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The Moraic Nature of Geminate Consonants in Moroccan Arabic: Evidence from Word-minimality, Syllable Structure and Word Formation[1]

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ملخص

يهدف هذا البحث إلى استحضار أدلة تدعم التمثيل العروضي المبني على الوقع'mora' للصوامت المضعفة في العربية المغربية. ومن أجل استحضار أمثلة من هذا القبيل، نعتمد على ثلاث ظواهر مورفو-فنولوجية، وهي: الحد الأدنى للكلمة والبنية المقطعية للأصوات والتضعيف الاشتقاقي للكلمة. بحيث نبين أن العربية المغربية لا تسمح بوجود كلمات مكونة من مقطع صوتي قصير على شكل صامت-صائت (CV) نظرا إلى أنه أحادي الوقع وبذلك لا يحترم الحد الأدنى المتمثل في وقعين، باستثناء إذا كان الصامت مضعفا (GV)، مما يشير إلى اتصاله بوقع على غرار الصائت الذي يليه. ثانيا، وبناءا على ظاهرة الإطالة التعويضية، نبين كيف يتم إطالة صامت قصير وجعله مضعفا من أجل الحفاظ على العدد الأصلي للوقع، ما يؤدي إلى ظهور صامت مضعف متصل بوقع. ثالثا، نبرز أن التضعيف الاشتقاقي في العربية المغربية يحتاج إلى التمثيل المبني على الوقع نظرا لما يسمح به هذا الأخير من تحليل نظري مسند من طرف لغات متعددة أخرى.

Abstract

This paper aims at offering firsthand pieces of evidence that can support the moraic conception of geminates in Moroccan Arabic. The evidence presented comes from word minimality, compensatory lengthening and word formation. First, we argue that that the existence of GV words (e.g. ddi ‘to take’), to the exclusion of CV words (e.g. *di), in MA proves that a geminate is underlyingly moraic, in that a monovocalic word with an initial geminate is qualified as bimoraic. We also claim that the fact that MA involves a case of compensatory lengthening that leads to the creation of geminate consonants represents additional evidence in support of the moraic representation of geminates. This is because that compensatory lengthening has been shown to be mainly a moraic preserving process across many languages. The third type of evidence we introduce consists in demonstrating that a moraic approach to consonantal length proves to be the best option to account for morphological gemination in MA and elsewhere thanks to the cross-linguistic generalizations it allows.

Keywords: moraic theory; geminate consonants; word-minimality; syllable structure; morphological gemination; Moroccan Arabic; Optimality Theory

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1. Introduction

The behavior of geminates in MA seems to tip the balance more in favor of a segmental representation, whereby geminates are represented as two root nodes (or two skeletal slots) sharing a single feature set (Goldsmith, 1976; McCarthy, 1979; Clements and Keyser, 1983; Levin, 1985; Selkirk, 1990):

(1) The skeletal representation of geminates

RN RN

[F]

This is mainly manifested by the analogous lexical distributional properties and phonological patterning of geminates and consonant clusters in MA. By this, we refer to the fact that geminates in MA occupy the same word positions that consonant clusters can occupy. Moreover, just like clusters, geminates in MA can be split (e.g. sədd 'to close' - məsd$_1$ud$_2$ 'closed') or partially reduplicated (e.g. sədd 'to close' - səd$_1$d$_2$ad$_3$a 'cover').

However, upon further scrutiny, it has been demonstrated that autosegmental skeletal theory alone fails miserably when it comes to explaining other independent issues such as the status of schwa in MA and the cross-linguistic asymmetrical nature of compensatory lengthening. In particular, the skeletal approach fails to account for the nonexistence of open syllables ending in schwa (i.e. Cə) and monovocalic words of the shape CəC despite being segmentally equivalent to CV syllables and CVC words, respectively.

Therefore, and in light of the overwhelming available evidence from a whole host of languages in support of the moraic status of geminates (e.g. Hindi (Davis, 1994); Koya (Sherer, 1994); Sinhala (Davis, 1999); Trukese (Churchyard, 1991; Hart, 1991; Davis and Torretta, 1998)), we react to the inadequacies of an exclusive skeletal approach to geminate representation by putting forward a moraic analysis of consonantal length in MA(McCarthy and Prince, 1986; Hayes, 1989; Davis, 1994, 1999, 2003, 2011):

(2) The moraic representation of geminates

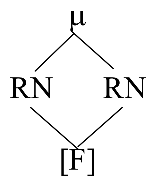
μ

RN

Precisely, in this paper, it will be shown that MA can provide internal evidence for the underlying moraicity of geminates as many other Arabic dialects do.

