

Rethinking Gemimates, Long-Distance Gemimates, and the OCP

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Building on the analysis of long-distance gemimates as reduplication, this article argues that the OCP may apply to identical consonants across an intervening vowel. This is adduced from the behavior of guttural consonants in Semitic. It is further argued that antigemination is not resistance to an OCP violation but avoidance of gemination; syncope between identical consonants avoids an OCP violation by creating a geminate. This entails that there is no surface representational distinction between true and fake gemimates. Finally, cases of reduplication are examined in which the standard reduplicant is changed to avoid either gemination or an OCP violation.

Keywords: OCP, gemimates, gutturals, reduplication, Semitic

1 Introduction

Perhaps no “principle” of generative phonology has received as much attention as the Obligatory Contour Principle (OCP), which has been used to explain a myriad of phonological and morphological phenomena. The OCP prohibits adjacent identical elements, where “elements” may be defined as tone, segments, features, syllables, or even morphemes (Yip 1998). A common formulation is taken from McCarthy 1986b.

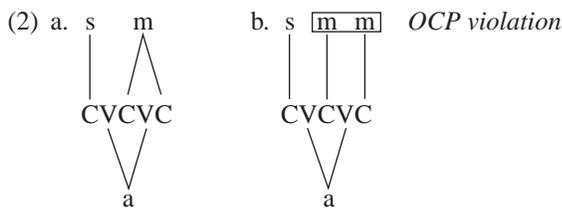
(1) *Obligatory Contour Principle*

At the melodic level, adjacent identical elements are prohibited.

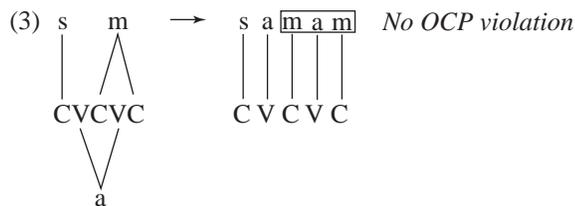
Although the OCP was originally formulated to apply to tone (Leben 1973, Goldsmith 1976), its application outside the domain of tone to Semitic root consonants (McCarthy 1979, 1981) is considered a landmark in autosegmental phonology. The combination of the OCP with autosegmental spreading provided an elegant analysis of the skewed distribution of repeated consonants in Semitic triconsonantal verb stems, that is, of why verbs like *samam* are attested and not those like **sasam*. If the OCP applies to Semitic roots, verbs such as [samam] cannot contain two

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instances of /m/, but must be analyzed as biconsonantal /sm/ and mapped to a triconsonantal template from left to right. The second consonant is spread to the final consonant position of the template, creating what is referred to as a ‘‘long-distance’’ geminate, a single consonant spread over two positions with a vowel intervening between the consonants, as in (2a).¹ The vowels are associated on a separate tier. Such a structure avoids violating the OCP, whereas a structure in which the two identical consonants are represented as separate root segments /smm/ would violate the OCP (2b).



A mechanism referred to as Tier Conflation (attributed to Younes 1983 in McCarthy 1986b) aligns the vocalic and consonantal tiers into a single linearized tier at a specified point in the derivation. Tier Conflation also aligns affixal morphemes lexically arrayed on separate tiers. The intervening vowel splits the long-distance geminate into two separate consonants during Tier Conflation. This is represented in (3).



In the post-Tier Conflation structure, intervening vowels prevent violation of the OCP.

As phonological theory has progressed and, with the advent of Optimality Theory (OT) (Prince and Smolensky 1993, McCarthy and Prince 1993, 1995), has taken some revolutionary twists, previous analyses and assumptions have begun to be questioned. For example, Gafos (1996, 1998) and I (Rose 1997) reject the long-distance geminate represented in (2a). We propose that Semitic roots characterized by doubling of the final consonant (i.e., *samam*) should instead be analyzed in terms of reduplication and that vowels and consonants are not segregated onto separate tiers. The biliteral analysis of the root as /sm/ remains the same.²

(4) s a m_i a m_i

¹ The representation is also assumed for vowels, but the focus of this article is on consonants.

² Association of segments to templates and the characterization of templates are not addressed here. See Buckley 1997a, Rose 1997, and Gafos 1998 on derivations of (primary) Semitic verb stems in OT.

The spreading analysis in (2a) was adopted partly to avoid OCP violations that would ensue if the consonants were separate and adjacent. A question that arises from the analysis in (4) is whether reduplication of this type violates the OCP, particularly since the vowel intervening between the two identical root consonants belongs to a different morpheme. In this article I will answer in the affirmative: the OCP *is* violated by two identical consonants separated only by a vowel, a situation that often results from reduplication—not just in Semitic, but in other languages as well. Although the OCP has previously been demonstrated to ignore intervening material (McCarthy 1988, Yip 1988, 1989, Suzuki 1998), this analysis applies only when individual features of the two relevant consonants are being considered, not when the consonants are completely identical. However, I will argue that an intervening vowel is ignored when computing the OCP between consonants, in both cases. The violability of constraints in OT allows the OCP to be violated in surface forms under pressure from higher-ranked constraints.

The article is organized as follows. In section 2 I assess the behavior of guttural consonants in Tigrinya and Tigre, two North Ethiopian Semitic languages. Gutturals may neither geminate nor occur as long-distance geminates, but they may be reduplicated. At first glance this appears to suggest that geminates and long-distance geminates pattern alike, a fact that could be attributed to a similar linked representation. Nevertheless, I show that the pattern of gutturals is most fruitfully analyzed as a widespread OCP-driven restriction on guttural repetition across an intervening vowel. This is a welcome result since, if long-distance geminates are really a form of reduplication, any similarity between them and true geminates cannot be attributed to a linked representation. Furthermore, normal/overapplication effects of palatalization and labialization in some Ethiopian Semitic languages demonstrate that verbs with reduplication (i.e., *fəʔfīt*) and verbs with final doubling or long-distance geminates (i.e., *fētīt*) do pattern alike and should therefore be represented alike (Gafos 1998, Rose 1997).³

In section 3 I extend the proposal that the OCP applies between consonants across an intervening vowel to languages previously hailed as the prime examples of antigemination, or resistance to syncope between identical consonants (McCarthy 1986b). I argue that the standard antigemination C_iVC_i sequence itself actually violates the OCP, just as it does in Tigrinya and Tigre with respect to the guttural subclass (see Berkley 1994 for a similar proposal about homorganic consonants in a CVC configuration). Resistance to syncope is reanalyzed as resistance to gemination, not avoidance of an OCP violation. Previous explanations were forced to stipulate identity restrictions on syncope, but this new account provides a more insightful explanation for why some syncope cases apply *only when* the consonants are identical (to avoid an OCP violation), whereas others apply *except when* the consonants are identical (to avoid geminates). The typology of syncope and epenthesis patterns that are sensitive to identical consonants documented in Odden 1988 is modeled as a difference in constraint ranking within correspondence theory (McCarthy and Prince

³ Various authors have pointed out that long-distance and local geminates do not always behave similarly with respect to geminate integrity or inalterability (Inkelas and Cho 1993, Hayes 1986, Schein and Steriade 1986). It is usually assumed that the long-distance geminate behaves differently because it has been split by Tier Conflation (McCarthy 1986b) and so no longer functions like a geminate. Tier Conflation is unnecessary in an analysis that adopts (4).

1995). In section 4 I examine the surface distinction between fake and true geminates and show that the behavior of fake geminates can be captured by reference to domains of OCP application. In section 5 I present examples from languages in which the shape of the reduplicant is altered to avoid violations of either the OCP or a constraint against gemination. I conclude with a summary in section 6.

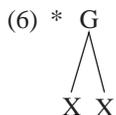
2 Gutturals in Ethiopian Semitic

2.1 Long-Distance Guttural Geminates

It is well known that guttural consonants (pharyngeals, laryngeals, uvulars) resist gemination in some Semitic languages (McCarthy 1994). This is true of those Ethiopian Semitic languages with a range of guttural consonants, notably Tigre and Tigrinya, which have [ʔ h ʕ ħ]. The Tigrinya imperfective forms in (5) demonstrate that when the paradigm requires gemination, guttural consonants do not geminate. Type A and Type B regular verb roots are shown for comparison (lexically determined conjugation patterns of different roots in Ethiopian Semitic are referred to as ‘types’). In some cases, such as the passive imperfective, another consonant geminates instead of the guttural (data from Berhane 1991).⁴

| | | | | | |
|-----|------------------------|---|---|----------------------------|-------------------------------|
| (5) | | <i>Type A</i> | <i>Type B</i> | | |
| | | ‘whip’ | ‘hurt’ | ‘pull’ | |
| | Imperfective | y $\dot{\text{i}}$ -gərrif | y $\dot{\text{i}}$ -biddil | y $\dot{\text{i}}$ -siħib | (*y $\dot{\text{i}}$ -siħhib) |
| | Passive imperfective | y $\dot{\text{i}}$ -g $\dot{\text{i}}$ rrəf | y $\dot{\text{i}}$ -b $\dot{\text{i}}$ ddəl | y $\dot{\text{i}}$ -ssaħab | (*y $\dot{\text{i}}$ -saħħab) |
| | Causative imperfective | yə-g $\dot{\text{i}}$ rrif | yə-bəddil | yə-sħib | (*yə-saħħib) |

A constraint banning double linking of guttural consonants would account for the failure of gutturals to geminate (G = guttural).



In a theory that allowed long-distance geminates, such a constraint on double linking would naturally extend to long-distance geminates and would predict that long-distance guttural geminates are also ruled out. This is exactly the case in Tigrinya and Tigre. There are no verbs with final double gutturals of the shape *CaGaG or *CaCGaG, that is, no verbs like *safal* or *basʔaʔ*.⁵ On the other hand, reduplication of gutturals is permitted, as the Tigre total-copy verb stems in (7) illustrate (the ^a is a transitional epenthetic vowel that prevents gutturals from appearing in codas).

⁴ Guttural consonants lower adjacent /ə/ to [a]. See Berhane 1991 for contexts.

⁵ Buckley (1990) analyzes trilateral roots with final doubling such as *kʔərdəd-* ‘dice’ as involving reduplication but those formed from biliteral roots such as *gəddəd-* ‘worsen’ as cases of spreading. Angoujard (1988) makes a similar assumption for the trilateral type, but does not pronounce on those formed from biliterals.

| | | | |
|-----|-----------------------|--------------------------------------|----------------------------------|
| (7) | <i>CGCG</i> | | <i>GCGC</i> |
| | faḥ ^a faḥ- | ‘rub together’ | ḥanḥan- |
| | naʔ ^a naʔ- | ‘to be unsteady, waver’ ⁶ | ʔabʔab- |
| | saʔ ^a saʔ- | ‘dance’ | ʔafʔaf- |
| | | | hathat- |
| | | | ‘care for someone’ |
| | | | ‘incubate, cover to let ripen’ |
| | | | ‘lecture, criticize incessantly’ |
| | | | ‘rush someone’ |

These verbs are formed from biliteral roots of the shape CG or GC by copying the root entirely. The existence of total-copy verbs with final gutturals as in (7) demonstrates that roots of the shape CG are possible; they simply cannot expand by doubling the final consonant: *CVGVG.⁷ Under the long-distance geminate analysis, the lack of final doubling verbs and the existence of the verbs in (7) follow directly from the ban on guttural linking. Nevertheless, I show in the next section that the reduplication analysis of final doubling verbs is better equipped to handle additional data from Tigre and Tigrinya.

2.2 Different Gutturals

Despite the apparent similarity between guttural gemination and long-distance guttural gemination, a ban on linking cannot extend to other facts from Tigrinya and Tigre. First, it is not only identical gutturals that are prohibited in the verb root, but also two *different* gutturals. Thus, there are no verb forms such as *Caḥaʔ-* or *Caʔah-* in Tigre and Tigrinya. This gap follows from the ban on adjacent homorganic consonants applied to Semitic roots (Greenberg 1950), attributed to the OCP (McCarthy 1988, 1994, Yip 1989, Padgett 1992, Pierrehumbert 1993, Elmedlaoui 1995, Buckley 1997b, Frisch, Broe, and Pierrehumbert 1997).

