

Geminates and Long Consonants in Jordanian Arabic

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Abstract

This paper aims at considering the phonological status of word final geminates in Jordanian Arabic (JA) within Optimality Theory (OT). A ban on trimoraic syllables in the language triggers a process of degemination. A crucial distinction is made between geminates and long consonants based on moraicity. Geminates are moraic while long consonants are not.

Key words: Geminates, Long consonants, Degemination, Jordanian Arabic, Optimality theory

1. Introduction

1.1 Overview

A great volume of literature has dealt with the phonetic implementation and phonological representation of geminates across different languages. Phonetically, geminates are treated as long sounds (Ladefoged and Maddieson 1996; Ball and Rahilly 1999) that counterpart singletons in Italian (Esposito and Benedetto 1999), Pattani Malay (Cohen, MacWhinney, Flatt and Jeferson 1999), Cypriot Greek (Arvaniti and Tserdanelis 2000, Tserdanelis and Arvaniti 2001), Arabic (Al-Tamimi 2004), etc. “Greater muscular tension in the articulating organs” is needed to produce geminates (Trubetzkoy 1969:161) and to hold the articulators and maintain a longer occlusion time for the geminate contoid (Catford 1977:298). There is myodynamic, aerodynamic and acoustic evidence (Hassan 1981; Al-Tamimi 2004) that there is a temporal compensation relationship between geminates and vowels preceding them (e.g. Cypriot Greek, Tserdanelis and Arvaniti 2001; Italian Esposito and Di Benedetto 1999; Arabic, Al-Tamimi 2004; Rembarrnga, Mckay’s 1980; English, German, Spanish and French, Delattre’s 1971; among others). The role of geminates and morphological derivation has also been discussed (Lahrouchi 2010; Dell and Elmedloui 2010)

Phonologically, however, there are three views on the nature of geminates. Delattre (1971) views gemination in terms of syllable structure. He sees gemination as a process of consonant re-articulation: whereas the first consonant occupies a syllable coda, the second one occupies the onset of the following syllable. He argues that geminates are different from long consonants in that geminates have two phases in their articulation. Accordingly, a geminated /b/, for example, has the representation in (1):

(1) Representation of geminates

$$\begin{array}{cc} X & X \\ | & | \\ & b & b \end{array}$$

According to this view, a geminate is a cluster of two identical consonants. The first occupies a syllable coda and the second is rearticulated as the onset of a following syllable. Long consonants, on the other hand, are seen as a single segment occupying two timing slots as represented in (2)

(2) Representation of long consonants

$$\begin{array}{cc} X & X \\ \diagdown & / \\ & b \end{array}$$

In support of Delattre's analysis, Miller (1987) conducted an acoustic study on tautomorphemic and heteromorphemic geminates in Levantine Arabic. Tautomorphemic

geminate are those that are part of a single morpheme. They are also known as monosegmental geminates (3). Heteromorphemic geminates, on the other hand, belong to two adjacent morphemes and result from a variety of phonological processes in the language, like consonant assimilation or vowel deletion (4-5).

(3) Tautomorphemic geminates in JA

a. ʕal.lam ‘(he) taught’

b. sad.dad ‘(he) aimed’

(4) Coronal assimilation

ʔal- šams → ʔaš- šams ‘the sun’

(5) Vowel deletion

ta-tabbaf → t-tabbaf ‘(he) traced’

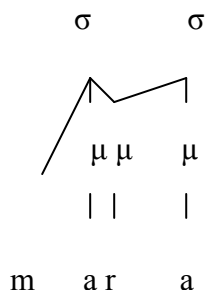
Miller concludes that there appear to be release spikes in both geminate types, suggesting the presence of movement during the geminate duration. The release spikes mark the point where the sound is being rearticulated. Ladefoged (1971) holds a different view on geminates. He sees geminates as long consonants. According to Ladefoged, geminates take the autosegmental representation in (2) above but never that in (1). For McCarthy (1979) and Leben (1980), who adopt an autosegmental approach to geminates, a geminate is seen as a single consonant mapped onto two skeletal tiers as discussed above. Both McCarthy and Ladefoged thus see a geminate as a single segment while Delattre argues that a geminate should be represented as two identical segments. Mitchell (1993) reviews the sources of initial geminates in vernacular Arabic and concludes that, “an anaptyctic vowel may be heard in most cases of initial gemination but it is never essential and better omitted” (pp. 93,94).

