Cyclic Rule Application of Chaha Geminate Devoicing*

Gwangrak Son
(Kyungnam University)

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This paper presents a test of cyclic rule application against geminate devoicing in Ethipian Semitic language of Chaha. Previous work on Chaha geminate devoicing (e.g., McCarthy (1986a), Rose (1997)) involves some ad hoc assumptions such as 'derived environment' or 'decomposition' of a rule that is otherwise one identical rule. This paper shows how the cyclic rule application, plus strengthened notion of 'geminate,' effectively captures all the given data in a simple and natural way without invoking additional devices necessary within the previous work.

Key words: Chaha, long-distance geminate. cyclic rule application, contrastive feature, geminate devoicing, geminate inalterability

1. Cyclic Rule Application in Chaha

In my previous work (Son (2004)), I argued for 'cyclic rule application,' before and after Plane Conflation, in Ethiopian Semitic language of Chaha. Prior to discussing main theme of the current paper, that is, applicability of cyclic rule to Chaha geminate devoicing, I would like to recapitulate some of the major arguments made in the previous work. Let us begin with the data in (1), originally from McCarthy

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(1983) and Rose (1994, 1997).

(1)[1]	2nd sg.masc.	2nd sg.fem.	
a.	nizəz	niz^{y}əz^{y}	'dream!'
	sidid	sid^{y}id^{y}	'drink coffee'
	sikik	sik^{y}ik^{y}	'stick in/up!'
b.	2sg. masc.	2sg.fem.	
	kitif	kitif	'chop'
	tirəf	tiref	'survive'
	siriβ	siriβ	'spin'
	Timəm	Timem	'be contrary'

In Chaha, a second person singular feminine subject has no overt segmental form of the agreement marker, but is realized by palatalization within the stem verb. Adopting the articulator based model developed by Sagey (1986) and Halle (1995), we may characterize Chaha palatalization as a leftward spreading of a [-back] feature, targeting the dorsal node of a compatible segment, alveolar and velar, as depicted

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1) Phonemic inventory of Chaha

(i) Consonants

Labial		Alveolar		Velar		
p	p^{w}	t	t^{y}	k	k^{y}	k^{w}
b	b^{w}	d	d^{y}	g	g^{y}	g^{w}
		T	T^{y}	q	q^{y}	q^{w}
f	f^{w}	s	s^{y}	x	x^{y}	x^{w}
		z	z^{y}			
m	m^{w}	n				
		r				
w		y				

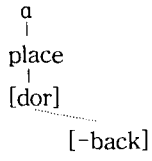
*The superscript, ^{y} and ^{w}: a palatalized and a labialized segment, respectively. T: voiceless alveolar ejective. q: voiceless velar ejective.

(ii) Vowels

i		ɨ	u
	e	ə	o
		ɛ a	ɔ

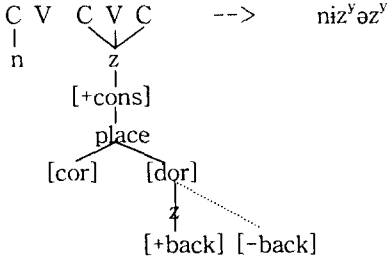
below.

(2) Chaha palatalization



The data in (1a) involves an instance of double palatalization in which the process affects all copies of a reduplicated consonant. The across-the-board (ATB) application noted here can be captured with the OCP-driven representation like (3), following a suggestion made by McCarthy (1983, 1986a).

(3)



In (3), all surface identical consonants originate in a single element on the root melody, so that palatalization of the medial consonant can be seen as an unavoidable consequence of the application of palatalization to the root final consonant. The multiple linking representation in (3) crucially relies on one thing to account for the across-the-board effects of palatalization: that is, palatalization must precede Plane Conflation.

However, the forms in (1b), in which a vowel is fronted in the second singular feminine form, challenges this rule order. If Chaha palatalization applies solely to the root plane before vowels and consonants are aligned on a single plane, the vowel fronting noted here would be mysterious.

To get a better understanding of this phenomenon of vowel fronting, it is worth reconsidering the whole process of palatalization, with the intention to see what procedure the language follows for the realization of the feminine marker within a stem verb. Let us consider (4).

