals: the explication of a problem in Chaha historical phonology and further illumination of the theory of morphology.

Like any member of the Semitic family, the ancestor language of Chaha inherited a number of morphological patterns with characteristic gemination. In the history of Chaha, however, two important sound changes occurred. First, all geminate obstruents were devoiced, and second, all geminates (obstruent or not)

1. This work was supported by the National Science Foundation under grant BNS-81210002 and the System Development Foundation under grant 626. Ejective consonants are indicated by capitalization and the distinction between [a] and [a̰], which is irrelevant to the questions at issue here, is not marked.

were simplified to single segments. Both of these sound changes are unremarkable; geminates often devoice, presumably because of the difficulty of maintaining a pressure differential across the glottis during a long constriction, and we can easily find other Semitic languages (like Modern Hebrew) in which degemination took place. The effect of these two processes on geminate voiced obstruents can be summarized as follows:

(1)	bb > p	dapara	'race'
	dd > t	gatara	'put to sleep'
	gg > k	makara	'suppurate'
	g ^Y g ^Y > k ^Y	mak ^Y ara	'burn'
	g ^W g ^W > g ^W	jak ^W ara	'become flexible'
	ʃʃ > č	gača	'rope an animal'
	zz > s	asara	'carry child'
	žž > š	gaša	'raid'

In all of the examples above, the medial consonant was formerly a voiced geminate obstruent (a form in which it actually occurs in several closely related languages).

In the interest of explicitness, let us formulate these two sound changes as phonological rules applied at an earlier stage of the language:

(2)	a. Geminate Devoicing	CC ∨ [-son] → [-voice]
	b. Degemination	∞ ∧ CC ∅

Both rules presuppose that geminates are represented as single units on the melodic tier linked with two slots of the skeletal tier, a representation that is demonstrably correct for Chaha as well as for other languages (McCarthy 1979, 1981, 1983, 1986). Under this theory, degemination is conceived of as deletion of a single skeletal slot rather than a segment.

Up to this point the story of Chaha has been unremarkable, but it turns out that there are quite a few puzzling exceptions to devoicing which speak directly to morphological questions. The following data represent an exhaustive list of the systematic exceptions in Leslau's (1979) dictionary, organized according to the reconstructed voiced geminate obstruent:

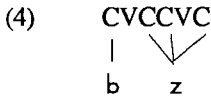
- | | | | |
|-----|----|----------------------|--------------------------|
| (3) | a. | dd | |
| | | adada | 'pick peas' |
| | | gadada | 'tear' |
| | | sadada | 'send away' |
| | | geradada | 'cut layers' |
| | | m ^w adada | 'name an elder as judge' |
| | | nadada | 'burn' |
| | b. | gg | |
| | | f ^w agaga | 'cut close' |
| | | fagaga | 'die (cattle)' |
| | | argagaT ^a | 'make sure' |
| | | beragaga | 'bolt' |
| | c. | zz | |
| | | azaza | 'command' |
| | | bazaza | 'be in low spirits' |
| | | derazaza | 'be blunt' |
| | | fazaza | 'be better' |
| | | gebazaza | 'fall asleep (foot)' |
| | | nazaza | 'dream' |
| | | tarazaza | 'make the last will' |

In the examples in (3), the former geminate consonant was in medial position, so the reconstructed forms are *addada* and so on. What these data show, and what we observe without exception in the Chaha lexicon, is that devoicing of historical geminates was blocked just in case the voiced geminate appeared in a configuration [...VC₁C₁VC₁...] (as in *addada*) or [...C₁VC₁C₁V...] (as in *argaggaT^a*)². Relevant examples are attested only with the consonants in the

2. The only published discussion of these facts I have been able to locate is that of Leslau (1979, vol III, pp. lxvii-lxxi). Leslau presents no systematic discussion of the exceptions, except in the case of *dd*, but the overall tenor of his remarks suggests that he regards the phenomenon as a whole as a kind of voicing assimilation.

list above, but we would expect the same behavior with all voiced obstruents in the language.