Second, the juxtaposition of gutturals from separate morphemes is also avoided in Tigre. This occurs with the causative morpheme /ʔa-/, the 1st person singular nonperfective subject marker /ʔi-/, and the broken plural prefix /ʔa-/ (Raz 1983). Broken plurals are formed by internal adjustment of the consonants and vowels rather than by affixation alone. When the singular form of a noun is of the shape CVCVC in Tigre, the broken plural frequently has an /ʔa-/ prefix.

| | | | |
|-----|-----------------|---------------|----------|
| (8) | <i>Singular</i> | <i>Plural</i> | |
| a. | kəbɪd | ʔa-kbud | ‘belly’ |
| b. | mɪtɪd | ʔa-mtud | ‘stake’ |
| c. | wəɾɪk’ | ʔa-wərrɪk’ | ‘silver’ |
| d. | bɪḥar | ʔa-bḥur | ‘sea’ |
| e. | dɪḥəb | ʔa-dhub | ‘gold’ |

When the initial consonant is a guttural, the /ʔa-/ prefix cannot be used; instead, a different broken plural pattern is adopted.

⁶ This verb is used only in a fixed form with the conjugated auxiliary *bela* ‘to say’: *naʔ^anaʔ bela*.

⁷ There is actually a distinction between the pharyngeals and laryngeals in Tigre. I found no verb roots of the form *Ch*, and only one of the form *Cʔ*. Verbs with pharyngeals in the second position are more common. In Tigrinya there are verbs like *lahlih-* ‘pant from fatigue’ (Buckley 1990).

| | | | | |
|-----|-----------------|---------------|----------------------|-----------------------------|
| (9) | <i>Singular</i> | <i>Plural</i> | | |
| a. | ʔikil | ʔakal | *ʔa-ʔkul | ‘corn, crop’ |
| b. | ħabil | ħabillit | *ʔa-ħbul | ‘rope’ |
| c. | ħiwar | ħawrət | *ʔa-ħwur | ‘foal, small donkey, camel’ |
| d. | ħarib | ħarib | *ʔa-ħrub/*ʔa-ħarrib | ‘water-skin’ |
| e. | ħakil | ħakillit | *ʔa-ħakul/*ʔa-ħakkil | ‘hoe’ |

An explanation based on a ban on gutturals occurring in coda position (McCarthy 1994, Rose 1996) could not account for two aspects of the data. First, this ban normally induces the epenthesis of a vowel following the guttural (e.g., *sʔanə → sʔanə ‘load’), so we might expect a form like ʔa-ʔʔakul in (9a). Second, such an analysis would explain only the plurals of the shape ʔa-GCVC, where the guttural would be in coda position, and not those of the shape ʔa-GVCCVC (by analogy with (8c) ʔa-wərrik’), where the guttural would be in onset position.

Furthermore, it is clear that the [ʔ] of the prefix is not doubly linked at the root to the initial guttural, since in many cases the guttural is a different consonant.⁸ Finally, this is not a ban on two gutturals cooccurring in the same word or in adjacent syllables, as the examples in (8d–e) demonstrate: ʔa-dhub. The relevant environment is two gutturals separated by a vowel.

The same phenomenon is found in verbs with the causative prefix /ʔa-/ in Tigre, shown with regular verbs in (10a–b). If the verb begins with a guttural, either the initial vowel is lengthened as shown in (10c) or, more commonly, the prefix is supplemented with the consonant [t], making it identical to the causative reflexive/passive prefix: /ʔat-/ (10d–e). The verb in (10d–e) also has the extra [ə] between the second and third root consonants characteristic of reflexive forms. All verbs are given in the 3rd masculine singular perfective, marked with the suffix -a.

| | | | | |
|------|---------------|----------|------------------|------------------|
| (10) | <i>Type A</i> | | <i>Causative</i> | |
| a. | kʔəla | ‘kill’ | ʔa-kʔəla | ‘cause to kill’ |
| b. | səbra | ‘break’ | ʔa-sbəra | ‘cause to break’ |
| c. | ħarsa | ‘plough’ | ħa:rəsa | ‘cultivate’ |
| d. | ʔakʔba | ‘guard’ | ʔat-ʔakʔəba | ‘cause to guard’ |
| e. | ħadga | ‘leave’ | ʔat-ħadəga | ‘make leave’ |

A similar avoidance strategy is found with the 1st person singular subject prefix, which is /ʔi-/ in both the imperfective and the jussive, as shown in (11a–d). This prefix does not occur if the root begins with a guttural consonant (11e–h), but it can be realized if another consonant intervenes between the two guttural consonants, either a root consonant as in (11c) or the reflexive /t-/ as in (11g). Finally, with no prefix, the 1st person singular jussive would be identical to the 2nd person masculine singular imperative form [ħidəg] ‘leave!’; to distinguish them, the first stem vowel of the 1st person singular jussive is realized as [i], as in (11h).⁹

⁸ Prunet (1990) analyzes the plural prefix as /ə/ with an epenthetic glottal stop to avoid an onset violation. Either way, the point is the same, that sequences of gutturals are avoided.

⁹ The same phenomenon is found with the 1st person plural marker /ʔin-/ which is realized as [na-] (the shape *Ca-* instead of *Ci-* is due to lowering triggered by the initial guttural): ʔin-səbbir ‘we break’ but na-ħass’ib ‘we wash’. This could be analyzed as being formed by analogy with the 1st person singular. The plural differs from the singular in the imperfective only by the presence of [n]: ʔi- versus ʔin-. In the jussive the 1st person plural has no [ʔ]: ni-sbər ‘let us break’ and ni-ħis’əb ‘let us wash’.

- (11) a. ?i-məzzin 'I weigh'
 b. ?i-səbbir 'I break'
 c. ?i-s'ʕin 'I load'
 d. ?i-sbər 'let me break'
 e. ʕas's'ib 'I wash'
 f. ʕaddim 'I join'
 g. ?i-t-ʕas's'ab 'I wash myself'
 h. ʕidəg 'let me leave'

The double-linking account is incapable of explaining the cases of guttural avoidance outlined above. Furthermore, the examples in (10d–e) and (11c,g) demonstrate that a guttural initial prefix is acceptable if another consonant appears between the guttural consonants. The only possible explanation is that there is a ban on *sequences* of guttural consonants when separated by only a vowel, but not when separated by a consonant. Moreover, no explanation for the Tigre examples is possible in terms of tier segregation. If morphemes are lexically represented on their own tiers (McCarthy 1986b), the two gutturals, belonging to different morphemes, would not be subject to the OCP. They would only reside on the same tier once Tier Conflation had applied and the affix and verb stem were aligned. But once this occurred, the vowel of the prefix would intervene between consonant and vowel. Therefore, the OCP effect must apply between the guttural consonants across the intervening vowel.

2.3 Some Apparent Exceptions

Three kinds of affixes with gutturals appear despite the guttural OCP restriction. These are the frequentative infix, the negative marker /ʔi-/ (e.g., ?i-ʔi-məzzin 'I don't weigh'), and *h*-initial 3rd person possessive and object clitics such as /-hu/ 'his', which occur with vowel-final nouns and verbs: for example, ?ide-ha 'her hand', ʕu-hu 'his brother', simʕa-hu 'listen to him' (the [h] is epenthetic; it does not occur with consonant-final nouns: raʔas-u 'his head'). I claim that the undominated constraint ONSET ('Syllables must have onsets'), unviolated in Tigre, forces insertion of the epenthetic [h] between vowels and forces maintenance of [ʔ] in initial position of the negative marker, despite the OCP violation. See Myers 1997, Yip 1998, and others on the OCP as a violable constraint in OT. With the other guttural affixes, alternative means of expressing the morphosyntactic features are available and are used instead of allowing the OCP violation. Note that in each case the alternative means does not involve simple deletion of the offending affixal guttural, which would leave an ONSET violation.¹⁰

Frequentative reduplication is another case in which a sequence of gutturals is allowed in Tigre and Tigrinya. The frequentative verb form is formed by copying the penultimate consonant

¹⁰ An alternative analysis would be to state that these affixes reside in a domain in which the OCP does not apply or is ranked low. (See Buckley 1996 on constraint domains in OT.) The negative marker and the clitics are the outermost of all affixes that may attach to the verb or noun. If any affixes are impervious to the OCP restriction, it should be those that are the least integrated into the verbal or nominal complex. I claim in section 2.4 that the guttural OCP in Tigrinya is restricted to the basic stem. Lowenstamm and Prunet (1986) also provide evidence that object clitics in Tigrinya form a separate phonological word from the basic stem and therefore escape OCP restrictions (see section 4.2).

as the onset of an infix [a], or [a:] in Tigre. The usual meaning is ‘intensive’ or ‘distributive’ in most Ethiopian Semitic languages, but ‘diminutive’ in Tigre. The following examples are from Tigre:

- (12) a. dəgma ‘tell, relate’ dəgga:gəma ‘tell stories occasionally’
 b. gərfa ‘whip’ gəra:rəfa ‘whip a little’
 c. baʔasa ‘fight’ baʔa:ʔasa ‘fight a little’
 d. saʔana ‘load’ saʔa:ʔana ‘load a little’

If the penultimate consonant is a guttural, reduplication does take place (12c–d), violating the OCP restriction on gutturals. A long-distance geminate analysis would claim that these examples are simply cases of reduplication, and since reduplication is allowed (i.e., forms like *ʕabʕab* ‘incubate, cover to let ripen’), this is entirely as predicted. I propose that these cases can be handled by constraints requiring both reduplication and identity between base and reduplicant to express the frequentative: MAX_{BR} and $IDENT_{BR}$ (Rose, to appear, Buckley 1998).¹¹

- (13) a. MAX_{BR}
 Every element of the base corresponds to an element in the reduplicant.
 b. $IDENT_{BR}$
 Correspondent elements in the base and the reduplicant have identical values for feature F.

The constraint MAX_{BR} requires reduplication as part of the formation of internal reduplication. No other kind of consonant may substitute, so identity of the base and reduplicant consonants is required and ensured by $IDENT_{BR}$. The normal epenthetic consonant in Tigre is [h] (Raz 1983) and in Tigrinya is [ʔ], both gutturals. Failure to reduplicate would result in vowel hiatus, exclusively ruled out: **ba.a:ʔas*. Tigre and Tigrinya flout other constraints in order to realize the frequentative, such as one on multiple reduplication (*nədəd-* → *nəda:dəd* ‘burn again’) and another on the size of the template, allowing frequentatives with five consonants (*məskər* → *məsəkə:kər* ‘testify again’) (Rose, to appear). I conclude that the frequentative base-reduplicant faithfulness constraints outrank not only restrictions on multiple reduplication and templatic size, but also the OCP applied to gutturals.

2.4 Tigrinya and Domains

Affixation in Tigrinya contrasts with affixation in Tigre in allowing sequences of gutturals separated by an intervening vowel across the basic verbal or nominal stem boundary. I claim in this section that the OCP in Tigrinya is in effect within a more delimited morphological domain. Tigrinya patterns similarly to Tigre with respect to the distribution of gutturals in basic verb

¹¹ It should be clarified that in an OT analysis of reduplication, complete identity is not necessary between a reduplicant segment and the base segment it copies, but the two segments are still related to each other via correspondence.

stems, but it allows the affix /ʔa-/ to occur adjacent to root gutturals, as shown in the following causative forms:

| | | | | |
|------|----------------|----------|------------------------|-------------------|
| (14) | <i>Regular</i> | | <i>Causative</i> | |
| | a. ʕayyənə | ‘spoil’ | ʔa-ʕayyənə | ‘cause to spoil’ |
| | b. ʔasərə | ‘arrest’ | ʔa-ʔ ^a sərə | ‘cause to arrest’ |
| | c. ʕaddəgə | ‘buy’ | ʔa-ʕaddəgə | ‘cause to buy’ |

The following plural forms also clearly show that the OCP restriction does not operate across the morphological boundary of the plural prefix /ʔa-/ in Tigrinya. Where available, cognate Tigre words are shown for comparison.

| | | | | |
|------|-----------------|---------------|------------------------|---------------|
| (15) | <i>Tigrinya</i> | | <i>Tigre</i> | |
| | <i>Singular</i> | <i>Plural</i> | <i>Singular</i> | <i>Plural</i> |
| | a. ɸəwi | ‘brother’ | ɸəw | ɸəw |
| | b. ʕof | ‘small bird’ | ʔaɸ ^a waf | |
| | c. ʔom | ‘tree’ | ʔaʔ ^a wam | |
| | d. ʔigri | ‘foot’ | ʔaʔ ^a gar | ʔigir ʔigar |
| | e. ʕarki | ‘friend’ | ʔaɸ ^a rixti | |

The OCP as applied to the gutturals operates at the level of the basic stem in Tigrinya, but at the level of the word in Tigre. That the OCP may be restricted to morphological domains in this manner is not new. Past interpretations of the OCP (Yip 1988), as well as recent reanalyses (Suzuki 1998, Alderete 1997, Itô and Mester 1998), also refer to given domains of application, such as the stem or prosodic word. (See also Buckley 1996 on constraint domains in OT.)