However, we argue that the representations above are not necessarily mutually exclusive. Rather, we believe that both a segmental representation and a moraic representation are simultaneously needed to provide a comprehensive account of geminate behavior cross-linguistically:

(3) A moraic two-root node representation (Noamane, 2018c)



In this work, we will try to provide evidence for the moraic level of the representation in (3). The segmental level, however, will be needed to account for the attested bi-positional patterning of geminates in MA (see Noamane (2018a-c) for more details on the behavior and representation of geminates and Noamane (2018b-d) for more on the status of geminates in the root).

Almost every Arabic dialect contains geminate consonants of some sort (Davis and Ragheb, 2014). Many of these dialects constitute a good source for data in support of the moraic conception of geminates. For example, Hadhrami Arabic, spoken near the southern coast of Yemen, provides an interesting argument against the patterning of geminates with consonant clusters. In this dialect, final consonant clusters are not allowed while final geminates are. This fact is indicated by the following items:

(4) Hadhrami Arabic (Davis and Ragheb, 2014:8)

a. /qird/ - [qirid]	‘monkey’
b. /bint/ - [binit]	‘girl’
c. [rabb]	‘Lord’
d. [ʔaxaff]	‘lighter’

The items in (4a)-(4b) show that Hadhrami resorts to vowel epenthesis to break up underlying consonant clusters. The items in (1c) -(1d) illustrate that epenthesis does not take place in the case of underlying geminates. This clearly demonstrates that geminate consonants exhibit distinct properties from consonant clusters. Contrary to Hadhrami Arabic, both final geminates and final clusters are allowed in MA (e.g. səmm 'poison' and fərx 'bird'). However, these distributional asymmetries/symmetries between geminates and clusters do not directly argue for or against the inherent moraicity of geminates.

Weight sensitive phenomena such as stress, word minimality and compensatory lengthening can tell us more about the underlying nature of geminates. For instance, in San'ani Arabic, Weight-by-Position is limited to one of the last three syllables of the word. That is, a CVC syllable in pre-antepenultimate position acts as monomoraic, failing to attract stress (item (5a)). Interestingly, stress does fall on CVG and CVV syllables even when in pre-antepenultimate position (items (5b) -(5c)). This can be attributed to the inherent weight of the geminate, making a CVG syllable heavy whatever its position in the word is.

(5) San'ani Arabic (Watson, 2002:82)

a. mak.ˈta.ba.ti:	'my library'
b. ˈha:.ka.ða.ha:	'like this'
c. mu.ˈsadʒ.dʒi.la.ti	'my recorder'

In MA, however, evidence for the effect of geminates on stress placement is not easy to come up with because all closed syllables in MA have equal weight due to the application of Weight-by-Position.

Another equally strong piece of evidence in support of the underlying moraic nature of geminates from an Arabic dialect is found in Lebanese Arabic, which imposes a bimoraic minimality condition on its content words. As a result of this condition, Lebanese Arabic has no words of the shape CV and CVC due to their monomoraic status. Yet, CVG words are frequently attested thanks to their bimoraic size, in which the geminate and the vowel contribute a mora each. Examples of words that prove this point are provided below:

(6) CVG words in Lebanese Arabic

bajj	'father'
sitt	'grandmother'
rabb	'god'
ʒidd	'grandfather'
ʔimm	'mother'

In the same spirit, the central aim of this paper is to provide evidence, from within MA, that could support the moraic conception of geminates. In particular, this paper is set to present evidence from three morpho-phonological phenomena that motivate the moraic representation of geminates. These include: word-minimality, compensatory lengthening and morphological gemination. For each phenomenon, we will show that the moraic analysis of geminates delivers better insights and allows for cross-linguistically generalizable accounts.