Clearly there is a systematic character to the pattern of verbs which do not exhibit geminate devoicing. Verbs of this pattern are known from work on other Semitic languages to have a characteristic representation. The Obligatory Contour Principle (OCP) (McCarthy 1981, 1986) requires that multiple occurrences of a consonant in the stem be represented by a single element of the root melody, so the root underlying, say, reconstructed *bazzaz* is /bz/. The second consonant of this root is spread to fill available slots of the CV skeleton as in:



Chaha presents strong independent evidence for the correctness of this representation. Chaha has morphological mutation rules of palatalization and labialization, rules that mark certain morphological categories either by themselves or with concomitant suffixes. These rules can be expressed informally as³:(3. Extensive discussion of these rules can be found in McCarthy (1983).)

(5)

a. **Chaha Labialization**

Round the rightmost labializable (labial or velar) consonant in the root.

b. **Chaha Palatalization**

Palatalize the last root consonant if it is palatalizable (coronal or velar).

A few simple examples of these two phenomena appear in (6):

(6) a. Labialization

Personal	Impersonal	
danaga	danag ^w a	'hit'
nakasa	nak ^w asa	'bite'
masara	m ^w asara	'seem'

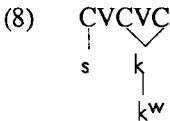
b. Palatalization (2nd person imperative)

Masculine	Feminine	
gʏakʏet	gʏakʏəč	'accompany'
nəmad	nəmaʝ	'love'
nəqeT	nəqeČ	'kick'

When the palatalized or labialized root consonant is the result of a one-to-many autosegmental association, however, all surface copies of the consonant display the secondary articulation:

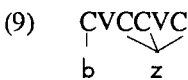
(7) a. Personal	Impersonal	
sakaka	sak ^w ak ^w a	'plant in the ground'
gamama	gam ^w amwa	'chip the rim'
b. Masculine	Feminine	
batət	bačəč	'be wide'
səkək	səkʏəkʏ	

This result is derived from two things: Chaha Palatalization and Labialization affect the root tier directly; and the OCP ensures that all «copies» of a root consonant originate in a single element on the root tier. Labialization, then, applies as in (8):



The OCP further ensures that there will not be any roots where Palatalization or Labialization fail to display this across-the-board behavior.

We can now use this one-to-many representation of sequences of identical consonants to derive the historical distribution of Geminate Devoicing. Consider again the representation of reconstructed *bazzaz*:



Under ordinary assumptions about how phonological rules are applied, this representation meets the structural description of Geminate Devoicing, and so the rule should apply to yield *bassas* and therefore **bassas* in the contemporary language by later Degemination. Considerable evidence from a rather different sphere -- the treatment of ordinary geminates rather than these special noncontiguous one-to-many representations -- suggests that these ordinary assumptions are in fact incorrect. Hayes (1986), building on work by Steriade (1982), has argued that the resistance of geminates to certain phonological rules can be derived from a principle of Geminate Inalterability that is characterized in exclusively structural terms:

(10) **Geminate Inalterability**

In a rule that mentions both the melodic tier and the skeletal tier, association lines are interpreted exhaustively.

In effect, what this principle says is that rules may be stipulated (by mentioning a single association line) to apply to simplex segments but not geminates. Rules may also be stipulated to apply to geminates only, by mentioning two association lines, as Geminate Devoicing does. It follows, then, that Geminate Devoicing cannot analyze a representation like that in (8) in which *z* has another association line outside the geminate, and therefore Devoicing will not apply. It is enlightening to contrast this behavior of Geminate Devoicing with the rules of Palatalization and Labialization, which **do** apply freely to multiply-linked root consonants with across-the-board effects. Palatalization and Labialization do not mention the skeletal tier (they have no reason to), and therefore Geminate Inalterability is not in force. Rules like these, which affect the root or melodic tier alone, clearly will not show exceptional behavior.