2.5 Gradient OCP and the Intervening Consonant

An OCP restriction on the guttural subclass is independently required to account for the lack of roots containing two different adjacent gutturals. Furthermore, it has been demonstrated that intervening consonants detrimentally affect the strength of the OCP in Semitic roots. Pierrehumbert (1993) and Frisch, Broe, and Pierrehumbert (1997) argue that cooccurrence constraints on Arabic root consonants should be assessed gradiently using a similarity metric (see Berkley 1994 on gradient OCP in English). They show that OCP constraints on homorganic consonants apply over intervening consonants in Arabic roots, but with a far weaker effect than between adjacent consonants. The existence of total-copy verbs with gutturals in Tigre and Tigrinya shows that an intervening consonant reduces or blocks the impact of the OCP over surface sequences of guttural consonants, but an intervening vowel does not. It follows that roots of the shape GCG should also be attested, although they are predicted to be far from numerous. Tigre has several roots of the shape GCG, with either identical or different guttural consonants.

| | | |
|------|----------|---|
| (16) | a. ʕarʕa | ‘cause someone to pasture cattle’ |
| | b. ʔarʔa | ‘shove’ |
| | c. ɸasʕa | ‘lack butter/milk in food; be dry due to lack of oil’ |
| | d. ɸanʔa | ‘twist ankle, leg’ |
| | e. hadʔa | ‘calm down’ |

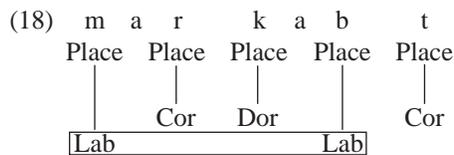
Buckley (1997b) reports 6 occurrences of such roots in his corpus of 2,744 Tigrinya roots (based on da Bassano's (1918) dictionary), all 6 with nonidentical gutturals. It should be pointed out that without considering the OCP the expected number of nonadjacent guttural trilateral roots totals 49,¹² indicating that the OCP may still function across intervening consonants, but only weakly to reduce the likelihood that such a root will occur. The data in (16) and Buckley's results further support the claim that the guttural OCP applies absolutely across intervening vowels, but only weakly across consonants.

2.6 *Locality and the Intervening Vowel*

The conclusion that a vowel intervening between two consonants does not impede the application of the OCP must be assessed with respect to the issue of locality or adjacency. It is well attested that when the OCP applies to features and not whole segments, it may apply across intervening segments (Steriade 1987, Padgett 1992, Odden 1994). In a feature-geometric framework this is often attributed to the hypothesis that features occupy different tiers and that intervening segments unspecified for the feature in question are irrelevant. For example, Akkadian labial dissimilation (von Soden 1969, Hume 1992, Odden 1994, Suzuki 1998) operates across intervening nonlabial consonants within the basic stem (excluding suffixes). The nominalizing prefix /ma-/ dissimilates to [na-] if the stem contains a labial consonant (17c–d).

- (17) a. ma-zuukt 'mortar'
 b. ma-ʃkanu-m 'place'
 c. na-pħar 'totality'
 d. na-rkabt 'chariot'

A tier-dependent analysis of this effect is given by Hume (1992), who attributes it to a constraint against two Labial C-Place articulators. Since the articulators of the other consonants are on separate tiers, they do not intervene, and the two Labial nodes are considered adjacent on the Labial tier, as illustrated in (18).



The Tigre data clearly exhibit a restriction on the guttural subclass and hence the restriction should operate at the level of a featural node such as Pharyngeal (McCarthy 1994), just as the labials do in Akkadian. However, this predicts that intervening consonants, unspecified for Pharyngeal, should not block the restriction in Tigre, and yet they do. An intervening consonant is important

¹² See Pierrehumbert 1993, Buckley 1997a and Frisch, Broe, and Pierrehumbert 1997 for more details on how this figure is calculated.

in Tigre, but immaterial in Akkadian. This suggests that Akkadian has no adjacency restriction, but Tigre does.

Odden (1994) identifies three important parameters of adjacency in accounting for a range of assimilatory and dissimilatory phenomena: root adjacency, syllable adjacency, and unbounded adjacency.¹³ The OCP can be restricted to apply between adjacent segments, between adjacent syllables, or across an entire word. As they stand, none of these parameters can account for the facts in Tigre. The unbounded adjacency of Akkadian clearly does not hold in Tigre, as discussed above, where intervening nonguttural consonants block. If the guttural restriction applied to adjacent root nodes, the vowels would be expected to block since they too have root nodes, yet they do not. If the restriction applied between adjacent syllables, or even adjacent onsets, forms like *?ar?a* ‘shove’ and *?i-t-has’s’ab* ‘I wash myself’ would not be possible. Again, the blocker is an intervening consonant. The CVC configuration does not fit neatly within Odden’s adjacency typology.

As the Tigre guttural OCP applies between adjacent *consonants* even when these are separated by a vowel, I propose that this configuration be incorporated into the adjacency typology.¹⁴

(19) *Consonant adjacency*

Two consonants in sequence are adjacent irrespective of intervening vowels.

Consonant adjacency may also apply in the configuration CC, providing the consonants are non-identical. This allows for dissimilation of root-adjacent and vowel-separated consonants. Both are found in Yimas (Foley 1991), where two liquids are disallowed in root-adjacent position and across a vowel. The perfective suffix /-r/ is realized as [c] following /l/: *ta + mpu + tpul + r + rm* → *tamputpulcrm* ‘they didn’t hit those two’ (p. 255). Elsewhere the /-r/ is deleted following /r/: *wu + r + ra* → *wura* ‘take in hand (perf. sg.)’ (p. 245). Across a vowel the second of two liquids is realized as [t]: *w + ar + ark* → *waratik* ‘make repeatedly’ (p. 54), *apr + ara* → *aprata* ‘open, spread (inchoative)’ (p. 290). I claim in section 3 that identical consonants in a CC configuration are geminates and do not violate the OCP. The adjacency typology thus includes root adjacency

¹³ Transplanar Locality is another parameter, used to assess interaction between consonants and vowels.

Odden (1994) cites many cases where the OCP applies under syllable adjacency. Since all of them involve languages with open syllables, they could be reanalyzed as cases where the OCP applies under consonant adjacency. The only exception is Dahl’s Law (velar voicing dissimilation) in Southern Gikuyu (Davy and Nurse 1982), which appears to be sensitive to syllable adjacency: witness contrasting pairs such as [a.ke.o.ki.ɲa] ‘and he trod on it’ with no voicing dissimilation and [a.yeo.ke.ra] ‘and he got up’ with voicing dissimilation. Davy and Nurse (1982) state that the assignment of the two vowels to separate syllables in the example [a.ke.o.ki.ɲa] is representative of careful speech and possible if the second vowel constitutes a vocalic prefix: /o-/ ‘Class 3 prefix’ or /e-/ ‘reflexive’. In fast speech such examples are pronounced with diphthongization and voicing dissimilation. Dahl’s Law can be suspended in careful speech in other Bantu languages, for example, Gusii: [i.nko.a.ke.aa.ye.te] ‘you hit it’ or [a.ro.ke.te] ‘he was circumcised’, [ka.ko.ro.ma] ‘he (Class 12) is biting’. Despite these examples, the syllable generalization does appear to be robust for Southern Gikuyu, so I will leave aside the issue of replacing syllable adjacency in this article.

¹⁴ *Consonant* refers to all consonants, including consonantal glides. Hume and Odden (1996) argue against the feature [consonantal], but only as traditionally defined to exclude laryngeals and glides. The restriction could also be formulated as “No adjacent C-Place,” but the model of Clements and Hume (1995) assumes that vowels also have C-Place. There may also be a vowel adjacency parameter, but I do not explore this here. See Suzuki 1998 for possible examples, such as Kera, Marshallese, Woleaian, Ainu, and Tzeltal.

(allowing for consonant-vowel dissimilation or consonant-consonant dissimilation), consonant adjacency, syllable adjacency, and unbounded adjacency. Following Suzuki (1998), the OCP may apply under any of these adjacency conditions and can therefore be split into a family of constraints. However, since unbounded adjacency subsumes the other cases, high ranking of a constraint subject to unbounded adjacency entails OCP violations locally and at a distance.¹⁵

The interpretation of consonant adjacency runs afoul of recent assumptions about the internal structure of segments and locality. Gafos (1996) argues that in a CVC configuration the consonant gestures are not local; the intervening vowel prevents interpreting them as such. However, he argues this primarily to prevent *assimilations* between consonants. Clements and Hume (1995) stipulate that both vowels and consonants have a C-Place node, a conclusion that also appears to be partly driven by the need to prevent consonant-consonant assimilation across an intervening vowel. However, in assessing the OCP, which regulates phonotactic constraints, locality is routinely defined over longer strings of segments that are never subject to assimilation. There is no attested assimilation between labial consonants across other consonants, but labials may dissimilate over other consonants at a distance, as seen in the Akkadian example (17). Dissimilatory effects are not subject to the same adjacency requirements as assimilatory ones, a distinction that could follow from constraints on local spreading (Ní Chiosáin and Padgett 1997, Walker 1998). In conclusion, interaction between consonants separated by a vowel is permissible in cases of OCP-triggered dissimilation effects, whereas it may not be permitted for assimilation.

It might appear that consonant adjacency could be analyzed as the OCP applying between onsets in adjacent syllables. Forms like *ʔarʔa* ‘shove’ and *ʔi-t-ħas’s’ab* ‘I wash myself’ in Tigre preclude this analysis, but there are also no examples showing dissimilation between an onset and a coda since gutturals are not allowed in coda position. However, cases of ‘‘syllable-bound’’ OCP effects do bear on the issue, since they involve dissimilation between onset and coda *across a vowel*. One case is that of Seri glottal deletion, cited by Yip (1988), whose discussion in turn is based on Marlett 1981 and Marlett and Stemberger 1983. In Seri the glottal stop of the passive prefix /a:ʔ-/ is deleted if it occurs in coda position following another glottal stop across a vowel: /ʔa-a:ʔ-sanx/ → ʔ-a:-sanx ‘who was carried’ or /ʔi-ʔ-a:ʔ-kašni/ → ʔi-ʔ-a:kašni ‘my being bitten’. This does not occur if the passive prefix precedes vowels: *t-a:ʔ-a:ʔ-itaχ* ‘was it made to burn?’ (Marlett 1981:77). Although Yip interprets this to mean that the ban on glottals is restricted to the domain of the syllable, another interpretation is possible: the OCP is still violated in *t-a:ʔ-a:ʔ-itaχ*, but the glottal stop may not be deleted because of a vowel-hiatus restriction, which is

¹⁵ Suzuki (1998) proposes a proximity hierarchy, designed to capture a range of intervening material in assessing adjacency. Intervening material may be nothing, as in geminate structures (which Suzuki assumes are a sequence of two identical segments), a single consonant, a mora, two moras, two syllables, and so on, ranked according to the following universal format, in which *X* stands for elements affected by the OCP:

- (i) *Proximity hierarchy*
 $X \dots X \{XX \gg *X-C_0-X \gg *X-\mu-X \gg *X-\mu\mu-X \gg X-\sigma\sigma-X \dots \gg X-\infty-X\}$

Although this hierarchy is intriguing, I do not adopt it since it allows too many unattested possibilities (i.e., two moras, two syllables).

consistently respected in Seri, with the exception of abstract consonant-initial stems (Marlett and Stemberger 1983). Thus, Seri can be analyzed as a case of consonant adjacency operating between onset and coda.¹⁶

2.7 Guttural Geminates and the Root/Stem

I have established that guttural restrictions in Tigre and Tigrinya are regulated not by the linked representation of long-distance gemination, but by a general OCP restriction on guttural consonants applying across a vowel. Assuming that guttural geminates in Semitic are doubly linked, they must be ruled out (a) by a separate constraint against guttural geminates, (b) by a surface constraint against a guttural sequence regardless of linking, or (c) by a ban on guttural codas or moraic guttural codas (McCarthy 1994). In both Tigre and Tigrinya an epenthetic [a] is inserted following gutturals to prevent gutturals from appearing in codas, except when they occur word-finally. Since word-final codas are usually analyzed as nonmoraic in Semitic (McCarthy and Prince 1990, Rose 1997, but cf. Buckley 1997a), an analysis banning moraic gutturals does double duty and captures both the lack of guttural codas and the lack of guttural geminates. The constraints on guttural geminates (a) or a sequence of gutturals (b) would also work, but in each case a separate constraint against guttural codas would also be required.