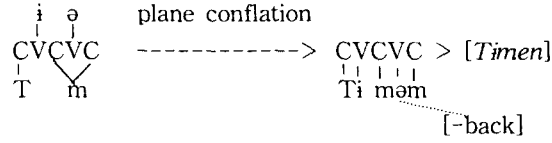
(4) Imperative

	2sg. masc.	2sg.fem.	
a.	kift	kift^{y}	'open!'
	dirg	dirg^{y}	'hit'
b.	nikif	nik^{y}if	'instigate quarrel'
	nigim	nig^{y}im	'collect'
c.	Timəm	Timem	'be contrary'
	kitif	kitif	'chop'

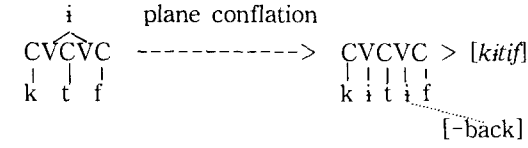
Palatalization at issue scans a word-final alveolar or velar first. If it encounters a word-final alveolar or velar, it affects the consonant (e.g., *kift^{y}* 'open'). Otherwise, it keeps spreading leftward to anchor at a potential landing site, velar. If the spreading successfully anchors at a velar without being hindered by any intervening material, then the velar is to be palatalized (e.g., *nik^{y}if* 'instigate quarrel'). There may be no velar within a word (e.g., *Timem* 'be contrary'), or the spreading may be blocked by an intervening alveolar (e.g., *kitif* 'chop'). When either of these cases arises, the rule has no way to realize the feminine suffix on the root consonant. Note that the language has no other way to mark the suffix than palatalization. Without palatalization, no distinction could be made possible between 2ndsg.masculine and feminine. Chaha does not seem to favor this sort of a verbal form that is obscure in gender. This seems to be the situation where the second spreading does arise to repair such sort of unwanted verbal forms. This time, a spreading may take place at the stage where vowels and consonants are folded on a single line, so it may fulfill the feminine suffix via vowel fronting. What is noteworthy about this process is that the rule applies twice, one before and the other after Plane Conflation. The derivation (5) illustrates

the vowel fronting observed in *Tömem* and *kötif*.

(5) a. *Timem*



b. *kitif*



In *Timem* (5a), the feature [-back] has no way to dock at the pre-Plane Conflation stage because of the lack of a compatible target on the root plane. The floating [-back], however, is to be realized, which requirement is fulfilled at the post-Plane Conflation stage by getting associated with the vowel *ə*, resulting in *e*. A gender distinction is thus made possible within the verb. In *kitif* (5b), a docking process is blocked by the intervening alveolar *t* before Plane Conflation,[2] but is fulfilled by vowel fronting after Plane Conflation.

The cyclic rule application analysis proposed above has an immediate consequence in explaining long-distance velar palatalization in a form like *nikʸif* 'instigate quarrel.' Note in this example that velar palatalization is forced, to the exclusion of vowel fronting. If Chaha palatalization were treated simply as a one time operation of a leftward spreading, then it would be hard to understand why the spread affects velar, not vowel the leftward spreading meets first. In order to account for this sort of velar palatalization, the grammar of Chaha must make an independent stipulation that the palatalization process suppresses vowel fronting in favor of velar palatalizaion. Admitting such stipulation,

2) Note that alveolar *t* is contrastive for the feature [back] (footnote 1), thus acts as a blocker for the spreading.

a question still arises as to how come a rule does skip an intervening potential target and apply to a next target. This problem, however, does not arise under the current approach. The preference of velar palatalization to vowel fronting simply follows from the derivational order. Palatalization is to apply to the consonantal plane first and then to vowel at the stage where two planes are folded. No independent stipulation is necessary.

In subsequent sections, I will show that cyclic rule application holds not only in palatalization but also devoicing that has affected geminate obstruents in the language over its history. For that purpose, in the following section I will describe facts concerning the Chaha geminate devoicing and McCarthy's lexical analysis on the changing process.