We have, then, a straightforward explanation for the exceptions to Geminate Devoicing in Chaha which provides further evidence, from a somewhat different domain, for the analysis of geminate paradoxes in other languages. On the other hand, we are left with two problems, one technical and one empirical. The technical one is that now Degemination cannot apply to forms like reconstructed *bazzaz*, an obviously incorrect result since the contemporary language has *bazaz*. Degemination is blocked in exactly the same way that Geminate

Devoicing is, since it too must exhaustively enumerate the association lines. The empirical problem involves the reconstructed voiced geminate *bb*, which devoiced (and degeminated) without exception in exactly the same class of forms where other geminate obstruents did not devoice. Examples like the following illustrate this problem:

(11)	<i>bb</i>	
	čapaba	'close halfway'
	žapaba	'dam water'
	xrapaba	'cover'
	qapaba	'shave'
	embapa	'pop when roasted'
	ančerapaba	'blink'

What property distinguishes the devoicing of reconstructed *bb* in all contexts from the treatment of the other voiced geminates? There is one characteristic which, I will argue, is essential to deriving this distinction. At the time when the Geminate Devoicing rule entered the language, Chaha had *no**p*, and in fact the sole source of *p* in modern Chaha is devoiced original *bb*. With all other voiced obstruents, devoicing was a process of neutralization, since the language had voiceless counterparts to them. In terms of Kiparsky's (1982) lexical phonological theory, we can say that Geminate Devoicing in the labial series was not a feature-changing rule, since it did not neutralize an opposition, while it was feature-changing in all other cases. Strictly speaking, since the language lacked a *b/p* contrast at this stage, the labial obstruent is unspecified for voicing, while other obstruents are marked (in at least one member of the pair) for voicing. Therefore, any rule assigning [-voice] to labials merely fills in a feature not marked contrastively on labials in the lexicon. To exploit this distinction between labials and other obstruents, we will first have to develop some additional machinery which integrates results in nonconcatenative morphology with the theory of lexical phonology.

I will assume that Chaha shares with the other Semitic languages a universal operation known as Tier Conflation, whereby the separate vocalic and consonantal tiers of the early morphology are folded together into a single representation in the course of the derivation (Younes 1983, McCarthy 1986). Tier Conflation

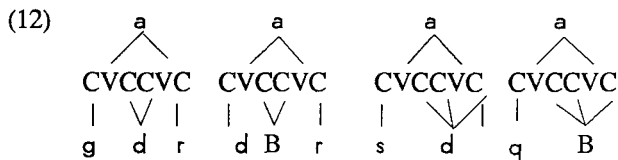
is a generalization of the lexical phonological principle of Bracket Erasure, which discards morphological structure from earlier levels at some later point of the simultaneous morphological and phonological derivations. In the case of Semitic morphological systems, Tier Conflation causes later rules to be insensitive to the root/vowel melody distinction that was important to earlier rules.

Besides Tier Conflation, we need to explore one other analogue in nonconcatenative morphological systems to a property of lexical phonology, the notion of derived environment. We will say that an environment is derived if it is created by the application of a language-particular rule, either phonological or morphological. The operative (and novel) part of this definition is the specification «language-particular». Bracket Erasure, especially in its more general form as Tier Conflation, could in principle create derived environments, since it alters the overall pattern of root-to-skeleton association. It is neither in the spirit of Kiparsky's (1973) alternation condition nor in the letter of the definition of derived environment just proposed for a universal convention like Tier Conflation to create derived environments for the subsequent application of lexical rules. We are therefore excluding this possibility out of hand, a move whose consequences will become apparent shortly⁴. In Kiparsky's theory, as a consequence of the Strict Cycle, feature-changing lexical rules apply only in derived environments.