If the guttural sequences in verbs like *saʔaʔ-* are ruled out by the OCP, why are other verbs like *gəfəf-* ‘collect, amass’ allowed, since they would presumably violate the OCP applied to the articulator Labial? I claim that all forms of reduplication are subject to the OCP; verbs such as *gəfəf* exist because formation of triconsonantal verbs via reduplication is more important than obeying the OCP restriction.¹⁷ This analysis holds for all consonants except gutturals, which also show stronger restrictions in nonadjacent positions in the root (Buckley 1997b). The ranking of constraints would be along the following lines, where TEMPLATE is used informally to refer to the expansion of the root to conform to the triconsonantal templatic shape, ranked within a hierarchy of place restrictions (McCarthy and Prince 1993):

- (20) OCP/PHARYNGEAL >>> TEMPLATE >>> OCP/VELAR, OCP/LABIAL >>> OCP/CORONAL

That the gutturals would have a stronger OCP constraint than other places of articulation could follow from markedness theory.¹⁸ The analysis in (20) also avoids duplication between a separate

¹⁶ The Seri case applies only with the passive prefix. Cantonese labial consonant dissimilation is another case often cited as arising from a syllable-bound constraint operating between onset and coda, but Yip (1988) shows that it actually reflects a morpheme structure constraint, as it also applies across syllables in language games.

¹⁷ The rightward nature of Semitic reduplication can be attributed either to affixation, as Gafos (1998) claims, or to a constraint that reduplication copy the rightmost base consonant (Rose 1997). The affixation analysis would encounter problems in explaining the lack of Tigrinya CGG verb stems, since the guttural OCP in Tigrinya does not apply across affix boundaries.

¹⁸ Lombardi (1995) proposes that Pharyngeal is the unmarked place of articulation because of laryngeal consonants. The marked nature of pharyngeal consonants [h ʕ] is due to combinations with other features. Lombardi's account does not take into consideration the behavior of laryngeal consonants depending on contrasts within a language (Rose 1996). This may not be a crucial issue, however, since some languages place OCP restrictions on subclasses of a particular place of articulation (i.e., coronal; also labial—see Elmedlaoui 1995) but not on other places of articulation.

lexical, morpheme structure constraint OCP and the same kind of OCP constraint applying to the output.¹⁹

To conclude this section: I have shown that an apparent similarity between long-distance guttural geminates and true guttural geminates in Tigrinya and Tigre is a coincidence. Sequences of guttural geminates are prohibited because the OCP applies strictly across an intervening vowel, but only weakly across a consonant, whereas guttural gemination is prohibited because moraic guttural codas are banned. This is a welcome result, since it wipes out a potential counterexample to proposals to do away with long-distance geminates, and it does so by making use of an independently necessary mechanism to restrict root formation in the two languages. The proposal that the OCP applies across vowels but not consonants has significant implications, in that it suggests that the OCP may be violated in various areas of the grammar of a language where it was previously thought not to apply. I now turn to one of those cases, that of antigemination.

3 Antigemination

3.1 The Tier Conflation Approach

Antigemination describes the effect whereby a phonological rule, such as syncope, is resisted if the resulting structure would violate the OCP by creating a sequence of adjacent identical segments (McCarthy 1986b). Typical examples are found in Afar, a Cushitic language of Eritrea. A syncope rule deletes unstressed vowels in a peninitial two-sided open syllable (21e–f). This rule is blocked if the consonants are identical (21g–h) (data from Bliese 1981).

- | | | | | | |
|---------|-----------|------------------|----|---------|----------------------|
| (21) a. | digib-t-é | ‘she married’ | e. | digb-é | ‘he married’ |
| b. | wager-t-é | ‘she reconciled’ | f. | wagr-é | ‘he reconciled’ |
| c. | xarar-t-é | ‘she burned’ | g. | xarar-é | *xarré ‘he burned’ |
| d. | danan-t-é | ‘she was hurt’ | h. | danan-é | *danné ‘he was hurt’ |

If the vowel were deleted in (21g–h), the two identical consonants would be adjacent and constitute an OCP violation, as shown for (21h) in (22).

- (22) $\begin{array}{cccccc} d & a & n & a & n & \\ | & | & | & | & | & \\ C & V & C & V & C] & \end{array} \rightarrow \begin{array}{cccc} *d & a & \boxed{n} & \boxed{n} \\ | & | & | & | \\ C & V & C & C] & \end{array}$

In this manner, the OCP acts as a filter on derivations. A crucial assumption under this approach is that if syncope had applied, the OCP violation would not be repaired by automatically fusing the segments to create a geminate. McCarthy (1986b) allows this to occur only when Tier

¹⁹ The analysis in (20) ties in well with recent reinterpretations of the OCP in terms of local conjunction of markedness constraints (Alderete 1997, Itô and Mester 1998). In this theory the OCP is reinterpreted in terms of marked structure occurring more than once in a given domain. A constraint like *PLACE/PHAR is self-conjoined, so that two occurrences are worse than one. This constraint is ranked separately; thus, it is functionally equivalent to a separate OCP/PHAR constraint. I will not adopt the local markedness approach here, as it does not explicitly capture adjacency, a fundamental property of the OCP; see Suzuki 1998 for comparison of local conjunction of markedness and the OCP.

Conflation (the mechanism that aligns separate morphemic tiers) is applied, although Yip (1988) questions this assumption. Cases where antigemination is ignored and syncope applies regardless are attributed to either (a) phonetic implementation rules outside the purview of phonological constraints or (b) separation of vowels and consonants onto distinct tiers, allowing for long-distance geminates. Those languages that resist syncope, like Afar, either must apply syncope following Tier Conflation or must not have vocalic and consonantal tier segregation in the first place. Those languages that allow syncope between identical consonants would apply the rule before Tier Conflation when the identical consonants form a geminate. This is the analysis proposed for Classical Arabic.

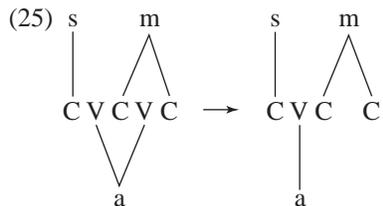
Classical Arabic has a process (referred to as Identical Consonant Metathesis in Brame 1970) that either syncopates or metathesizes a vowel in an open syllable between two identical consonants in the verb stem. Although Brame analyzes syncope as metathesis followed by vowel shortening (/madada/ → [maadda] → [madda] ‘he stretched’), the surface result is loss of the vowel between two identical consonants. A regular Form I (see McCarthy 1979, 1981 on forms or *binyanim*) perfective stem has the shape CVCVC throughout the paradigm: for example, *katab-tu* ‘I wrote’ and *katab-a* ‘he wrote’ (23a,d). A verb with final doubling has the shape CVCC when followed by vowel-initial affixes as in (23e–f) (examples from McCarthy 1986b and Brame 1970).

- (23) a. *katab-tu* ‘I wrote’ d. *katab-a* ‘he wrote’
 b. *samam-tu* ‘I poisoned’ e. *samm-a* ‘he poisoned’
 c. *madad-tu* ‘I stretched’ f. *madd-a* ‘he stretched’

In the imperfective verb form, and in some plural forms, metathesis occurs instead of syncope, as seen in (24d), where the verb stem shape is CVCC instead of the standard CCVC of regular roots as in (24c).

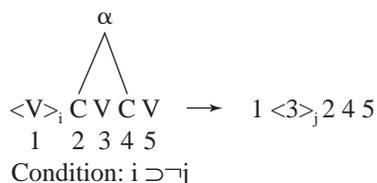
- (24) a. *ta-ktub-na* ‘you (f.pl.) write’ c. *ya-ktub-u* ‘he writes’
 b. *ta-mdud-na* ‘you (f.pl.) stretch’ d. *ya-mudd-u* ‘he stretches’

The verbs with final identical consonants are represented as cases of long-distance gemination. Deleting or displacing the vowel leaves an acceptable geminate structure, as shown in (25).²⁰

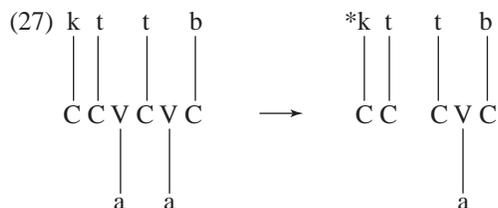


Since the rule applies only between identical consonants, and only between tautomorphic consonants, it is formulated so as to include the long-distance geminate in the representation (McCarthy 1986b), as shown in (26).

²⁰ It is unclear whether the vowel position or just the vowel is deleted. Either way, the point is the same.

(26) *Arabic Identical Consonant Metathesis*

McCarthy (1986b) further points out that consonants originating in other morphemes, such as the infix /t/, which appears in the Form VIII verb measure, are not subject to the metathesis rule: *k-t-atab-a* 'he copied', **kattab-a*. As the infix /t/ is a separate morpheme from the root /t/, they are not represented as a long-distance geminate. Therefore, deleting the vowel would create a sequence of identical consonants, as in (27), violating the OCP.



As seen in (25), the long-distance geminate respects the OCP and antigemination is not violated when syncope applies. Antigemination will only be violated if the consonants are separate and adjacent, which occurs when Tier Conflation splits the segments (22). The syncope of Classical Arabic doubled verbs is therefore a case of syncope applying before Tier Conflation.

This analysis relies crucially on Tier Conflation. Even apart from the fact that the application of Tier Conflation at an intermediate stage in the derivation is incompatible with current OT approaches to phonology and morphology, Tier Conflation has had a checkered and problematic history. Odden (1988) criticizes the separation of consonants and vowels onto distinct tiers, which entails Tier Conflation, and also questions the universality of antigemination. Bat-El (1988) shows how reference to morphemic distinctions is required even following Tier Conflation. Rules that apparently had to apply before Tier Conflation have been reanalyzed: McCarthy (1983) relied on the long-distance geminate representation to capture Chaha floating palatalization, but I have shown (Rose 1994) that Chaha floating palatalization must follow Tier Conflation, and Gafos (1998) and I (Rose 1997) provide reanalyses in terms of reduplicative identity within OT. Banksira (1997) shows that Tier Conflation is irrelevant to Chaha devoicing, which operates on surface representations, rather than operating before and after Tier Conflation as argued by McCarthy (1986a). Gafos (1998) argues that V/C planar segregation and Tier Conflation are overly powerful tools that are not required if long-distance geminates are reanalyzed as reduplication as in (4). In the following section I will show that the alternative interpretation of the OCP that I proposed in section 2 for Tigre gutturals, combined with the rejection of long-distance geminates and Tier Conflation, does not create a problem for analyzing antigemination, but actually explains more effectively why syncope in a language like Classical Arabic applies only between identical consonants.