Generally, The MA dialect from which our data is collected can be described along the lines of Benhallam & Dahbi (1990) and Ech-Charfi (2004). Such a variety is termed 'Average Moroccan Arabic' in the first work and 'Standard Moroccan Arabic' in the second. It is mainly characterized by the neutralization of dialectal and regional particularities. However, the pattern where we deal with gemination as a compensatory lengthening process is found specifically in the MA dialect spoken in the region of Safi, located in the west of Morocco (Abdelmajid Jahfa, personal communication).

The rest of this paper is mapped out as follows. Section 2 presents evidence from word-minimality for the moraic conception of geminates. Sections 3 introduces evidence pertaining to syllable and moraic structures. Section 4 highlights the advantages of a moraic approach in accounting for morphological gemination. Section 5 debunks some of the accounts that have argued against the moraic nature of geminates. Section 6 concludes this paper.

2. Evidence from word-minimality

Many languages place a restriction on the prosodic size of their content words. Particularly, a language may demand that words should consist of at least a binary foot, under a syllabic or a moraic analysis (McCarthy and Prince, 1986). As a result, light syllables would not be permitted to constitute words on their own in these languages. In order to ensure this word minimality requirement, languages of this type make use of various repair strategies (Paradis, 1988) to keep their words in check, either via entirely banning light monosyllabic words or enhancing their structure by augmenting their size (e.g. vowel lengthening) or making them prosodically heavier (e.g. Weight-By-Position). In OT, the requirement of a minimal size on words is ensured by the stipulation of the constraint FT-BIN (short for Foot-Binarity):

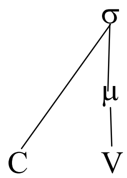
(7) **FT-BIN** (Prince and Smolensky, 1993):

Feet should be binary under moraic or syllabic analysis.

This constraint penalizes every word with less than two moras or two syllables for that matter. By doing so, such a constraint ensures that input forms meet the minimal word threshold required by the language in question. The details as to how this requirement is satisfied are defined by the interaction with other constraints.

As has been noted elsewhere (Al Ghadi, 1994; Boudlal, 2001), MA enforces the word minimality condition on its content words. This is manifested by the nonexistence of words of the shape CV for being monomoraic.[2] Thus, every CV candidate would lose in any possible competition for it is always going to violate the undominated FT-BIN.

(8) Monomoraic syllables in MA



Despite qualifying as bimoraic by virtue of containing long vowels, CVV words do not emerge in MA for the simple reason that long vowels are not part of its phonological system. In OT terms, the constraint against long vowels (i.e. *V:) happens to be high-ranked in the grammar of MA.

However, it is observed that MA allows words consisting of a geminate plus a short vowel (i.e. GV), see (9) for examples, which begs the question: what difference does it make to have a geminate in a word? The answer to this question lies in Morén's (1999, 2003) distinction, which maintains that weight comes in two flavors, namely distinctive and coerced. Distinctive weight is the result of a lexical specification of moraicity, whereby segments (i.e. vowels and geminates) are underlyingly moraic. Coerced weight, on the other hand, stems from a restriction on surface moraicity in some phonological context (e.g. Weight-by-Position).

(9) Moraic word-initial geminates in MA

ddi	*di	'to take'
mm^{w}i	*m^{w}i	'my mother'
bb^{w}a	*b^{w}a	'my father'
lla	*la	'No'
ssi	*si	'Mr.'

[2] Exceptions to this restriction include the words: ʒa 'come', ma 'water', xu 'brother'. These words rarely occur in isolation, hence their sub-minimality is often compensated for through combining with other morphemes, for example ʒa-w 'they came', l-ma 'the water', xu-h 'his brother'.

Within the realm of moraic theory, it is argued that geminates and vowels have distinctive weight by dint of being inherently moraic. This means that they would tend to contribute weight to their words. In support of this claim, the presence of GV words in MA, as opposed to CV words, could constitute evidence for the moraic nature of geminates in MA. Therefore, GV words can be said to be possible because they are inherently bimoraic, with each segment contributing a mora, unlike CV shapes where singletons are nonmoraic.

(10) Distinctive weight in moraic phonology

Geminate	Short vowel	Long vowel
μ	μ	μ μ
C	V	V

We posit that the distinctive weight of GV words is ensured by the faithfulness constraint IDENT-Weight, which requires underlying weight specifications of segments to be preserved.

(11) **IDENT-Weight**:

An output segment should bear the same weight as an input one.