2. Lexical Analysis of Chaha Geminate Devoicing

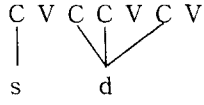
Chaha has undergone geminate devoicing, by which geminate obstruents have been devoiced during its historical development. Interestingly, not all geminate obstruents have undergone devoicing. See (6) below:

(6)[3]	a. gaddara	>	gatara	'put to sleep'
	dabbara	>	dapara	'race'
	maggara	>	makara	'suppurate'
	azzara	>	asara	'carry a child'
	b. saddada	>	sadada (*satada)	'send away'
	faggaga	>	fagaga (*fakaga)	'die (cattle)'
	bazzaza	>	bazaza (*basaza)	'in low spirits'
	argaggaTa	>	argagaTa (*argakaTa)	'make sure'
	c. cabbaba	>	capaba	'close halfway'
	zabbaba	>	zapaba	'dam water'
	qabbaba	>	qapaba	'shave'

3) *T* in McCarthy (1986a) = voiceless alveolar ejective.

The geminate devoicing rule freely applied to a form like *gaddara* 'put to sleep' (6a), but was systematically blocked in a configuration of [...$VC_iC_iVC_i$...] (as in *saddada* 'send away') or [...$C_iVC_iC_iV$...] (as in *argaggaTa* 'make sure') (6b). According to McCarthy (1986a), the inapplicability of the rule to such forms is traceable to the OCP and the Geminate Inalterability principle. The OCP demands that "multiple occurrences of a consonant in the stem be represented by a single element of the root melody" (McCarthy (1986b: 212)). *saddada* in (6b) then will have the underlying root /sd/, as illustrated in (7):

(7)



In (7), *d* has another association line outside the CC sequence, violating Hayes's (1986) version of the Geminate Inalterability (i.e. exhaustive enumeration of association lines); consequently, the geminate devoicing rule is blocked.

On the other hand, the rule application is unimpeded when the second radical is realized as *b* as in *cabbaba* 'close halfway'(6c). Noticing the distinctive rule applicability to a form like *saddada* and *cabbaba* despite their structural equivalence, McCarthy claimed that the rule assigning [-voice] to labials does not belong to the same category as the rule assigning [-voice] to other obstruents. That is, he argued that the former is feature-filling since there was no *b/p* contrast at the time when the geminate devoicing entered the language, whereas the latter is feature-changing, for obstruents other than labials were historically marked for voicing. In addition to this distinction, he explored another machinery called a 'derived environment', which is defined in somewhat deviated way from the standard assumption (see Kiparsky (1973a) and Kenstowicz (1994) for its original definition). His notion of 'derived environment' is an "environment that is created by the application of a language-particular rule" (McCarthy (1986a:216)). For instance, he treated medial *dd* in *gaddara* as a property derived by a language-

particular rule, arguing that the form has been created by the morphological template-filling process, which was assumed to be unique to Semitic languages. By contrast, according to him, a sequence of medial geminate in *saddada* has been created by the universal principle of Plane Conflation, thereby constituting a non-derived environment. To account for the distinctive rule applicability to labials versus other obstruents, he has also identified feature-changing and feature-filling as lexical and postlexical, respectively. He claimed that feature-changing rules apply only in derived environment while no such restriction holds on feature-filling rules.

With all these devices, he explained the difference in the rule applicability between *saddada* and *cabbaba* as follows. Recall that the geminate devoicing rule is blocked on *saddada* due to the Geminate Inalterability before Plane Conflation aligns consonants and vowels on a single tier. The rule was prevented from applying in the post-Plane Conflation stage as well, this time by the derived environment requirement. On the other hand, *cabbaba* has undergone the rule in the post-Plane Conflation stage, for the rule applying to labials is feature-filling and is applicable not only in a derived environment but in a non-derived environment as well.

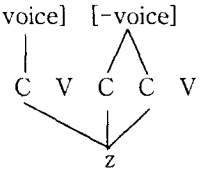
McCarthy's account seems to work well for the range of data in (6). However, such forms as in (8) pose a problem.