We can now return to the problem at issue, the distribution of devoiced geminates in Chaha. Although there is a single rule of Geminate Devoicing, we distinguish two modes in which it might apply, one feature-changing (affecting *dd*, *zz*, etc.), and one non-feature-changing (affecting */bb/*, which we will now write as */BB/*, in recognition of its status as a labial archisegment unspecified for voicing). Furthermore, we must identify Geminate Devoicing as a lexical rule, since it has surface exceptions in the form of reconstructed *saddad*, *bazzaz*, and so on. We now have the resources we need to complete the analysis.

4. In his most recent work, Kiparsky has reconstructed the notion of derived environment and of the limitation of feature-changing lexical rules to such environments as a consequence of the Elsewhere condition. If every derivation is initiated by a rule $\emptyset \rightarrow$ root, then this rule is more specific than any subsequent rule that might alter the root in a feature changing way without referring to context outside the root. This account is not consistent, so far as I can judge, with the analysis I give for Chaha. In any case, it makes no sense to say that, in [[[A]B]C], AB constitutes a derived environment for rules requiring tautomorphemicity, where AB is «tautomorphemic» solely by virtue of Tier Conflation/Bracket Erasure.

The output of the morphological rule associating roots with skeletal templates appears as follows:

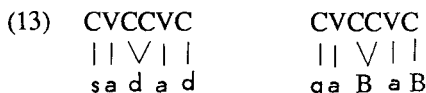


These representations are immediately submitted to the rule of Geminate Devoicing, with the following results. In *gaddar*, the gemination of the medial *d* is a property derived by the morphological rule associating root with template⁵; Geminate Devoicing, although a feature-changing lexical rule, can apply freely.

The application of Geminate Devoicing to reconstructed *dabbar* will also occur at this point, but it is indifferent to the derived environment requirement. Although it happens that the environment is derived, Devoicing of *BB* is not feature-changing, since the language lacks *p* (or *pp*); thus, this rule would apply in any case. In this respect, introduction of the noncontrastive feature [voice] in labials is exactly parallel to lexical application of rules assigning stress or syllabification, two other properties that can be determined by lexical rules in nonderived environments precisely because they are not used contrastively.

For the other two representations, reconstructed *saddad* and *qabbab*, Geminate Devoicing is blocked by Geminate Inalterability. Since the associations of *d* and *b* are not exhaustively enumerated in the Devoicing rule, Devoicing cannot apply.

We now continue with the derivation. Either by virtue of the application of subsequent morphological rules or at word level, Bracket Erasure generalized as Tier Conflation will apply to these two forms, yielding the representations below:



5. Note that this presupposes that all Semitic verbs are morphologically complex and therefore constitute derived environments; this is surely correct.

Here, Tier Conflation has folded the vocalic and consonantal melodies into a single tier, eliminating the morphological complexity they had inherited from prior nonconcatenative morphology. We refer now to the particular definition of derived environment proposed above. Although the representation of *saddad* meets the structural description of Geminate Devoicing and does not contravene Geminate Inalterability, Devoicing cannot apply. Devoicing of *dd* is a feature changing rule, since the language contains *t*, and this is not a derived environment. The representation of *saddad* meets the structural description of Geminate Devoicing only by virtue of the universal principle of Tier Conflation, not by the application of some language-particular rule. Thus, the Strict Cycle blocks Devoicing. Devoicing of /BB/, however, applies unimpeded, since it is not feature-changing and is therefore indifferent to whether the environment is derived or not. At some point after the assignment of [-voice] to /BB/, a default rule assigns [+voice] to all remaining /B/ (in effect, the nongeminate ones).

Just as the extension of Bracket Erasure to nonconcatenative systems reveals its more general form as Tier Conflation, so too with the concept of a derived environment.