Whether geminates are sounds produced with two phases or with two skeletal slots, linguists agree that in both cases they are long consonants counterparting the singletons (Ball and Rahilly 1999; Ladefoged and Maddieson 1996). However, the term “long” might be illusive. It is based on the general view that “most languages with a distinction of consonant length have only two distinctive lengths” (Ladefoged and Maddieson 1996:93). This distinction is most apparent intervocalically. Intervocalic gemination is more common than peripheral gemination (Thurgood 1993; Muller 2001). This typology usually correlates with evidence showing that word-initial and word-final geminates are perceptually less salient because the difference in duration between geminates and singletons is less perceptible when the following sound is a consonant rather than a vowel. The duration ratio usually shows that geminates are 1.5-3 times as long as singletons. This ratio becomes lower when gemination occurs peripherally (Pajak 2009).

Within Moraic Theory, a geminate is seen as a consonant encoding inherent weight rather than length. It follows that a geminate is always moraic, and any CVC syllable should count as heavy if the coda consonant is part of an underlying geminate, even in languages where

CVC syllables otherwise count as light (Tranel (1990)). Thus, a word like /mar*ra/ meaning (he passed by) in Arabic will have the syllable structure in (6) under Moraic Theory:

(6) Geminate within moraic theory



The most remarkable feature of geminates is the one discussed in Kenstowicz and Pyle (1973). They note that geminates form a bond that avoids phonological rules in two ways: first, geminates do not undergo a phonological rule that has the effect of changing one half of the geminate while leaving the other as is; second, geminate clusters do not allow an epenthetic vowel to split them into two pieces. These two features are referred to in the literature as *inalterability* and *inseparability*, respectively.

In linear phonology, geminates are distinguished from singletons by the feature [+long]; otherwise, they are referred to as a sequence of two identical segments (7)

(7) Representation of the Geminate /bb/ in Linear Phonology:



Kenstowicz (1994:411) provides examples on the behavior of geminates in Biblical Hebrew. A process of stop spirantization turns postvocalic stops into fricatives. This phonological process affects short stops but not long stops ‘geminates’. The data in (8) exemplify:

(8) Spirantization in Biblical Hebrew

<u>Input</u>	<u>Output</u>	<u>Gloss</u>
katab	kaθav	‘write’
gibbor	gibbor	‘hero’

The language also shows that geminates behave not just as long consonants, but also as sequences of consonants. Biblical Hebrew has a vowel reduction rule that reduces a vowel in the context ___ CVCV in plural nouns. Reduction is blocked when the vowel is followed either by a consonant cluster or a geminate. Consider the data in (9):

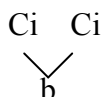
(9) Vowel Reduction in Biblical Hebrew

<u>Input</u>	<u>Output</u>	<u>Gloss</u>
a. malak-im	kəɫaxim	‘kings’
b. galgal-im	galgalim	‘wheels’
c. sappir-im	sappirim	‘sapphires’

Thus within linear phonology, a geminate is either a long consonant or a sequence of two identical consonants.

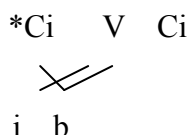
In the nonlinear framework, the dilemma facing the representation of geminates within the older linear framework no longer exists. Within this framework, geminates are associated with two skeletal positions as shown in (10).

(10) Representation of Geminates in Nonlinear Phonology



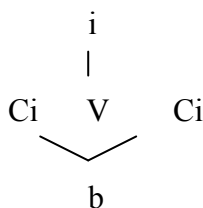
As stated earlier, epenthesis may not split the two parts of a geminate. This is an inseparability effect. Guerssel (1977, 1978) discusses Berber syllabification and shows that a process of schwa-epenthesis is triggered in medial CCC clusters /amə.tfu.nast ‘like a cow’/; however, when the first two consonants of the sequence form a geminate, i.e., in a CiCiC cluster (tazzla ‘running’, **tazəzla*), schwa-epenthesis is blocked. Failure of epenthesis to apply in such sequences is a function of the multiple linkages in (10) and the ban on line-crossing in (11), (Glodsmith 1976, 1990):

(11) Ban on Line-Crossing



The ban on line-crossing was found to be problematic (Ito 1986:223). She notes that, in nonconcatenative morphology, vowels and consonants are represented on two separate tiers (McCarthy 1979b, 1981). Accordingly, the ban on line-crossing cannot block epenthesis since association lines will never cross (12).