(8)	zazza	>	$z^{\gamma}as^{\gamma}a$	'be cold'
	gaggara	>	$g^{\gamma}ak^{\gamma}ara$	'straighten out'
	dəraddara	>	dəratara	'step on'
				(McCarthy (1986a))

The devoicing of, for example, *zz* in *zazza* 'be cold' is unexpected, since the feature-changing lexical rule will be blocked from applying to non-labials both in the pre- and post-Plane Conflation stage for the same reason as in *saddada*. McCarthy (1983, 1986b) noticed this problem and suggested that the forms in (8) be morphologically created. His point is that [voice] may be directly associated with consonant slots

of the prosodic template [...$C_iVC_iC_i$...] just in case it marks the frequentative aspect of the verb, in a manner stated below.

(9)



Although this claim is not implausible considering the 'non-concatenative morphology'of the language, it is still suspect since the rule of geminate devoicing operates not only on these verbs with frequentative aspect but also on nouns which do not carry aspectual markers at all. See the forms in (10) alongside with their equivalents in Eza.[4]

(10)	Eza	Chaha	
	agdadda	agdata	'partition in the house'
	dadda	data	'chest'
	daddu	datu	'parasol'
			(Leslau (1979)).

The forms above do not convey frequentative meaning in all regards; nevertheless they have undergone devoicing. Besides an empirical problem of this kind, the lexical analysis sketched above inha geminate devoicing, which clearly patterns as a lexical rule ideed casts a series of conceptual doubts. First, on this approach, Chan all respects (e.g, toleration of lexical exceptions, a typical characteristic of lexical rules),[5]

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4) Ezha is the most closely related language to Chaha, both belong to the central western Gurage.

5) Loanwords do not undergo devoicing (McCarthy (1986a:219), Kenstowicz (1994:445)), the fact indicating the rule as lexical. See the data below.

Chaha	Amharic	
ngs	nggs	'reign'
nzb	lzzb	'be flexible'

was compelled to be decomposed into two subcategories, lexical and postlexical rules. As McCarthy himself noted, such decomposition can hardly avoid criticisms of the loss of generality. Second, the specifically defined notion of a 'derived environment' was necessary to account for the distinctive rule applicability to labials versus other obstruents. If we could obtain the difference between the two phonemic categories without adding an otherwise unnecessary convention of the language-specific notion, it would be more desirable in the sense of economy. Third, the notion of 'derived environment' induces a technical problem as well. The really operative part of McCarthy's (1986a:216) definition of derived environment is the specification of 'language-particular.' 'Language-particular' was originally defined in McCarthy (1986a) as a morphological association of C/V melodies with the prosodic template. In his subsequent work (1989:72), he expanded the notion of C/V melodies, arguing that planar V/C segregation is required not only in the Semitic languages but also in languages which do not support a morphological separation of vowels and consonants. True that V/C planar segregation constitutes not language-specific but language-universal, then how does a phonological rule have access to the information of whether a given template filling process is morphological or lexical? Fourth, Geminate Inalterability may not suffice causing rule blockage on a form like *saddada*. Take Hausa, for example. In the language, palatalization, described first by Gregerson (1967) and analyzed by McCarthy (1986a) and Cole (1987), is widely known to operate in violation of the Geminate Inalterability. Gashow, a dialect of Yokuts, is also reported to undergo lowering without respect to the principle at issue (Archangeli (1985)).

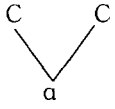
Indeed, the so-called 'long-distance geminates' behave differently in many ways from the normal type of geminates. For instance, the constituent segments of a long-distance geminate are dissected into parts by a phonological operation, e.g., by Plane Conflation. This phenomenon is unexpected given the Geminate Inseparability, a principle that strongly resists geminate structure to be disrupted by any phonological rule (kenstowicz (1994:410)) or to be split by any

intervening material (Schein & Steriade (1986:691)). In the next section, I will refine the structure of the long-distances geminates, which I hope together with the cyclic rule application advocated in section 1 will nicely resolve all the problems disclosed within the lexical approach.