These results, based on a plausible extension of the definition of derived environment and the theory of Tier Conflation, which enjoys a considerable amount of independent support in any case, provide us with a scrupulously accurate account of historical developments of voiced obstruents in Chaha. Tier Conflation also provides us with an explanation for the behavior of Degemination. Recall that Chaha presented the additional puzzle of why Degemination can apply freely to reconstructed *saddad* or *qabbab*, given that Hayes's version of Geminate Inalterability -- exhaustive enumeration of association lines -- should block Degemination in exactly the same way that it blocks Geminate Devoicing. If Degemination is a postlexical rule, however, then it will have access to representations after Tier Conflation (in which Geminate Inalterability will be without effect) and, moreover, it will be indifferent to whether the affected geminate constitutes a derived environment or not. Thus, it should apply with complete generality, as it in fact does.

The analysis has forced us to regard Geminate Devoicing as a lexical rule, since it is sensitive to whether or not it is neutralizing, and Degemination as a

postlexical rule, since it applies in what are, by our lights, underived environments. It turns out that the history of loan words in Chaha provides substantial independent support for this proposal. Over time Chaha has borrowed verbs from other languages, particularly Amharic. Naturally, many of these verbs contain medial voiced geminates. What we find is that these loans never undergo devoicing but invariably do undergo degemination⁶:

(14)	Tabaqa	'be tight'	< Amharic Tabbāqa
	Tabasa	'roast'	< Amharic Tabbasa
	nadafa	'sting'	< Amharic naddafa
	nagasa	'reign'	< Amharic naggasa
	nazaba	'be flexible'	< Amharic lazzaba
	azana	'be sad'	< Amharic azzana

The invariant application of Degemination in loans is typical of a postlexical rule, since such rules are arguably exceptionless (Mohan 1982). The fact that such loans do not undergo Geminate Devoicing, however, is unsurprising, since Devoicing is lexical and therefore freely tolerates exceptions. The same explanation can be given for the occasional cases of native verbs that are exceptions to Geminate Devoicing discussed by Leslau (1979).

An obvious move, slightly at variance with our account, ought to be entertained at this point. Devoicing of /BB/, as a non-feature-changing rule apparently applied after Tier Conflation, could be regarded as postlexical. In effect, this decomposes Geminate Devoicing into two operations, one lexical (affecting /dd/, /gg/, /zz/, etc.) and the other postlexical (affecting /BB/). A straightforward argument against this alternative is the existence of lexical exceptions like those discussed immediately above to both instantiations of Geminate Devoicing. A more complex argument is that having separate rules that bring the same result - one in a neutralizing way and the other nonneutralizing -- is exactly what

6. There are a very few exceptions to the regularity of Degemination in Leslau's (1979) material. Nevertheless, his statements are quite clear on this issue: «...*geminaton, as a rule, does not occur in West Gurage [which includes Chaha]*» (1979, III, lxxiv); «*The assimilatory consonant [in cases of total assimilation] most normally remains simple in the non-geminating dialects [which include Chaha]*» (1979, III, lxxviii). The exceptions are likely to be attributed to one of two factors: the result of assimilation by phonetic-implementation rules, which follow the postlexical phonological rule of Degemination, and thoroughly unassimilated loans in the speech of Chaha/Amharic bilinguals.

taxonomic phonemics would require and is vulnerable to precisely the same criticisms raised by Halle (1955) for the parallel case in Russian. The loss of generality in cases of this sort, if we are compelled to write two separate rules, is transparent.

Our results to this point have involved the rule of Geminate Devoicing primarily, but similar considerations hold for another rule, one affecting geminate coronal sonorants. Although the remote ancestor of Chaha distinguished /*r*, and *n* as separate phonemes, during the period that concerns us they are in complementary distribution. The coronal sonorant phoneme appears as *n* when preconsonantal, word-initial, or geminate, but it is *r* when prevocalic (and not geminate) or word-final. Thus, there is a single coronal sonorant phoneme whose surface reflexes include *r* and *n* but not /.