(12) The Inefficiency of the Ban on Line-Crossing



Ito concludes that a linked structure such as the geminate is ‘syllabified fully’, and thus

epenthesis is not required.

1.2 Distribution of Geminate and Statement of the Problem

Cross-linguistically, geminates tend to occur in certain phonetic environments; intervocalically and after short stressed vowels (Thurgood 1993). Thurgood (1993:1) states that “syntagmatically, the most favored environment for long consonants to occur in is intervocalically, following a short, stressed vowel and preceding another short vowel.” Therefore, most of the proposed phonological representations of gemination come “almost exclusively from intervocalic geminates; it is perhaps unsurprising that they should face some difficulties in representing non-intervocalic geminates” (Muller 2001:12).

Medial geminates in Arabic are contrastive. However, distinctiveness of word final geminate/singleton contrast in Arabic is controversial. Mitchell (1990) lists the two Arabic words /ʕaam/ (year) and /ʕaam:/ (public) to exemplify distinctiveness. Other examples that prove distinctiveness in word final geminate/singleton are also listed in El Saaran (1951) (/ħaad/ (deviated) and /ħaadd/ (sharp), for example). In contrast, Cowell (1964:23) states that, in Syrian Arabic, word final geminates “may occur after an accented vowel”; however, they “do not actually contrast with single ones.” Like Cowell, Ghalib (1984: 31) contends that “geminates occurring word-finally are non-distinctive in Arabic because contrasts between single and geminate consonants in this position are non-significant.”

With regard to temporal differences between geminate/singleton consonants, the majority of work on Arabic geminates shows that intervocalic geminates witness temporal compensation with the preceding vowel (Blanc 1952; Mitchell 1990; Al-Tamimi 2004; etc.).

Al-Tamimi, Abu-Abbas, and Tarawneh (2010) provide conclusive evidence in favor of the contrastive nature of word final geminates in Arabic. They conclude that spectrographic and videofluoroscopic analyses show that final geminates are permissible in Jordanian Arabic. The temporal compensation maintained with the preceding vowel and the tension in articulating the geminates enhance perceptual boundaries and maintain phonemicity.

The rest of this study advances an OT account of word final geminates in JA. The main purpose is to provide phonological evidence which shows that a distinction between long consonants and geminates is inevitable. Further, it will be argued that this distinction should be approached in terms of weight rather than duration.

2. Geminate in JA

Like Standard Arabic and virtually all other Arabic vernacular, Geminate in JA are phonemic as can be shown in the minimal pairs in (13)

(13) Phonemic geminates in JA

a. barad	'he got cold'	barrad	'refrigerated'
b. walad	'a boy'	wallad	'gave birth to'
c. ʕalam	'a flag'	ʕallam	'he taught'

All phonemic sounds in the language have geminated counterparts that contrast word medially as shown in (13) above and word finally as can be seen in (14).

(14) Word final phonemic geminates in JA

a. saar	‘he walked’	saarr	‘pleasing’
b. faar	‘a mouse’	faarr	‘fugitive’
c. maal	‘money’	mall	‘bored’

Although controversial, word initial geminates, we believe, occur when the definite article assimilates to a following coronal as in (15)

(15) Initial phonemic geminates in JA

a. daar	‘a house’	ddaar	‘the house’
b. tiin	‘figs’	ttiin	‘the figs’
c. salaam	‘peace’	ssalaam	‘the peace’

2.1 Geminate integrity in JA

In JA, geminates behave in a way that is characteristic of geminate integrity: they are immune to epenthesis. Consider the data in (16):

(16)

	<u>Input</u>	<u>Output</u>	<u>Gloss</u>
a.	xadd	xadd/*xadid	‘cheek’
	ʕamm	ʕamm/*ʕamim	‘paternal uncle’
	dʒadd	dʒadd/dʒadid	‘seriously’
	barr	barr/*barir	‘land’
	sadd	sadd/*sadid	‘dam’
	madd	madd/*madid	‘he stretched’
b.	xadd-u	xad.du	‘his cheek’
	ʕamm-u	ʕam.mu	‘his paternal uncle’
	sadd-u	sad.du	‘he blocked it’
	madd-u	mad.du	‘he stretched it’

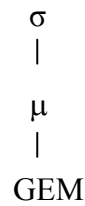
Data in (16) prove that geminates in JA surface unchanged. They are fully parsed. An input geminate surfaces as an output geminate. This is accounted for by a faithfulness constraint that requires an identity relation to hold between input and output geminates. This constraint is formulated in (17):

(17) IDENT-IO (GEM)

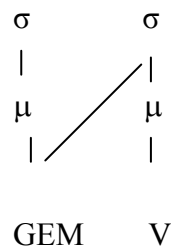
An output correspondent of an input geminate is also a geminate.