3.2 Antigemination as OCP Violation

To explain the difference between Classical Arabic and Afar without appealing to Tier Conflation and long-distance geminates, I apply the proposals made in section 2 for Ethiopian Semitic gutturals and make the following assumptions:

- (28) a. A surface sequence C_iVC_i violates the OCP under consonant adjacency.
 b. Any surface C_iC_i sequence in a given domain is a geminate and does not violate the OCP.

I assume that any *output* sequence of two identical consonants within the same domain (i.e., prosodic word, basic stem) constitutes a geminate, a single consonant with a long duration. This is in line with phonetic evidence, which has found no distinction between surface true and fake geminates, as documented by Miller (1987) for Levantine Arabic. See also Boersma's (1998:427) statement that "adjacent identical gestures may be heard as a single gesture." Therefore, when syncope applies between two identical consonants, a geminate automatically results, an assumption also made by Kisseberth (1970) and Yip (1988). I follow Keer (1998) in proposing that coalescence of two segments violates only IDENT constraints pertaining to features and not the constraint UNIFORMITY (McCarthy and Prince 1995). Given this assumption, it follows that coalescence of identical segments violates no faithfulness constraints. Keer argues that fusing adjacent identical segments is always preferred to leaving them separate, as two separate segments would violate markedness constraints (i.e., *LAB, *COR) twice rather than once. They would also violate the OCP. This hypothesis entails that underlying geminates will always be a single input consonant by Lexicon Optimization (Prince and Smolensky 1993) and that any geminates arising from syncope will automatically fuse and be represented as a single gesture with long duration.²¹ This also ensures that a geminate resulting from syncope does *not* violate the OCP. The distinction between a "true" geminate and a "fake" geminate, as in Tigrinya (Kenstowicz 1982), arises from morpheme concatenation. I maintain that the different phonological behavior of fake and true geminates can be attributed to their morphological affiliation, a point I will elaborate on in section 4. Odden (1988) provides evidence that identical adjacent consonants even in separate words may resist regular epenthesis in languages as diverse as Yir Yoront, Tondano, and Icelandic, suggesting that (28b) may even be applicable across word boundaries in some languages.

Turning now to the individual analyses, I propose that syncope applies in Classical Arabic final doubled verbs precisely to avoid violating the OCP operating under consonant adjacency. This directly contradicts the antigemination analysis in McCarthy 1986b, which argues that a pre-Tier Conflation C_iVC_i configuration does not violate the OCP. But the antigemination analysis offers no explanation for why syncope would apply only when the flanking consonants are identical. This is built into the description of the rule as a stipulation. The analysis proffered here provides an explanation: to avoid an OCP violation. Nevertheless, the two analyses do coincide

²¹ Myers (1997) allows two adjacent H tones to surface in a winning candidate, but the second is realized phonetically as downstep. Different phonetic behavior of fake and true geminates, however, is unattested.

in that the structure resulting from syncope is analyzed in both cases as a geminate. The analysis I propose is inspired not only by the Ethiopian Semitic data, but also by data discussed by Hoberman (1988). He cites several examples from different Semitic languages, where gemination (in his terms, local spreading) is preferred to long-distance spreading. In Syriac, for example, biliteral roots are positioned to avoid vowels occurring between identical consonants (29c–d), even if this violates the normal left-to-right distribution of root consonants in Semitic (29a–b), and results in discrepancies between the members of the paradigm.

- (29) *Root* pk ‘smash’ *Root* ktb ‘write’
- | | | |
|------------------------|----------|-------------------------------------|
| a. pekk-et | ketb-et | Class I perfect 1sg. |
| b. paakk-aa | kaatb-aa | Class I active participle 2sg. fem. |
| c. te-ppok *te-pkok | te-ktob | Class I imperfect 2sg. masc. |
| d. appek *apkek | akteb | Class IV perfect 3sg. masc. |

In my terms, the OCP would be violated in a sequence such as *-pkok*, but not in a sequence such as *-ppok* because [pp] is a geminate. Syriac prefers gemination to violating the OCP.

To account for Form I verbs (23), a constraint preventing geminates (NO-GEM) is necessary in addition to the OCP, as well as familiar faithfulness constraints within correspondence theory such as MAX_{IO}, which prevents deletion. NO-GEM is expressed as a ban on long consonants.

- (30) a. *NO-GEM*
 Long consonants are disallowed.
- b. *OCP-[C-Adj]*
 A sequence of adjacent identical segments is disallowed (consonant adjacency).
- c. *MAX_{IO}*
 Every element of the input has a correspondent in the output.

In Classical Arabic the OCP must be ranked higher than NO-GEM to account for cases where syncope occurs only when the consonants are identical, but not elsewhere. It must also be ranked higher than MAX_{IO}. The output of syncope [madda] in (31a) violates NO-GEM and MAX_{IO}, but unlike the losing candidate in (31b), it does not violate the OCP.²² I abstract away from the nature of the input and represent the root-aspect vowel complex as a fully formed stem, which may be concatenated at a different level. See Orgun 1996 on morphological levels in OT.

- (31) *madda* ‘he stretched’

| /madad-a/ | OCP | MAX _{IO} | No-GEM |
|------------|-----|-------------------|--------|
| ☞ a. madda | | * | * |
| b. madada | *! | | |

²² The candidates *mada* and *maada* in which the consonant is deleted would violate a high-ranking constraint against consonant deletion. They would also violate constraints on templatic shape and MAX_{BR}, as no reduplication is apparent in the output form.

A regular verb would not undergo syncope since there are no violations of the OCP, as shown in (32).

(32) *kataba* ‘he wrote’

| /katab-a/ | OCP | MAX _{IO} | No-GEM |
|-------------|-----|-------------------|--------|
| a. katba | | *! | |
| ☞ b. kataba | | | |

This analysis provides an explanation for why syncope occurs only between identical consonants. Although it is certainly plausible that there is a constraint requiring syncope of unstressed vowels in open syllables, it would necessarily be ranked below MAX_{IO}. Such a constraint will be necessary for other languages such as Afar and other dialects of Arabic, which have more widespread syncope, but the driving force behind the deletion of the vowel in Classical Arabic is the OCP violation. The same ranking, OCP >> No-GEM, also drives the metathesis effects illustrated in (24). No reference is made to long-distance geminates or Tier Conflation in this analysis. The rankings in (31), combined with the new interpretation of the OCP, provide a more insightful account of the syncope effects in Classical Arabic than previous analyses, which were forced to stipulate the identical consonants in the structural description of the rule. Furthermore, languages that display similar deletion effects between identical consonants (i.e., Maliseet-Passamaquoddy, Koya; see Odden 1988) may be analyzed the same way without relying on an otherwise unwarranted (i.e., not driven by the morphology) separation of vowels and consonants onto distinct tiers.

Before discussing antigemination cases, I would like to address the problematic Form VIII *ktataba* ‘he copied’ in Classical Arabic. Recall that the Tier Conflation explanation for the verb’s failure to undergo metathesis to *[kattab-] relied on the stipulation that the rule apply only to long-distance geminates. In addition, the two instances of [t] have separate representations under the Tier Conflation hypothesis, and bringing them to adjacent positions via metathesis would violate the OCP. There are two problems with assuming that the consonants would violate the OCP if the vowel were deleted. First, according to the morphemic tier hypothesis, the two instances of [t] would be on separate morphological tiers at the point at which syncope applies, so no OCP violations would occur. An OCP violation could occur after Tier Conflation applied, since the two instances of [t] would then be adjacent. But McCarthy (1986b:257) states that Tier Conflation automatically fuses separate adjacent identical consonants into true geminates, so the structure should be legitimate. Second, if the application of the OCP to two adjacent consonants is really responsible for blocking metathesis, we might expect metathesis or another avoidance strategy to apply when the root begins with a [t], which should also place two separate consonants in adjacent position ([t-t-abaʕ-] ‘follow, pursue, investigate’), yet this does not occur (*[tatbaʕ]). Of course, if metathesis is stipulated to apply only to long-distance geminates, such a response would be ruled out, and the metathesis rule would be inapplicable to [kataba-]. I have already shown the weakness of an approach that stipulates the linked representation in the rule formulation. I

propose instead that the failure of metathesis to apply in [katab-] is due to a constraint on morphosyntactic feature realization requiring distinctness between forms (Gnanadesikan 1997, Rose 1997, Urbanczyk 1998, Walker 1998). If metathesis were to apply, the output would be identical to Form II—*kattab*—and would violate constraints on morphological distinctness. Form II ‘causative’ is indicated morphologically by gemination of the medial consonant, whereas Form VIII ‘reflexive’ is conveyed by the position of the affix [t] following the first consonant. This does not entail that a given verb must have a Form II for the metathesis to fail to apply, only that if metathesis did apply, the verb would no longer resemble Form VIII and would be identical to a Form II causative. Tolerating the OCP violation induced by the two instances of [t] is preferable to violating distinctness of morphological expression.

Let us turn now to Afar. Bliese (1981) notes that the identity condition on syncope is unexpected since Afar has geminate consonants. This would seem to suggest that NO-GEM should not outrank the OCP. However, given the violable nature of constraints in OT, NO-GEM does not need to be a surface-true exceptionless condition in a language in order to manifest its presence. It is sufficient for it to be ranked higher than the OCP. In Afar, syncope occurs in regular verbs, so a constraint is necessary to capture it. I informally label the constraint *DELETE*²³ and it must outrank MAX_{IO}, as shown in (33).

(33) *digibe* ‘he married’

| /digib-e/ | DELETE | MAX _{IO} |
|-------------------|--------|-------------------|
| a. <i>digibe</i> | *! | |
| ☞ b. <i>digbe</i> | | * |

For a verb with consonant repetition, we must consider the other constraints NO-GEM and the OCP. NO-GEM must be ranked over the OCP,²⁴ and over the syncope constraint DELETE, since no deletion occurs. The resulting form violates the OCP, but this is preferable to violating NO-GEM, as (34) illustrates.

(34) *danane* ‘he was hurt’

| /danan-e/ | NO-GEM | DELETE | MAX _{IO} | OCP |
|--------------------|--------|--------|-------------------|-----|
| ☞ a. <i>danane</i> | | * | | * |
| b. <i>danne</i> | *! | | * | |

Thus, Afar is a paradigm case of antigemination: it avoids creating geminates. McCarthy (1986b) shows how syncope does apply between two identical consonants that belong to different mor-

²³ This could be formulated as a ban on adjacent light open syllables. See Zawaydeh 1997.

²⁴ I have found little extra evidence to support this ranking over the opposite one. Violations of both constraints abound. One potential case is that vowel-final (feminine) nouns form the plural by reduplicating the last consonant and adding [a]: *amo* ‘head’, *amooma* ‘heads’ (Bliese 1981:177). Consonant-final (masculine) nouns form the plural by adding a suffix *-wa*: *alib* ‘tendon’, *alib-wa* ‘tendons’. If reduplication were applied to consonant-final stems, a geminate would result: **alib-ba*. Derived gender is also formed by applying the same reduplication strategy to both feminine and masculine vowel-final nouns, but derived gender is not marked on consonant-final nouns.

phemes in Afar. This is to be expected if the OCP is limited to certain morphological domains. I return to this in section 4.