The case that concerns us is the treatment of the geminated coronal sonorant, written /NN/. A rule spells it out as a nasal stop:

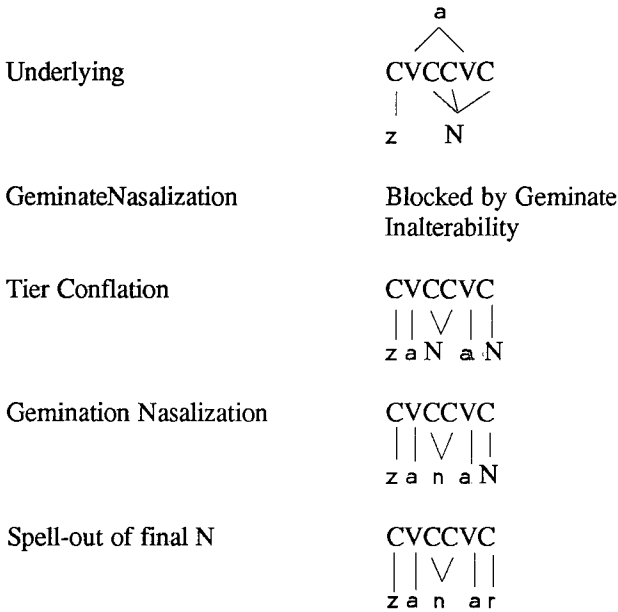
$$(15) \text{ Geminate Nasalization} \quad \begin{array}{c} \text{CC} \\ \vee \\ \text{N} \rightarrow \left[\begin{array}{l} +\text{nas} \\ -\text{cont} \end{array} \right] \end{array}$$

Like devoicing of /BB/, this rule is not feature changing, since *n* and *r* are in complementary distribution. (In particular, there is no contrast between *nn* and *rr*) We would expect this rule, like devoicing of /BB/, to apply freely to representations that are underived in the technical sense developed above, even though they could not undergo Geminate Nasalization at earlier stages of the derivation because of Geminate Inalterability. In fact, this is the case, as the following data show:

(16)	sanara	'stretch'
	zanara	'jump'
	x ^w anara	'dock ear'
	an ^č anara	'flow'
	endebanara	'roll'
	enk ^w anara	'snore'
	ensebanara	'be coiled'
	an ^č ranaqa	'milk'
	anqranata	'accumulate'
	anq ^w eranasa	'pour out'

The derivation of *zanar* (from reconstructed *zaNNaN*) will then proceed as follows:

(17)



The rule of Geminate Nasalization may be either lexical or postlexical. Since it never applies in a feature-changing manner, unlike Geminate Devoicing, we have no evidence to establish whether it is lexical or not. Since Nasalization seems to have applied exceptionlessly even in loan words, it is likely that it is postlexical.

Yet another bit of the history of Chaha consonantism also provides evidence for the account offered here. Chaha, like several other Semitic languages, underwent a process of postvocalic spirantization, in this case limited to *k* and its labialized and palatalized counterparts. As in the other languages with spirantization, this process is blocked with geminates by Geminate Inalterability. Thus, for example, reconstructed *makkaNa* and *makaN*, the perfective and jussive of 'advise', are respectively *makara* and *maxer* in the contemporary language. This spirantization rule, which we will formulate as in (18), has the characteristics of a feature-changing lexical rule: it is feature changing because *x* and its labialized and

palatalized versions also occur in nonpostvocalic contexts and it is lexical because, at least in contemporary Chaha, we find that it has exceptions, chiefly in the loan vocabulary.