3. Feature Geometrical Analysis of Chaha Geminate Devoicing

As a point of departure, let us characterize a geminate in terms of a doubly-linked structure, essentially following Leben (1980) and McCarthy (1986a, b). In (11) below, a single phonemic element is mapped to two skeletal positions.

(11)

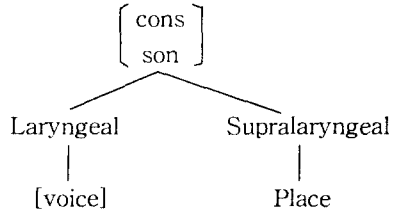


This structure ensures that geminate sequences act as a monosegment, sharing a single unit on the articulatory tier. The linkage between the two constituent segments is tight, so it characteristically repels insertion of any intervening segment, termed as 'inseparability' by Kenstowicz and Pyle (1973). Strictly following the definition of 'Geminate Inseparability,' I conjecture that the linkage between the geminate sequences persists throughout derivations (see the discussion around (16) in support of this view). The linkage must not be broken apart at any level of derivation. Two consequences immediately follow. First, the so-called 'long-distance geminates' will be excluded from the set of geminates since multiply-linked segments are split apart by intervening material at the stage when Plane Conflation applies. This means that 'long-distance geminates' are not subject to the principle of geminate, Geminate Inseparability or Geminate Inalterability. Recall that for McCarthy (1986a) the rule application of geminate devoicing to a form like /saddada/ [sadada] 'send away' is blocked by Geminate

Inseparability (see the discussion around (7)). However, such analysis is unadmissible under the current approach. Second, a rule affecting any tier under the single segment will spread its phonological influence over to every skeletal slot associated with it.

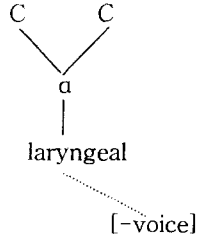
In this study I treat geminate devoicing of Chaha as a leftward spreading of an autosegmental feature [-voice], targeting the laryngeal node of a geminate root. I take Halle's (1992, 1995) model, in which the [voice] feature is a dependent of the laryngeal node, constituting a separate branch from the supralaryngeal dominating the place node, as depicted below (irrelevant nodes are omitted):

(12)



The rule of geminate devoicing then can be stated as (13):

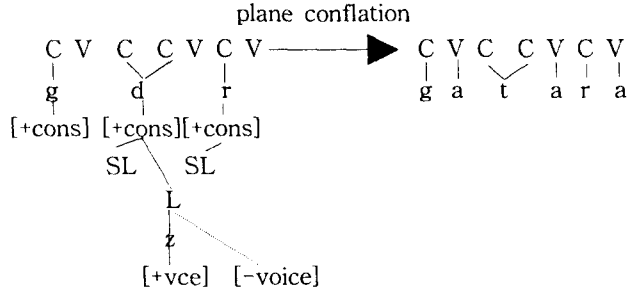
(13)



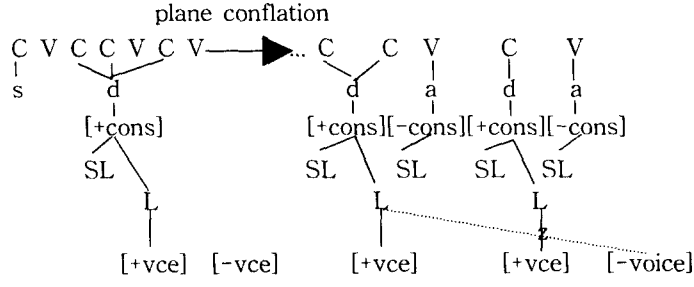
As always in the analysis of feature geometry, contrastive feature specification is central, serving to distinguish transparent segments from opaque ones. Velars and coronal obstruents are contrastive for voicing feature in Chaha, by having voiced and voiceless segments underlyingly (e.g., */d/* vs. */t/*, */g/* vs. */k/*, etc.). By contrast, voicing feature is noncontrastive for labials and coronal sonorants; they do not have

voiceless (or voiced) counterparts in the underlying segment inventory. On the other hand, vowels are unmarked for voicing feature, a universal property. Given these feature specifications, velars and coronal obstruents will be predicted to be opaque, while labials, coronal sonorants and vowels to be transparent to the rule of spreading [-voice] feature. The feature geometrical configuration (14) shows the analysis as to the forms in (6) (SL, and L represent supralaryngeal, and laryngeal, respectively):