Though space limitations preclude my reanalyzing the numerous other examples of antigemination and post- and pre-Tier Conflation rules given in McCarthy (1986b) and the other relevant examples in Yip 1988 and Odden 1988, I note that all are amenable to reanalysis in terms of the OCP applying under consonant adjacency. A further consequence of the analysis presented here is that the lack of syncope between identical consonants can be directly tied to the overall lack of geminates in some languages, for which a NO-GEM constraint is clearly necessary. Under the antigemination account, only the OCP is argued to be relevant in syncope. For example, Kisseberth (1970) claims that Tonkawa syncope does not apply between reduplicated consonants precisely because the language lacks geminates: for example, /picena-ʔ/ → [picnoʔ] ‘he cuts it’ but /hewawaʔ/ → [hewawoʔ] ‘he is dead’. McCarthy (1986b) argues that Kisseberth’s gemination explanation is inferior to one relying on antigemination. However, his objections are based on (a) the assumption that the output of syncope would not be a true geminate and (b) the fact that geminates arise in the language via morpheme concatenation. Both of these objections can be addressed within the present theory. The output of syncope does violate NO-GEM; my interpretation coincides with Kisseberth’s view of surfacing geminates. Second, in many languages without underlying geminates (e.g., English, Modern Hebrew), geminates may arise at morpheme boundaries or via assimilation. This only suggests that NO-GEM is very high ranking but not completely undominated, as permitted within OT. Constraints on faithfulness would prevent deletion of input segments despite creation of geminates. Given the hypothesis that input geminates always consist of a single segment (Keer 1998), the only faithfulness constraint violated by simplification of a tautomorphic geminate would be MAX- μ . A heteromorphic geminate, on the other hand, results from the concatenation of two separate input consonants. Deleting one of these will violate MAX-C in addition to MAX- μ . The ranking of NO-GEM with these two faithfulness constraints on segments and moras gives a three-way typology of languages with geminates.

- (35) a. *Language with no geminates*
 NO-GEM \gg MAX-C, MAX- μ
 b. *Language with only heteromorphic geminates*
 MAX-C \gg NO-GEM \gg MAX- μ
 c. *Language with heteromorphic and tautomorphic geminates*
 MAX-C, MAX- μ \gg NO-GEM
 MAX- μ \gg NO-GEM \gg MAX-C

The interaction of these constraints does not produce a system that allows tautomorphic geminates but disallows heteromorphic geminates by deletion. As far as I know, this is a correct prediction.

3.3 NO-GEM and Epenthesis

In languages that have no geminates on the surface, NO-GEM will necessarily be highly ranked, in many cases above the OCP. It follows that epenthesis or deletion may occur to prevent geminate structures from arising on the surface. Deletion occurs in Burum (Gasaway 1997), a Papuan

language of the Finisterre-Huon group: /ek-ket/ → [eket] ‘they saw’ or /nen-nini/ → [nenini] ‘our sister’. Epenthesis is reported in Yimas (Foley 1991), another Papuan language. Underlying /mml/ is realized as [mimil] ‘Javanese file snake’ and identical consonants in different morphemes are separated by epenthesis: /nakatimayk-kiak/ → *nakatimaykikiak* ‘I call him’. Unlike in English or Modern Hebrew, in these languages the geminate ban is absolute, even eliminating geminates that might arise through morpheme concatenation. More challenging is the behavior of “long-distance” geminates in a Semitic language that places restrictions on geminates, the subject of this section.

Chaha and Muher are two closely related Ethiopian Semitic Gurage languages. Both languages have biliteral verbs with final doubling (i.e., long-distance geminates). However, Muher has geminate consonants, whereas Chaha has geminates only in certain restricted environments: word-finally in participles used as part of compound verbs, word-initially preceded by an epenthetic vowel in a small group of nominals, and across morpheme boundaries with certain sonorant-initial affixes (see Banksira 1997:70, 116, 154, 158 for details). The location of the geminates at word edges suggests that they have arisen via morpheme concatenation, but I have no explicit evidence to support this hypothesis for all cases. In all other areas in which Muher has geminates, cognate Chaha words have a single surface consonant.

The “long-distance” geminates (or biliteral roots with reduplication) behave differently in the two languages. In the imperfective form of the verb, there is normally no epenthesis between the two final consonants of a triliteral root if a suffix is added, no matter the nature of the consonants.

| | | | |
|------|-------------|---------------------|---|
| (36) | <i>Root</i> | <i>Imperfective</i> | |
| | Muher | kft | yi-kəft- <i>im</i> ^w -t ‘they open (m.pl.)’ |
| | | sβr | yi-səβr- <i>im</i> ^w -t ‘they break (m.pl.)’ |
| | Chaha | kft | yi-kəft-o ‘they open (m.pl.)’ |
| | | sβr | yi-səβr-o ‘they break (m.pl.)’ |

The only exception to this is found in final doubled verbs, formed from biliteral roots. In Muher, which allows geminates, there is no epenthesis between the consonants. In Chaha, which generally does not allow geminates,²⁵ epenthesis separates the two identical consonants.

| | | | |
|------|-------------|---------------------|--|
| (37) | <i>Root</i> | <i>Imperfective</i> | |
| | Muher | sd | yi-sədd- <i>im</i> ^w -t ‘they (m.) chase’ |
| | | mz | yi-məzz- <i>im</i> ^w -t ‘they (m.) extract from a bundle’ |
| | | df | y-a-dəff- <i>im</i> ^w -t ‘they (m.) lie in wait’ |
| | Chaha | sd | yi-sədīd-o ‘they (m.) chase’ |
| | | mz | yi-məziz-o ‘they (m.) extract from a bundle’ |
| | | df | y-a-dəfif-o ‘they (m.) lie in wait’ |

²⁵ But see Banksira 1997, where it is argued that Chaha has underlying geminates that are simplified on the surface in all contexts except those listed above. Note that words with double *z* have a tendency to form geminates in Chaha: for example, *yifəzz* ‘it is better’ rather than *yi-fəziz*. Thus, *yiməzizo* can also be pronounced as *yiməzzo*. I have no explanation for why [zz] is favored.

As shown in (38), the Chaha data can be accounted for by ranking NO-GEM higher than the OCP and the faithfulness constraint preventing epenthesis, DEP_{IO}, ‘‘Every element of the output has a correspondent in the input.’’

(38) *yisədido* ‘they (m.) chase’

| | No-GEM | DEP _{IO} | OCP |
|-----------------------|--------|-------------------|-----|
| ☞ a. <i>yisədīd-o</i> | | * | * |
| b. <i>yisədd-o</i> | *! | | |

Because Muher freely allows geminates, NO-GEM is ranked lower than DEP_{IO} and no epenthesis occurs to prevent gemination.

Unlike in the verb forms, in other cognate words that have geminates in Muher we find a single consonant in Chaha, not epenthesis: for example, Chaha *kimir* versus Muher *kimmir* ‘pile’ (Leslau 1979). We can reasonably assume that Chaha had surface geminates at one time, since we find traces of them. Devoiced obstruents occur where geminates are found in Muher: for example, Muher *səbbər-* versus Chaha *səpər-* ‘break’. Geminate integrity (the resistance of geminates to epenthesis; Hayes 1986) can be captured by the ranking NO-GEM >> OCP >> MAX_{IO} (i.e., it’s better to simplify the geminate by deleting a mora than to insert a vowel and violate the OCP). The final-doubling verbs bypass the NO-GEM >> OCP >> MAX_{IO} ranking because of a higher-ranked constraint on templates. I argued in section 2 that the templatic size constraint forces reduplication with biliteral roots in Semitic. The templatic size constraint on the verb is satisfied if epenthesis applies, but would be violated by lack of reduplication (i.e., *səd-o*). Thus, epenthesis applies regardless of the OCP violation it entails. No size constraint is in force for the nouns, and simplification of the geminate is chosen instead of epenthesis, in order to avoid an OCP violation. In the next section I will show how the Chaha case fits into the typology of interaction among the OCP, NO-GEM, and the faithfulness constraints MAX and DEP.

Under a Tier Conflation/long-distance geminate analysis, the Chaha/Muher data prove problematic, partly because the mechanics of Tier Conflation are not clearly defined. Since Chaha allows long-distance geminates but disallows geminates, there must be some means to distinguish them, namely, an (empty) vowel position between the two final consonant slots: *sədVd* (Rose 1992, Prunet 1996, Prunet and Petros (Banksira) 1996, Banksira 1997). If there were no vowel position, the (disallowed) geminate would not be split by epenthesis in Chaha, either before or after Tier Conflation, as this would violate geminate integrity. But even adopting the empty vowel slot raises problems. It is unclear whether (a) the mere presence of the vowel slot causes the long-distance geminate to split, or (b) a lexical vowel occupying a templatic slot is necessary to separate a long-distance geminate. Under scenario (a) the long-distance geminate should break apart in both Chaha and Muher, resulting in a sequence of two identical consonants in each case, a violation of the traditional OCP (unless fusion of the offending consonants is an option in Muher—but McCarthy (1986b) states that fusion is a consequence of Tier Conflation alone). Under scenario (b) the long-distance geminate should remain after Tier Conflation. No epenthesis would be

necessary even in Chaha since the structure is *not* a true geminate, and the surface form *yisaddo* ‘they (m.) chase’ is incorrectly predicted for both Chaha and Muher. This kind of fact is unproblematic within the present analysis. NO-GEM must be a high-ranked constraint in Chaha to account for the lack of geminates in the language in general. By ranking it over DEP, we allow epenthesis to apply to prevent creation of any geminates on the surface, even when epenthesis is not independently necessary for syllabification.

3.4 Range of Identity Effects in Syncope and Epenthesis

Comparison of Afar and Classical Arabic responses to syncope illustrates just two of the possibilities available to indirectly reference identical consonants in syncope or epenthesis processes by using two well-motivated constraints, the OCP and NO-GEM. Odden (1988) summarizes the kinds of syncope and epenthesis rules that occur in languages and the relevance of identical consonants. The cases he discusses can be accounted for by ranking NO-GEM and the OCP with respect to faithfulness constraints (DEP and MAX) and whatever constraints drive epenthesis (INSERT) and syncope (DELETE). The deletion cases and relevant languages are given in (39).

- (39) a. *Delete a vowel unless flanking Cs are identical* (Afar)
 NO-GEM >> DELETE >> MAX, OCP
 NO-GEM >> DELETE, OCP >> MAX
- b. *Delete a vowel blindly* (Hindi, Klamath, Maltese Arabic, Akkadian)
 DELETE >> MAX, NO-GEM, OCP
- c. *Delete a vowel only if flanking Cs are identical* (Classical Arabic, Koya, Telugu)
 OCP >> MAX, NO-GEM >> DELETE
 OCP >> MAX >> DELETE, NO-GEM

Case (39a) is Afar resistance to syncope (antigemination), captured with either ranking. Blind deletion (39b) is found when DELETE is ranked above all other constraints, which are not crucially ranked with respect to each other. Odden cites Hindi, Klamath, Maltese Arabic, and Akkadian as languages of this type, in which vowels are deleted even if the flanking consonants are identical. If MAX is ranked over DELETE as in (39c), then no deletion occurs, unless there is a high-ranked constraint such as the OCP forcing deletion. Thus, deletion occurs only when the OCP-violating configuration C_iVC_i would otherwise result. This is the Classical Arabic syncope case; Odden also cites non-Semitic examples, among them Koya and Telugu.

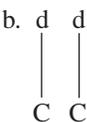
The insertion cases are similar. Epenthesis applies everywhere except when a violation of the OCP would occur (40a). Geminate integrity could be recast under this ranking as a special case of OCP avoidance. Geminate integrity is found in a language like Palestinian Arabic, where epenthesis occurs between two word-final consonants, but not if they form a geminate. I will return to this in section 4, as it touches on the issue of true versus fake geminates. Epenthesis applies everywhere in the case described in (40b); Odden cites Yimas, Chukchi, and Hua as languages of this type. In (40c), where DEP is ranked above INSERT, epenthesis applies only when a violation of NO-GEM would otherwise occur, as in Chaha or Lenakel.

- (40) a. *Insert a vowel unless flanking Cs are identical* (Palestinian Arabic)
 OCP >> INSERT >> DEP, NO-GEM
 OCP >> INSERT, NO-GEM >> DEP
- b. *Insert a vowel blindly* (Yimas, Chukchi, Hua)
 INSERT >> DEP, NO-GEM, OCP
- c. *Insert a vowel only if flanking Cs are identical* (Chaha, Lenakel)
 NO-GEM >> DEP >> INSERT, OCP
 NO-GEM >> DEP, OCP >> INSERT

In conclusion, ridding phonological theory of Tier Conflation and long-distance geminates does not deprive us of an account of antigemination. On the contrary, by appealing to two general constraints on identical consonants, NO-GEM and the OCP, I have shown how the ranking of these constraints with respect to faithfulness constraints captures the syncope and epenthesis processes that refer to identical consonants, without incorporating that reference directly into the syncope or epenthesis rules themselves. Furthermore, this account explains why epenthesis and syncope occur *only* when the flanking consonants are identical, an insight that was missing in previous analyses. Finally, it obviates the need for V/C segregation in languages that otherwise show no evidence for it. In the following section I return to the distinction between fake and true geminates.