- (18) Spirantization VC
 |
 k -> [+cont]

The observations that Spirantization is a lexical rule, that it is feature-changing, and that it is subject to Geminate Inalterability (because it mentions both melodic and skeletal tiers and because it must not apply to geminates in any case) lead us to the conclusion that *k* under the appropriate conditions will show the same behavior as the voiced obstruents in (3). In fact, this is the case, as the forms in (19) demonstrate:

- | | | |
|------|------------|---------------------------------|
| (19) | akaka | 'scratch' |
| | sakaka | 'drive a peg' |
| | maskak | 'a peg' |
| | atrekakasa | 'quarrel' |
| | mukeka | 'root of plant sp.' |
| | mukʸikʸa | 'grass growing among plant sp.' |

Just as in the case of the voiced obstruents, the observations hold without exception over the relevant set. The representations of reconstructed /sakkaka/ and /maskak/ appear in (20):

- (20)
- | | | | | | |
|--|--------|---|---|---|--------|
| | CVCCVC | | m | | CVCCVC |
| | | ↘ | | ↘ | |
| | s | k | | s | k |

At this pre-Tier Conflation stage of the derivation, although the final *ks* in both forms nominally meet the structural description of Spirantization, that rule is blocked by Geminate Inalterability since the melodic elements branch. Subsequently Tier Conflation applies and the representations, although they are permitted by Geminate Inalterability to undergo Spirantization, fail to meet the

derived environment requirement of the Strict Cycle. Therefore the results for Spirantization, a feature-changing rule, exactly parallel those for the feature-changing applications of Geminate Devoicing.

It is useful to contrast the feature-changing rule of Spirantization in Chaha with its counterpart in Tiberian Hebrew (and in Tigrinya as well). Hebrew Spirantization is non-feature-changing, since its six different outputs (for the six obstruents) arise in no other way in the language. This means, under the account offered here, that Hebrew Spirantization should not show any effects of what the representation looked like before Tier Conflation, just like Chaha Geminate Nasalization and Geminate Devoicing of /BB/. This is in fact the case, as Hebrew forms like *sāβeβa* and *sibbeβ* (both from the root /sb/) demonstrate. This is particularly interesting because this behavior of Hebrew Spirantization is entirely orthogonal to the lexical/postlexical distinction -- Spirantization is arguably both lexical (McCarthy 1986) and postlexical (since it applies across word boundaries).

We can now turn to two other classes of cases in which Geminate Devoicing might be expected to interact with the morphology. The first type we will consider is verbs [C₁VC₁C₁...] -- that is, verbs whose first and second stem consonants are identical. Although such verbs are unknown in Arabic and are not reconstructible for proto-Semitic, they occur sporadically in the Ethiopian branch of the family.

Geminate Devoicing in verbs of this type almost always applies in the small number of attested forms. The following list is exhaustive:

- (21) a. g^wg^w
 g^wak^wara 'bellow'
- b. g^yg^y
 g^yak^yara 'straighten out'
 g^yak^yata 'accompany'
- vs. with no devoicing
 tag^yag^yaza 'be haughty'
- c. zz
 zasa 'act mad'
- d. žž
 žaša 'be cold'

The devoicing of, for example, *zz* in reconstructed *zazza* is obviously unexpected in view of our previous discussion of forms like *bazzaz*. Unfortunately, no cases occur where non-feature-changing rules affecting geminates might apply in forms of this type.

The data in (21) are, then, problematic. One solution that comes to mind is to analyze the root of 'bellow' not as /g^wr/ but rather as /g^wg^wr/, as Broselow (1985) has suggested for a similar set of forms in Amharic. This of course contravenes the Obligatory Contour Principle, but it also runs into insuperable empirical problems. Palatalization and Labialization, which are incontrovertible tests of the underlying unity of Chaha root consonants, exhibit the same pattern of overapplication in verbs of this type as they do in the uncontroversial cases of spreading in (7):

- | | | |
|------|--|---|
| (22) | g ^y ak ^y ara
ziza | g ^w ak ^w er
žaša |
|------|--|---|

Therefore we cannot refer this problem to a different lexical representation.