The output geminates in (16a) have the structural representation in (18) and those in (16b) have the structural representation in (19):

(18) Structural Representation of Word-Final Geminate:



(19) Structural Representation of Word-Medial Geminate:



The structural descriptions of geminates introduced above are very important for the discussion in this paper. A geminate will be treated as a **SINGLE** segment, but written as two identical segments to differentiate it from single consonants.

The faithfulness constraint in (17) is intended to preserve a property of geminates that distinguishes them from singletons. The feature (GEM) gives the sound from one and a half to three times the closure duration of corresponding singletons (Ladefoged and Maddieson 1996:12). The constraint in (17) is satisfied when the underlying mora associated with the geminate is preserved in the output.

The constraint in (17) is not undominated in JA. Other more highly ranked constraints might deprive an input geminate from its mora in order to produce well-formed structures in the output. A universal constraint bans moras from associating with coda consonants in word final position. This constraint is introduced in (20):

(20) *FINAL-C- μ Kager (1999)

The final consonant is weightless

Another constraint that is active in JA phonology is one that bans trimoraic syllables. Arabic syllables in general are maximally and optimally bimoraic (Broselow 1992:10). This implies that the data sets in (21a-d) are problematic in JA where the third word in each set is trimoraic:

(21) Trimoraic syllables in JA

- | | |
|---|---|
| a. ζ amm / ζ aam/ ζ aamm | ‘paternal uncle’/ ‘year’/ ‘general’ |
| b. sadd / saad / saadd | ‘he blocked’/ ‘prevailed’/ ‘is blocking’ |
| c. d ζ add / d ζ aad / d ζ aadd | ‘really?’/ ‘gave generously’/ ‘serious’ |
| d. barr / baar / baarr | ‘land’/ ‘went bad’/ ‘good to his parents’ |

The first two examples from each set are not problematic since they conform to the phonological dictates of the language. They are monosyllabic and bimoraic words in JA. The third example in each set poses a problem to the bimoraicity condition on syllables in JA. This constraint is introduced in (22):

(22) *3 μ

No trimoraic syllables.

The trimoraicity problem posed by forms like / ζ aamm/, /saadd/, /džaadd/, and /baarr/ may be solved by a number of different stipulations. We could propose a vowel-shortening rule that would reduce the number of moras in each word. Such a proposal will be neutralized by a higher ranked faithfulness constraint between the input and the output like MAX-IO(V). We could propose an epenthesis rule between the members of the geminate. Such a rule would be ruled out by the dictates of the higher ranked DEP-IO(V). A degemination process will solve the problem. Such a process would turn word final geminates into singletons. Consider the data in (23a,b):

(23) Degemination

	<u>Input</u>	<u>Output</u>	<u>Gloss</u>
a.	ζ amm	ζ amm/ * ζ am	‘uncle’
b.	ζ aamm	ζ aam/ * ζ aamm	‘a year’

According to (23a), degemination overapplies producing undesired outputs. An output like /* ζ am/ violates a high-ranking constraint in JA that bans monomoraic lexical words in the language. This constraint is formalized in (24):

(24) *PrWd μ

A prosodic word is minimally bimoraic.

Nevertheless, the interaction of the constraints in (25) below will guarantee that degemination will be active only when necessary. The desired outputs exemplified in (26) for / ζ aamm/ ‘general’, (27) for / ζ aam/ ‘year’, and (28) for / ζ amm/ ‘paternal uncle’ are achieved:

(25) *PrWd μ , *3 μ , DEP-IO(V) , *FINAL-C- μ >> IDENT-IO (GEM)

(26)

Input: ζ aamm	*PrWd μ	*3 μ	DEP-IO(V)	*FINAL-C- μ	IDENT-IO (GEM)
a. * ζ aam					*
b. ζ amm				*!	
c. ζ aamm		*!		*	
d. ζ aa.mim			*!		*
e. ζ aam.ma		*!	*	*	
f. ζ aa.mma			*!		