This constraint has to be ranked over the markedness constraints *μ/C and *μ/V, militating against moraic consonants and moraic vowels, respectively.

(12) Constraints against moraic elements (Sherer, 1994)

***μ/C**: Moraic consonants are not allowed

***μ/V**: Moraic vowels are not allowed

The interaction between these constraints is illustrated in the following tableau:

(13) IDENT-W>>*μ/C, *μ/V

/CμVμ/	IDENT-W	*μ/C	*μ/V
☞a. CμVμ		*	*
b. CVμ	*!		*
c. CμV	*!	*	

By violating the high-ranking IDENT-W in different ways, candidates (13b) and (13c) are excluded. The optimal candidate, however, obeys IDENT-W by preserving the weight specification of the input. Therefore, GV words inherently satisfy the word minimality condition.

Another way to be inherently bimoraic is for a word to include two full vowels, each with a mora: CVCV, CCVCV, CVCVC, CVCCV. Examples of these word shapes are provided in (14) below:

(14) Inherently bimoraic word shapes

CVCV		*CCVCV*	
ʃita	'broom'	mdina	'city'
fuṭa	'towel'	ħdida	'iron bar'
mika	'plastic bag'	brika	'lighter'
biḍa	'egg'	rwina	'mess'
CVCVC		*CVCCV*	
ʒiran	'neighbors'	saqṭa	'lock'
sarut	'key'	ʒumla	'sentence'
ħanut	'grocery shop'	manṭa	'blanket'
kamun	'cumin'	ʃanṭa	'suitcase'

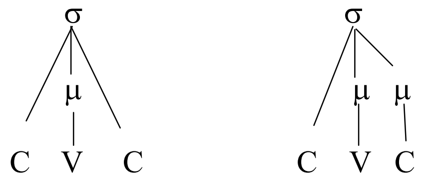
However, words of the shape CVC and CCV, like the ones in (15), also abound in MA despite being monovocalic. This raises the question: what is that makes CVC and CCV words bimoraic despite being monovocalic? To answer this question, we refer to Morén's second type of prosodic weight, i.e. coerced weight. On this basis, we show that the prosodic minimality of these forms is equally obtained through the interaction of constraints that are independently needed for regulating syllabic well-formedness in MA.

(15) Bimoraicity by coercion

CCV		*CVC*	
ʃra	'buy'	ʃaf	'see'
ʕja	'get tired'	gal	'say'
ʒra	'run'	ħiṭ	'wall'
bka	'cry'	ʕid	'feast'

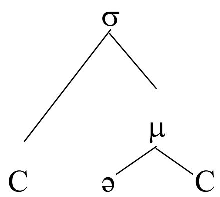
In the case of CVC words, we postulate that bimoraicity is achieved thanks to the language specific preference of Weight-by-Position, which assigns a mora to every consonant in coda position, making every closed syllable with a full vowel bimoraic.

(16) Moraic codas in MA



Therefore, closed syllables in MA are always heavy, except when headed by a schwa, which, despite being a vowel, is nonmoraic. This discrepancy stems from the fact that, unlike full vowels, a schwa can never occur in an open syllable *Cə and cannot be a head of monosyllabic words of the shape *CəC. In multisyllabic words, however, a schwa heading a syllable shares the mora of its coda.

(17) Closed schwa syllables are monomoraic (Bensoukas, 2006; Bensoukas & Boudlal, 2012a-b)



Turning back to CVC words, we posit that the word minimality of this pattern is met by assigning a second mora to the consonant in coda position, CVμCμ. We believe that this is drivable from the constraint *APPENDIX, which prohibits weightless codas.

(18) ***APPENDIX**(Sherer, 1994):

Weightless codas are prohibited

This constraint must dominate the constraint against moraic codas (i.e. *μ/CODA) in order to coerce the consonant in the coda position into acquiring weight (See Rosenthall and Hulst (1999) for similar ranking). The following tableau demonstrates this interaction:

(19) *APPENDIX >>*μ/CODA

/CVμC/	*APPENDIX	*μ/CODA
☞a. .CVμCμ.		*
b. .CVμC.	*!	

In previous accounts, namely Al Ghadi (1994) and Boudlal (2001), it is assumed that the output form CVμCμ is derived through the following constraint interaction: FT-BIN >> H-NUC >> *CODA. This is illustrated by the tableau below, where coda consonants are believed to be coerced into acquiring weight mainly to satisfy the word minimality threshold, represented here by the constraint FT-BIN.