The correct solution comes from an examination of another, much larger class of cases, represented by forms with total reduplication of a biconsonantal root. Devoicing of geminate obstruents, we find, applies systematically in these examples (again, the list is exhaustive)⁷:

- | | | |
|------|--|-----------------------------------|
| (23) | a. dd
deratara
debataba | 'step on; be stout'
'hesitate' |
| | b. gg
agbakaba
gemakama | 'heap'
'break edge' |
| | c. g ^w g ^w
g ^w erak ^w ara | 'burrow' |
| | d. zz
zerasara
zemasama | 'scatter'
'be wet' |

7. The forms in (23) should not be confused with verbs like *gezagaza*, which have no devoicing because they are not reconstructed with medial geminates. The original contrast between reduplicated biliterals with and without medial gemination is preserved fairly consistently in the Western Gurage language Endegeñ, and this distinction is reflected by the etyma in Leslau (1979).

Again, data from Palatalization (and Labialization) demonstrate the underlying unity of these reduplicated roots :

(24) *deratara* *Janjər*

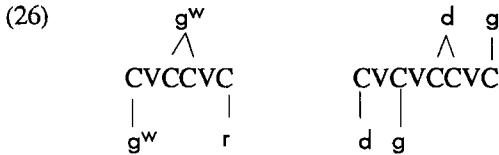
My thesis is that these cases - (21) and (23) - all involve copying of the phonemic melody rather than spreading. It is clear that neither type can be derived from the application of the basic rules of association that function completely automatically with biconsonantal roots, and it is obvious that the many verbs with full root reduplication are simply incompatible with spreading. This copying of the phonemic melody is preceded by the morphological rules of Palatalization and Labialization, whence the perfect regularity with which these morphological rules overapply. Because there is copying rather than spreading, Geminate Inalterability cannot affect the application of Geminate Devoicing, and so in these two cases alone Devoicing applies normally.

The structures of these two types of verbs, before copying, are as follows:

(25) CVCCVC CVCVCCVC
 | | | |
 g^w r d g_l

Two comments about these representations. The form on the right, the input to full root reduplication, can be derived by the normal mode of left-to-right one-to-one association of root with skeleton. It differs from other biliteral roots in that spreading of the *g* is prohibited, a circumstance that, I suggest, will trigger copying to fill the vacant C slots. The form on the left, a member of a very tiny class, is prohibited from spreading as well but also must be lexically marked to associate the final root consonant *r* with the last C slot of the skeleton. It is appropriate that these very rare verbs are doubly exceptional.

The representations in (25) and ones like them, before copying, undergo the morphological rules of Palatalization and Labialization. Phonemic melody copying, association, and erasure of unassociated elements then yield the derived representations in (26) (for the tier structure, see Broselow and McCarthy, 1984):



Geminate Devoicing at this stage applies without regard to Geminate Inalterability; no problem of inalterability arises because there is no spreading. We therefore derive exactly the pattern in (21) and (23).

The postlexical rule of Geminate Nasalization also shows no sensitivity to the morphological complexity of reduplicated forms, as we would expect. What we require to show this is a copied form where one /N/ is an original geminate and the other is in prevocalic or word-final position, where /N/ is realized as *r*. Such examples are quite common, and without exception they show transparent application of the rule:

(27)	arfanafa	'soften'
	amanama	'shake stick'
	arTanaTa	'be about to break'
	arqanaqa	'make a hole'

We find the same thing in other cases, involving different realizations of nongeminate /N/: *yadanger* (jussive of *derakara*), *nagrag* 'voracious' (cf. *neganaga*).

In summary, we have seen that the distinction between feature-changing (neutralizing) and non-feature-changing rule applications is essential to understanding the history of Chaha consonantism. This analysis provides us with a new source of evidence for the interaction of lexical phonology and nonconcatenative morphology, independently confirming the role of Tier Conflation and of the Strict Cycle in morphophonological derivations.

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