The optimal candidate is (26a) since it only violates the lower ranked IDENT-IO (GEM). Each of the rest of the candidates violates at least one higher ranked constraint that renders it non-optimal. The only crucial dominance relation is found between DEP-IO (V) and IDENT-IO (GEM). The former crucially dominates the latter. Otherwise, /ʒaa.mma/ would surface as the optimal output.

Now consider the effect of the constraint ranking above on an input like /ʒaam/ ‘year’. In (27), IDENT-IO (GEM) is deleted from the hierarchy because it is vacuously satisfied by all constraints since the input form has no geminates. The optimal form is (27a) since it does not violate any of the constraints. This suggests that there is no particular ranking of the constraints. Each of the rest of the candidates fatally violates at least one of the constraints.

(27)

Input: ʒaam	*PrWd μ	*3 μ	DEP-IO(V)	*FINAL-C- μ
a. * ʒaam				
b. ʒamm				*!
c. ʒaamm		*!		*
d. ʒaa.mim			*!	
e. ʒaam.ma		*!	*	*
f. ʒaa.mma			*!	
g. ʒam	*!			

Note that the optimal outputs in (26) and (27) are identical despite the differences between the inputs in each case. This implies that when a speaker of JA says /ʒaam/, he could be understood to mean either ‘general’ or ‘year’. In fact, there is no such ambiguity between the two forms. The pronunciation of the two words is entirely different and creates no conceptual confusion on the part of the listeners. This apparently problematic state of affairs does not really affect our analysis above since speakers of the language rely on differences in the quality of the vowel in each of the words above to distinguish the two words rather than on the presence or absence of the final geminate, (an issue that we do not wish to pursue here any further and hence will be left for future research).

Now we need to see if the constraints introduced so far can handle an input like /ʒamm/ ‘paternal uncle’.

(28)

Input: ʒamm	*PrWd μ	*3 μ	DEP-IO(V)	*FINAL-C- μ	IDENT-IO(GEM)
a. * ʒamm				*	
b. ʒaamm		*!	*	*	
c. ʒaam			*!		*
d. ʒam	*!				*
e. ʒam.mi			*!	*	
f. ʒam.im			*!		*

According to (28), the optimal candidate is (28a). Note that it is now crucial to set a domination hierarchy between DEP-IO(V) and *FINAL-C- μ , which were equally ranked in (27). Reversing their order in (28) will produce (28c) as the optimal output. This suggests that DEP-IO(V) crucially dominates *FINAL-C- μ .

2.2 Affixation to word final geminates

Words in JA that end in a geminate consonant may be followed by a consonant-initial suffix as the data in (29a-d) show:

(29) Affixation and trimoraic syllables

<u>Input</u>	<u>Output</u>	<u>Gloss</u>
a. ζ amm	ζ amm.na	‘our uncle’
b. rabb	rabb.na	‘our God’
c. madd	madd.hen	‘he stretched them’
d. sadd	sadd.hen	‘he closed them’

The constraints introduced so far are sufficient to produce optimal outputs from the examples in (29). Tableau (30) exemplifies:

(30)

Input: rabb-na	*PrW μ	*3 μ	DEP-IO(V)	*FINAL-C- μ	IDENT-IO(GEM)
a. * rabb.na					
b. rab.na					*!
c. rab.bi.na			*!		
d. raab.na		*!	*		*

Candidate (30a) is optimal since it does not violate any of the constraints. The closest rival is (30b) which is ruled out due to a fatal violation of IDENT-IO (GEM).