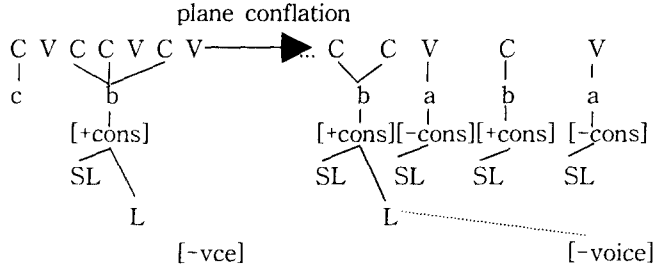
(14) a. gaddara > gatara



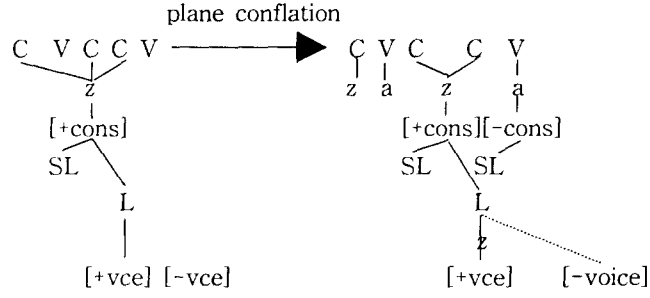
b. saddada > sadada (*satada)



c. cabbaba > capaba



d. zazza > $z^{y}as^{y}a$

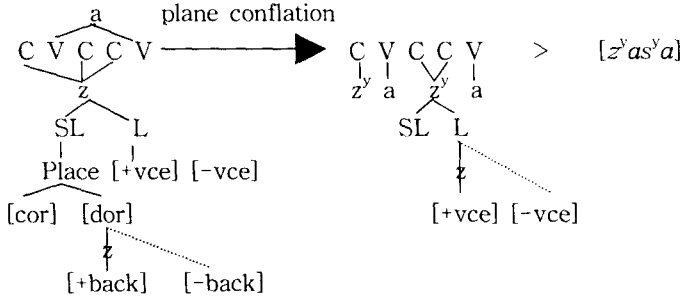


In (14a), the rule applies at the pre-Plane Conflation stage. Coronal sonorant *r* is unspecified for the voicing feature, and therefore invisible to the rule spreading [-voice] feature. Following McCarthy (1986a), I analyze the rule assigning [-voice] to non-labial obstruents as feature-changing. Given the feature geometrical structure, this process can be expressed as an association of the spreading [-voice] feature with the laryngeal node of the root geminate *d*, delinking the underlying [+voice]. Consequently, *gaddara* becomes *gatara*. In (14b-d), the rule application is blocked at the pre-Plane Conflation stage since the structural description of the rule is unsatisfied. Note that the geminate devoicing rule in (13) applies only to the geminates with two branches, barring its application to the long-distance geminates. In (14b), [-voice] spreads at the post-Plane Conflation stage cyclically, but the docking process fails due to the intervening root final *d*. which is contrastive for

the voicing feature. The presence of the opaque segment will break the associating line of the spreading [-voice] to the laryngeal node of the root geminate, creating the configuration of the Line Crossing Constraint violation (Goldsmith (1976), Pulleyblank (1986)). By contrast, the intervening segment *b* in (14c) does not act as a blocker. This is because labials were unmarked for voicing at an earlier stage of the language when the geminate devoicing occurred. As labials were unspecified for voicing, the rule assigning [-voice] to labials can be construed as a feature-filling or as a linking process (in terms of feature geometry). The correct surface form *capaba* thus results. Finally, in (14d) no blocker exists to the right side of the target geminate *zz*, deriving *z^{y}as^{y}a* correctly. (The only intervening element is a vowel, which is noncontrastive for the spreading feature and hence invisible to the rule.)