4 Fake versus True Geminates

One of the intriguing results to emerge from autosegmental theory was the difference between fake and true geminates. Fake geminates arise in the course of the derivation as morphemes are concatenated or if syncope applies. True geminates are underlying or may be produced through total assimilation of one consonant to another. A true geminate is doubly linked (41a), whereas a fake geminate is a sequence of two identical consonants (41b).

- (41) a.  b. 

In this article I have taken the position that the output of syncope between identical consonants produces a geminate, which violates the constraint NO-GEM. As stated earlier, this is in line with phonetic evidence. In this section I will examine two classic cases of fake and true geminates and show how the notion of morphological domains helps capture their behavior.

4.1 Palestinian Arabic and OCP Domains

A typical example of how fake and true geminates behave differently is found in Palestinian Arabic. In this dialect epenthesis splits word-final clusters, but does not affect true geminates (42c) (Abu-Salim 1980). Fake geminates, which arise from the concatenation of a suffix with a consonant-final stem, pattern like other consonants in inducing epenthesis. In (42e) the 1st person singular suffix /-t/ is attached to a *t*-final stem and epenthesis ensues.

- (42) a. ʔakl → ʔakil 'food'
 b. ʔibn → ʔibin 'son'
 c. sitt *sittit 'grandmother'
 d. sitt-na → sittna *sittitna 'our grandmother'
 e. fut-t → futit *futt 'I entered'

The ranking OCP >> No-GEM, one means of capturing geminate integrity, can account for (42c), but not (42e), for which *[futt] would be expected. The representational approach handles these cases because only true geminates can be subject to geminate integrity.

The representational approach makes no reference to morphological affiliations, but it is clear that the two instances of [t] in [futit] belong to different morphemes, whereas the geminate [tt] in [sittit] is wholly contained within a single morpheme. As discussed in section 2, the OCP may apply within certain domains, such as an internal stem or a phonological word. If the OCP applies only within the basic stem in Palestinian Arabic, we can account for the epenthesis that appears to disregard the OCP.²⁶ In (42c) the OCP would be violated if epenthesis occurred within the morpheme. The other constraints, such as No-GEM and No-COMPLEX-CODA, are unranked with respect to each other.

- (43) *sitt* 'grandmother'

| /sitt/ | OCP | No-GEM | No-COMPLEX-CODA |
|-----------|-----|--------|-----------------|
| a. sittit | *! | | |
| ☞ b. sitt | | * | * |

As for the form *futit*, if the high-ranked OCP applies only within the basic stem, it is not violated, and epenthesis may occur. (For an alternative approach to domains of application using different constraint rankings, see Buckley 1996.)

- (44) *futit* 'I entered'

| /fut-t/ | OCP | No-GEM | No-COMPLEX-CODA |
|------------|-----|--------|-----------------|
| ☞ a. futit | | | |
| b. futt | | *! | * |

There are other cases of geminate integrity in Palestinian Arabic. The definite article /l-/ assimilates totally to a following coronal. As (45d–f) illustrate, total assimilation results in a geminate.

²⁶ A constraint such as INTEGRITY (McCarthy and Prince 1995; 'No element of the input has multiple correspondents in the output') could also be used to capture the resistance of geminates to epenthesis. However, if the effects can be derived from the interaction of the OCP with other constraints, then INTEGRITY will not be required.

- (45) a. l-ʔamar ‘the moon’
 b. l-walad ‘the boy’
 c. l-furun ‘the oven’
 d. ʃ-ʃams ‘the sun’
 e. z-zalame ‘the man’
 f. t-talaata ‘Tuesday’

Assimilation confirms phonological integration of the /l-/ prefix with the noun stem. Guerssel (1978) argues that assimilation across a morpheme boundary serves to obliterate the boundary. Epenthesis in the middle of such a geminate would violate the OCP: *zizalame. This prediction can be tested on words beginning with two consonants. Palestinian Arabic syllable structure disallows CCC sequences (i.e., three timing positions filled by consonants), even across words, and epenthesis normally occurs between the first two consonants of the three-consonant sequence (46a–b). If there are four consonants, it occurs between the second and third: CCiCC (46c). However, with a geminate resulting from total assimilation (46d), epenthesis occurs after the first consonant—CiCCC—and not internal to the geminate.

- (46) a. l-walad i kbiiir ‘the boy is big’
 b. l-walad i zyiiir ‘the boy is small’
 c. l-walad likbiiir ‘the big boy’
 d. l-walad iz-zyiiir *lizyiiir/*zizyiiir ‘the small boy’

The example in (46d) violates both the ban on CCC sequences and the constraint on geminates. Assimilation is more important than obeying either of these restrictions; hence, the constraint requiring assimilation must be highly ranked. ASSIMILATION can be loosely formatted as follows: ‘In a sequence coronal₁-coronal₂, align left edge of coronal₂ gestures with left edge of coronal₁.’ In (47a–b) ASSIMILATION has failed to apply. In (47c–d) ASSIMILATION applies, but (47c) incurs a violation of the OCP, which is ranked above NO-GEM.

- (47) l-walad izzyiiir ‘the small boy’

| /... l-zyiiir/ | ASSIMILATION | OCP | No-GEM | No-CCC |
|----------------|--------------|-----|--------|--------|
| a. lizyiiir | *! | | | |
| b. lzyiiir | *! | | | * |
| c. zizyiiir | | *! | | |
| ☞ d. zzyiiir | | | * | * |

Unlike in Palestinian (and Moroccan) Arabic, in Algerian Arabic assimilation is suppressed if the output would create a sequence of three consonants (Guerssel 1978): /t-drəb/ → [tədrəb] ‘you hit’—not *[ddrəb], which is the cognate verb form in Moroccan Arabic. This shows that the constraint against a triconsonantal cluster outranks ASSIMILATION in Algerian (Guerssel (1978)

captures it via rule ordering). In summary, it is possible to capture the different behavior of fake and true geminates in Palestinian Arabic without explicit reference to their linked representation.

4.2 Tigrinya Spirantization

Tigrinya spirantization is another classic case of a representational distinction between fake and true geminates (Schein 1981, Kenstowicz 1982, Lowenstamm and Prunet 1986). Voiceless velar stops [k k'] and their labialized counterparts [k^w k^w'] are spirantized in postvocalic position. The spirantized version of the velar ejective has various pronunciations ranging from [χ] to [ʕ] to [ʔ].²⁷ I transcribe it in all the following examples as [x'].

- (48) a. kəlbi 'dog'
 b. ʔa-xlab 'dogs'
 c. k'ət̪il-u 'he killed'
 d. ti-x'ət̪l-i 'you (f.sg.) kill'

The verb forms in (49) illustrate the alternations between stops and fricatives. In the imperfective form the medial consonant is geminated as part of the paradigm. If it is a voiceless velar, it is not spirantized.

| (49) <i>Perfective</i> | <i>Imperfective</i> | <i>Jussive</i> | |
|------------------------|---------------------|----------------|---------------|
| kəfətə | yi-xəffit | yi-xfət | 'open' |
| məxərə | yi-məkkir | yi-mkər | 'advise' |
| məx'əzə | yi-məkk'iz | yi-mk'əz | 'cut (hair)' |
| bətəxə | yi-bəttix | yi-btəx | 'sever, snip' |

Other cases of gemination are found with object clitics (Kenstowicz 1982). Vocalic clitics cause optional gemination of the preceding consonant of the stem (50a–c). Velars geminated by this process are not spirantized (50b–c). Consonant-initial object clitics trigger gemination if the preceding segment is a vowel (50d–e). Again, velar geminates do not spirantize (50e). When the geminate is derived via complete assimilation, no spirantization occurs either. This is found with the passive prefix /t-/, which undergoes total assimilation to the following root consonant, as in (50f–g).

| | | |
|--------------------|-------------------------|----------------------------|
| (50) a. yi-sbər-o | [yisbərro]/[yisbəro] | 'let him break it' |
| b. yi-btək-o | [yibtəkko]/[yibtəxo] | 'let him sever, snip it' |
| c. yi-barik-o | [yibarikkko]/[yibarixo] | 'let him bless him' |
| d. k'ət̪əl-u-ni | [k'ət̪əlunni] | 'they killed me' |
| e. məxər-u-ka | [məxərukka] | 'they advised you (m.sg.)' |
| f. yi-t-kəfət | [yikkəfət] | 'let it be opened' |
| g. yi-t-k'ət'k'ət' | [yikk'ət'k'ət'] | 'let him be beaten up' |
| | cf. [təx'ət'k'ət'e] | 'he beat up (someone)' |

²⁷ The ejective stop [k'] is sometimes transcribed as [q]. In southern Tigrinya /k k'/ are also spirantized following gutturals and glides (Denais 1990, Berhane 1991).

However, when two identical voiceless velars abut across a morpheme boundary, the first one spirantizes.

- (51) a. *m̄irax-ka* 'your (m.sg.) calf'
 b. *ʔamlax-kum* 'your (m.pl.) god'
 c. *yi-barix-ka* 'he blesses you (m.sg.)'
 d. *barix-ki* 'you (f.sg.) blessed'

Spirantization applies to heteromorphemic or fake geminates, but not to true geminates.

First, let us consider why geminate consonants are immune to spirantization. There must be a ban on geminate velar fricatives: *[xx]. Kirchner (1998) shows that geminate fricatives are disfavored crosslinguistically because greater effort is needed to maintain the constriction over a longer duration. Further support within the Ethiopian Semitic family comes from the Gurage language Muher, in which tautomorphemic geminate /x/ is realized as [kk]: *m̄akk̄ər-ə* 'he advised' versus *yə-mx̄ir* 'let him advise' (cf. *b̄att̄ax-x̄əm* 'you (m.sg.) extracted' vs. *b̄att̄ax-əm* 'he extracted'). Second, there must be a constraint banning spirantization of the first part of a geminate sequence: *[xk]. That constraint is available in the form of the OCP. If spirantization takes place, the result is a sequence of two velars, a violation of the OCP applied to the Dorsal place of articulation. Recall that the Semitic Place OCP applies within the basic stem, thus affecting strictly adjacent consonants or those separated by a vowel. A geminate consonant [kk] avoids violating the OCP. The question then arises why the forms in (51) escape the OCP.

On the basis of independent evidence regarding nasalization and stress, Lowenstamm and Prunet (1986) argue that the possessive and agreement clitics in (51) are separate phonological words from the stems and that the (traditional) OCP operates only within the phonological word. The two instances of /k/ that are adjacent across a phonological word boundary do not violate the OCP and hence are not forced to fuse into a true geminate to escape an OCP violation. Spirantization freely applies to the first /k/ as it has no connection to the second. This is another instance of the OCP being restricted to a given domain. Furthermore, it was shown in section 2 that the guttural OCP also only applies within the basic stem in Tigrinya. Tableau (52) for the jussive form 'let him bless you' shows the inapplicability of the OCP to the two adjacent velars. The constraint *[Vk] bans postvocalic velar stops.

- (52) *yibarixka* 'let him bless you (m.sg.)'

| <i>/yi-barik-ka/</i> | *[xx] | OCP | *[Vk] |
|------------------------|-------|-----|-------|
| a. <i>yibarix-xa</i> | *! | | |
| b. <i>yibarik-ka</i> | | | *! |
| ☞ c. <i>yibarix-ka</i> | | | |

Let us now turn to the other cases of gemination derived via assimilation or prolongation (spreading) of the single consonant over two timing positions. As in Palestinian, in Tigrinya assimilation signifies phonological incorporation into the basic stem. Spirantization would then cause an OCP violation. It is less clear whether the geminate [kk] in forms such as *barix-u-kka*

‘he blessed you (m.sg.)’ is within a single OCP domain. Regardless of this question, the gemination triggered by the object clitics reflects a morphological gemination requirement on a par with stem-internal gemination. This is shown by the fact that, at least for some speakers, gemination of consonant-initial clitics occurs with the gerundive (used to express the past tense) (53a) but not with perfective or imperfective forms (53b–c).