The behavior of geminates across word boundary might invoke epenthesis. This happens when a geminate-final word is followed by another word that starts with a consonant cluster. Consider the examples in (31a-d):

(31) Geminates across word boundary

<u>Input</u>	<u>Output</u>	<u>Gloss</u>
a. madd bSaaT	mad.dib.SaaT	‘he stretched a carpet’
b. zatt ktaab	zat.tik.tab	‘he threw a book’
c. ζ add xjuul	ζ ad.dix.juul	‘he counted horses’
d. gadd hmaar	gad.dih.maar	‘the size of a donkey’

A process of epenthesis is invoked to produce optimal syllable structure with simple margins. Epenthesis inserts the high short vowel /i/ between a geminate and a following consonant cluster. Treating a geminate as a single consonant, the epenthesis site is predictable. It takes place between the first and second consonants since what we have is a CCC cluster. The

markedness constraint against complex margins becomes very important in accounting for the outputs in (31). In CCC clusters, the geminate occupies coda position for one syllable and onset position for a following syllable. Thus it will have the structure we introduced for medial geminates in (19) repeated in (32) for convenience:

(32) Structural Representation of Word-Medial Geminates

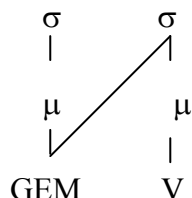


Tableau (33) provides an example to clarify the importance of *CM in the derivation of the phrase /zat.tik.taab/ from /zatt ktaab/ ‘he threw a book’:

(33)

Input: zatt ktaab	*3μ	*CM	DEP-IO(V)	*FINAL-C-μ	IDENT-IO(GEM)
a. * zat.tik.taab			*		
b. zatt.ktaab		*!			
c. zat.ktaab		*!			*
d. zat.ki.taab			*		*!
e. * zatt.ki.taab			*		

According to (33), the actual candidate (33a) fails to surface as the only optimal form. It is as optimal as (33e), which like (33a) only violates DEP-IO(V) because of the epenthetic vowel.

The seemingly optimal candidate (33e) is actually ruled out by a constraint in JA, and many other dialects, that bans the high short unstressed vowel(s) from appearing in open syllables. Such a vowel would be syncopated and would never surface. Syncope in JA is dealt with in the following section. This constraint will have to dominate DEP-IO(V) in order to allow (33a) to surface as the only optimal output.

2.3 Fake geminates

So far, the discussion of geminates has been limited to what is typically referred to as ‘true geminates’, i.e. those geminates in the output that have corresponding geminates in the input. There is actually another type of geminates in JA and all other Arabic dialects, including standard Arabic, which could arise as output sounds that do not have corresponding geminates in the input. These geminates are referred to as ‘fake geminates’. Such geminates usually arise when a vowel that is followed and preceded by identical sounds is deleted. For example, in Berber (Guerssel 1977, 1978), deletion of the prefixal vowel /a/ in /t-a-tbirt/ ‘pigeon’ creates the sequence /tt/ which subsequently undergoes epenthesis. Fake geminates also arise when the initial or the only consonant of a suffix is identical to the final consonant of the stem. Such cases are found in JA, and the geminates that result are broken up by

epenthesis. Consider the data in (34) where the subject suffix –t indicates 1st sg. m/f:

(34) geminates and epenthesis

	<u>Input</u>	<u>Output</u>	<u>Gloss</u>
a.	falat-t sakat-t	fa.la.tit sa.ka.tit	‘I escaped’ ‘I kept silent’
b.	Talab-t ʔakal-t	Ta.la.bit ʔa.ka.lit	‘I demanded’ ‘I ate’

The identical consonants in (34) belong to two different morphemes, i.e., they are hetromorphemic, unlike the cases of geminates we have been dealing with in the discussion earlier which belong to a single morpheme, i.e., tautomorphemic (Kenstowicz 1994).

When the geminates are tautomorphemic or ‘true’, the identity constraints on geminates discussed earlier are activated, but with hetromorphemic or ‘fake’ geminates, these constraints are not activated. Fake geminates are treated just like any other sequence of consonants that may be split by epenthesis. Fake geminates are separated by an epenthetic vowel due to the demands of *CM which prohibits complex onsets and codas in JA.

3. Conclusions

As far as geminates are concerned, it is concluded that geminates in JA are either ‘true’ in which case they are immune to epenthesis, or they are ‘fake’ and may be split by an epenthetic vowel. When a true geminate is found in a monosyllabic word with a long vowel, a degemination process is activated due to a constraint against trimoraic syllables in the language. When a geminate is followed by a word that starts with a consonant cluster, an epenthetic vowel separates the CCC cluster between the first and second consonants.

Geminates in coda position do not violate *CM and they differ from their singleton counterparts in that geminates are moraic word finally while singletons are not. The process of degemination does not incur a MAX violation. Accordingly, word final geminates are distinctive and may occur in minimal pairs with singletons.

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