At this stage, it will be instructive to take a look at a form like *z^{y}as^{y}a* in which not only devoicing but palatalization also is realized.

(15) zazza > z^{y}as^{y}a



In (15), a derivation of *z^{y}as^{y}a* from *zazza*, all the surface identical consonants of *z* are associated with a single root consonant at the pre-Plane Conflation stage, so palitalization affecting the root spreads its influence to all the linked surface consonants. By contrast, geminate devoicing at this stage cannot dock on the laryngeal node of *z* because of the failure meeting the structural description of the rule. The rule,

however, is permissible to affect the geminate sequence *zz* at the post-Plane Conflation stage, leaving the first leg of *z* intact. This is because in the post-Plane Conflation stage the geminate and the first *z* constitute a separate root by virtue of the intervening vowel, and the geminate devoicing can have access to the rightmost consonant exclusively.

An important corollary of the present analysis is that constituent segments of a geminate must share a single root even in the post-Plane Conflation stage; otherwise, the structural description of the rule (13) would not be met and the rule would have no way to apply. The Biblical Hebrew supports this view. The Biblical Hebrew rule of postvocalic spirantization is blocked from applying to a form like *fäkkärä* (**fäxkärä*, or **fäxxärä*) 'he boasted' (Schein & Steriade (1986)). The vowel interaction with obstruents indicates that Plane Conflation must have aligned the vocalic and consonantal planes at the time that spirantization applies. Suppose the following two possible representations formed in the post-Plane Conflation stage. Then, the blockage of the rule can be explained with a doubly-linked structure (16a), but not with a split structure (16b).

(16) a. CVC CVCV
fä k ä rä

b. CVCCVCV
fä k kä rä

The second leg of the doubly-linked *k* in (16a) is not postvocalic on the skeletal tier; thus, the rule cannot apply without violating the Geminate Inalterability. If the geminate sequences were split, as in (16b), there would be no obvious reason for the first *k* not to undergo the rule. The cyclic rule application, plus a strengthened definition of 'geminate,' advocated in this paper exerts several advantages over the previous lexical approach. First and foremost, language-specific notions such as 'derived environment' or 'decompostion of a rule' can be eliminated. Recall that these specifically defined notions were needed to account for the distinctive rule applicability to labials versus non-labial obstruents (e.g., /cabbaba/ [capaba] vs. /saddada/ [sadada]). Under the current

approach, the necessary distinction simply comes as a consequence of cyclic rule application, before and after Plane Conflation, in conjunction with the constituent structure of geminate, and the contrastive feature specification well established in the feature geometrical analysis. Second, such forms as in (8) (e.g., *zazza* > *z^{y}as^{y}a*) and (10) (e.g., *agdadda* > *agdata*) had to be treated in some exceptional way under the lexical analysis, by appealing to whether a form is morphologically determined or lexically created. Such necessity does not arise on the current approach. Devoicing of the final *dd* is not an anomaly; the apparent devoicing simply comes as a result of the rule application after Plane Conflation has isolated the final *d* sequence from the first leg of the long-distance geminate. Note importantly that the present approach does not invoke Geminate Inalterability as a key factor in the analysis of the so-called 'long-distance geminate.' It does not seem desirable to account for the rule blockage on a form like *saddada* by recourse to Geminate Inalterability, a principle of which should be better viewed as operating solely on the normal geminates-viz., a sequence of identical sounds in which constituent segments remain next to each other at all levels of representation. In this paper the rule blockage in such a form is rather attributed to discrepancy of the long-distance geminates from the set of pure geminates in terms of their structure.

In conclusion, the lexical analysis of Chaha geminate devoicing costs too much for the explanation of the data presented in literature. In contrast, by employing the mechanism of cyclic rule application, plus the strengthened notion of geminate structure, we can capture all the given data in a simple and natural way without invoking additional assumptions necessary within the lexical analysis.

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Son, Gwangrak
Division of English Language and Literature
Kyungnam University
wolyoung 449, Masan, Kyungnam, South Korea 631-701
Phone: (055) 249-2121
e-mail:ygson0@kyungnam.ac.kr

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