- (53) a. *barix-u-kka* ‘he blessed you (m.sg.)’
 b. *yi-barix-u-xa* ‘they bless you (m.sg.)’
 c. *barəx-u-xa* ‘they blessed you (m.sg.) (punctual)’

We can call this gemination-requiring constraint MORPHOLOGICAL GEMINATION (MORPH-GEM). As (54) shows, any half-spirantization will cause this constraint to be violated.

- (54) *barixukka* ‘he blessed you (m.sg.)’

| /barix-u-ka/ | *[XX] | MORPH-GEM | *[Vk] |
|-----------------------|-------|-----------|-------|
| a. <i>barixuxxa</i> | *! | | |
| b. <i>barixuxa</i> | | *! | |
| ☞ c. <i>barixukka</i> | | | * |
| d. <i>barixuxka</i> | | *! | |

This analysis whereby the OCP applies only within the domain of the basic stem also predicts that a biliteral verb with a final doubled /k/ should not allow half-spirantization if the two instances of /k/ occur in string-adjacent position within the stem. This is confirmed by the verb ‘to scratch off’, formed from the root /ħk/.

- (55) *Perfective* *Imperfective*
 a. *ħaxəx-ə* *yi-ħakkix* ‘he scratches (off)’
 b. *ħaxəx-u* *yi-ħakk-u* ‘they scratch (off)’

It can be inferred that the geminate [kk] in *yi-ħakk-u* is not the same as that in the 3rd person masculine singular form, but is formed from the base and reduplicant consonants occurring in the second and third positions of the base. This is by analogy to regular verbs that take the imperfective verb stem CəCC when followed by a vowel-initial subject suffix (e.g., *yi-səbr-u* ‘they break’ but *yi-səbbir* ‘he breaks’; see Buckley 1997a for an analysis of the alternation). In all the forms except the imperfective 3rd person masculine plural, the /k/ is spirantized according to the requirement of postvocalic spirantization. The spirantization requirement even outweighs base-reduplicant identity between reduplicated velars. However, with *yi-ħakk-u* there is an opportunity to avoid the OCP violation by realizing both velars as [k] and forming a geminate. This motivates the ranking OCP >> *[Vk], shown in (56).

(56) *yihakku* ‘they scratch off’

| /yi-hak _i k _i -u/ | *[xx] | OCP | *[Vk] |
|---|-------|-----|-------|
| a. <i>yihaxx-u</i> | *! | | |
| b. <i>yihaxk-u</i> | | *! | |
| ☞ c. <i>yihakk-u</i> | | | * |

With the other verb forms in the paradigm in (55), all of the verb forms will violate the OCP whether they spirantize or not. This is because the OCP applied to consonants also operates across intervening vowels. Therefore, spirantization applies to satisfy *[Vk], even outweighing IDENT_{BR}.

In summary, the notion of domain in the application of the OCP plays a role in determining spirantization in Tigrinya, supporting the claims made by Lowenstamm and Prunet (1986).

4.3 Conclusion

There are several different options for dealing with fake geminates that arise in the course of a derivation. One, the two consonants may reside in separate domains and have no impact on each other (Tigrinya spirantization). Two, they are separated by epenthesis, which may either be a general operation within the language (Palestinian Arabic) or occur specifically to avoid geminates. Three, one of the consonants may be deleted. This occurs if the language strictly enforces the geminate ban, as does Burum. If none of these processes occur, and adjacent identical consonants are allowed to surface, they are treated as true geminates and will violate NO-GEM.

5 Non-Semitic Examples and Reduplication

With the exception of Afar, most of the languages discussed in this article have been Semitic, and even Afar belongs to the Afro-Asiatic language family. However, the generality of constraints such as the OCP and NO-GEM is such that their effects should be found in other languages. One prediction the present analysis makes is that many cases of reduplication might violate the OCP, particularly those that reduplicate a single open syllable. Yip (1998) assumes that the OCP can be outranked by constraints requiring reduplication (e.g., REPEAT: ‘‘The output must contain two identical elements’’), or a constraint pertaining to morphological realization, forcing reduplication to occur to express morphological features, even if in so doing the OCP is violated. In this section I show how some languages may restrict the size of the reduplicant to avoid violations of both the OCP and NO-GEM. I first examine languages that avoid geminates and then turn to ones that avoid violating the OCP.

5.1 Reduplicants Avoid Geminates

Urbanczyk (1996:283) shows that reduplication in Lushootseed resists adjacent sequences of identical consonants—in my terms, geminates. The distributive reduplicant is usually of the shape CVC (57a–b), but when the first two consonants of the stem are identical, the shape is CV (57c–e).

- (57)
- | <i>Base</i> | | <i>Distributive</i> |
|------------------------|-------------------------------------|---|
| a. ʔəpús | ‘aunt’ | ʔəp-ʔəpús ‘aunts’ |
| b. læg ^w əb | ‘youth, young man’ | læg ^w -læg ^w əb ‘youths, young men’ |
| c. ləlwáʔsəd | ‘sleeping platform’ | lə-ləlwáʔsəd ‘sleeping platforms’ |
| d. wíw’su | ‘children; little’ | wí-wiw’su ‘little (pl.)’ |
| e. c’íc’al | ‘long feathers with thick stems’ | c’í-c’íc’al-b ‘sprouted wings’ |

Lushootseed generally bans geminates, allowing only $g^w g^w$, qq , and ll , but most geminates are reduced to a single consonant. Urbanczyk argues that an OCP constraint (here applied in the traditional way to identical consonants resulting from reduplication) and a No-LINK (= No-GEM) constraint are both necessary to rule out an adjacent sequence of identical consonants. As shown in (58), these are both ranked above a MAX constraint applied to the base-reduplicant relationship.

- (58) *c’í-c’íc’al-b* ‘sprouted wings’

| /RED + c’íc’al/ | No-LINK | OCP | MAX _{BR} (Root) |
|-------------------|---------|-----|--------------------------|
| a. c’íc’c’íc’al-b | | *! | ** |
| b. c’íc’c’íc’al-b | *! | | ** |
| ☞ c. c’íc’íc’al-b | | | *** |

Under the analysis presented here, no distinction is necessary between the fake and true geminates found in candidates (58a) and (58b); No-GEM is simply ranked above the OCP, but the OCP is interpreted differently, as applying across vowels. Both candidates violate the OCP in that they contain two instances of identical consonants separated by a vowel, but this constraint proves irrelevant when faced with high-ranking No-GEM, as shown in (59).

- (59) *c’í-c’íc’al-b* ‘sprouted wings’

| /RED + c’íc’al/ | No-GEM | OCP | MAX _{BR} |
|-------------------|--------|-----|-------------------|
| a. c’íc’c’íc’al-b | *! | ** | ** |
| ☞ b. c’íc’íc’al-b | | ** | *** |

Thus, Urbanczyk’s analysis (reinterpreted in (59)) provides another example of a language that restricts geminates, but tolerates OCP violations.

A parallel example is found in Burum (Gasaway 1997). As stated in section 3, no geminates are found in this language, and any arising via morpheme concatenation are simplified. This is true of reduplicants as well: the normal bimoraic reduplicant shape seen in (60a–b) is reduced in (60c–d) to prevent gemination.

- (60)
- | | | | | |
|----------|-----------|-----------|-------------|-----------|
| a. toko | ‘to meet’ | tokotoko | | ‘meeting’ |
| b. mal | ‘to live’ | malmal | | ‘life’ |
| c. korak | ‘ear wax’ | korakorak | *korakkorak | ‘ear wax’ |
| d. tat | ‘to sit’ | tatat | *tattat | ‘sitting’ |

Spaelti (1997) provides other cases of geminate resistance in the reduplication of West Tarangan dialects of Indonesia.

5.2 Reduplication Avoids OCP Violations

The reverse of the Lushootseed and Burum situation is found in Nukuoro (Carroll and Soulik 1973) cited by Odden (1988). In this language intensive reduplication takes the prefixal shape CVCV unless the first two consonants are identical, in which case the shape is CVC. Maximal reduplication is not achieved, not because of a ban on geminates, but because of the OCP. In (61a–c) normal reduplication occurs. In (61d–g) the CVC shape is found.

| | | | |
|------|-------------|------------------|--|
| (61) | <i>Base</i> | <i>Intensive</i> | |
| a. | balavini | bala-balavini | ‘awkward’ |
| b. | badai | bada-badai | ‘meddle in others’ affairs’ |
| c. | gili | gili-gili | ‘coral rubble; skin in an unhealthy condition’ |
| d. | bobo | bob-bobo | ‘rotten’ |
| e. | lili | lil-lili | ‘easily angered’ |
| f. | sasa | sas-sasa | ‘stammer from nervousness’ |
| g. | nanu | nan-nanu | ‘complain repeatedly’ |

The form in (61c) shows that the reduction of the CVCV shape is not the result of a constraint against complete identity between base and reduplicant, such as *REPEAT (Yip 1998). Instead, the CVC shape appears only when the first two consonants of the base are identical. Even the vowels may be nonidentical, as in (61g).

Tableau (62) illustrates how creating a geminate reduces the number of OCP violations.²⁸ Having only one syllable reduplication violates MAX_{BR} in that two segments are not copied (62c), or if templatic constraints are imposed on the size of the reduplicant, it does not achieve a bimoraic minimum.

(62) *bobbobo* ‘rotten’

| /RED + bobo/ | OCP | MAX _{BR} | NO-GEM |
|--------------|------|-------------------|--------|
| a. bobo-bobo | ***! | | |
| b. bob-bobo | ** | * | * |
| c. bo-bobo | ** | ***! | |

A similar example is found in Nakanai (Johnston 1980:257, Spaelti 1997). When a CV syllable is reduplicated either once or twice, syncope occurs to create a geminate. The syncope vowel is the one that occurs between the two identical consonants. If there is more than one

²⁸ An alternative explanation would invoke the constraint INTEGRITY, as in Buckley’s (1998) account for a similar effect in Manam.

reduplicant, the syncopated vowel is either pretonic or, if stress occurs elsewhere, the vowel of the second reduplicant.

- | | | | |
|---------|----------------|---------------|-----------------------|
| (63) a. | /lololo/ | [llólo] | ‘listening’ |
| b. | /lololoau/ | [lolloáú] | ‘listening to me’ |
| c. | /mememe/ | [mmémɛ] | ‘shiny’ |
| d. | /mememeti/ | [mɛmmétɪ] | ‘already shiny’ |
| e. | /matatutuluti/ | [matattulúti] | ‘already sleepy-eyed’ |
| f. | /uru pepeho/ | [uru ppého] | ‘very big’ |

In conclusion, these examples show the varied ways that the OCP and No-GEM may be ranked in different languages, and how they may interact to affect the size of reduplicants.

6 Conclusion

I began this article by examining a puzzling distribution problem in two North Ethiopian Semitic languages with respect to guttural consonants. At first glance it appeared to provide support for a distinction between repetition of consonants via long-distance gemination and repetition via reduplication. However, I showed that the long-distance geminate analysis cannot be upheld, because the repetition involves different kinds of gutturals. To handle the resistance of gutturals to appearing within roots or stems when a vowel intervenes, but not when a consonant does, I proposed that the OCP should be able to apply across intervening vowels within certain domains (the prosodic word in Tigre, the basic stem in Tigrinya). This proposal has immediate consequences for the analysis of antigemination effects in Semitic languages and others that crucially relies on an interpretation of the OCP applied to strictly adjacent consonants and not those separated by a vowel. Yet this new interpretation of the OCP actually handles the antigemination cases in a more explanatory fashion, by justifying the role of identical consonants in syncope application and resistance. I reanalyzed data from Classical Arabic and Afar, relying on this alternative interpretation of the OCP and a general constraint against geminates within OT. I also extended the analysis to cases of reduplication that restrict the size of the reduplicant to avoid gemination or OCP violations.

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