(20) FT-BIN >>H-NUC>> *CODA

/CVμC/	FT-BIN	H-NUC	*CODA
☞a. .CVμCμ.			*
b. CVμ.C		*!	
c. .CVμC.	*!		

Yet, when we consider larger patterns, our analysis appears to be more consistent in deriving moraic codas. For example, the pattern CVCVC is canonically bimoraic, hence it would be unnecessary to make its coda moraic for FT-BIN reasons. Thus, both CVμ.CVμCμ and CVμ.CVμC would satisfy FT-BIN and both would violate *CODA, leaving us with a tie.

(21) Tie between candidates (a) and (c)

/CVμCVμC/	FT-BIN	H-NUC	*CODA
☞a. CVμ.CVμCμ			*
b. CVμ.CVμ.Cμ		*!	
☞c. CVμ.CVμC			*

This specific pattern proves that the moraic status of the coda is not ensured by FT-BIN, but rather it is the result of an independent requisite against moraless codas, represented by *APPENDIX.

(22) *APPENDIX, *μ_h/C>>*μ/CODA

/CVμCVμC/	*APPENDIX	*μ_h/C	*μ/CODA
☞a. CVμ.CVμCμ			*
b. CVμ.CVμ.Cμ		*!	
c. CVμ.CVμC	*!		

Words of the shape CCV are also abundant in MA. In this regard, we purport that the bimoraicity of such words is achieved by means of creating a syllabic consonant out of the first member of the consonant cluster, C.CV.

(23) Syllabic consonants in MA

$$\begin{array}{c} \sigma \\ | \\ \mu_h \\ | \\ C \end{array}$$

We argue that the prosodic minimality of this pattern derives from the interaction between the constraints *COMPLEX and *μ_h/C, where the former is the dominant constraint: *COMPLEX>> *μ_h/C. Thus, candidate (24b) is ruled out primarily for violating *COMPLEX. Candidate (24a) wins out for satisfying *COMPLEX and satisfying word minimality.

(24) *COMPLEX >>*μ_h/C

/CCVμ/	*COMPLEX	*μ_h/C
☞a. Cμ.CVμ		*
b. .CCVμ.	*!	

(25) ***μ_h/C**:

Consonants cannot not be moraic syllable heads.

Al Ghadi (1994:7) claims that the structure C.CV is derivable from either FT-BIN or *COMPLEX. We maintain that such a claim poses a serious problem for the grammar since it leads to a constraint disjunction whereby both FT-BIN and *COMPLEX can yield the winner C.CV, which undermines the ranking arguments *COMPLEX>> *μ_h/C or Ft-Bin >> *μ_h/C. In OT, “the ranking argument is secure only if there is no third constraint that could also be responsible for the winner beating the loser” (McCarthy, 2008:42).

(26) Constraint disjunction: both FT-BIN and *COMPLEX can do the job

/CCVμ/	FT-BIN	*COMPLEX	*μ_h/C
☞a. Cμ.CVμ			*
b. .CCVμ.	*W	*W	L

This tableau shows that a solid ranking argument cannot be guaranteed since both FT-BIN and *COMPLEX do the same job. They both disfavor the loser CCV and prefer the winner C.CV.

To resolve this problem, we look at larger patterns. The pattern CCVCV is canonically bimoraic by virtue of containing two full vowels. Hence, the structure C.CV.CV could not derive from the ranking FT-BIN>> *μ_h/C since the prosodic minimality requirement is already satisfied. As a result, candidate (27b) loses only for violating *COMPLEX, while it ties with the winner for FT-BIN.

(27) *COMPLEX >>*μ_h/C

/CCVμCVμ/	*COMPLEX	*μ_h/C
☞a. C.CV.CV		*
b. CCV.CV	*!	

In this case, the only way to account for the syllabic consonant at the beginning of the pattern is by positing the ranking *COMPLEX>> *μ_h/C. As a result, *COMPLEX appears to be consistent in deriving syllabic consonants everywhere in the grammar, while FT-BIN seems to do so only when the canonical pattern fails to meet the prosodic threshold. Based on this, we conclude that the creation of syllabic consonants in MA results from the constraint *COMPLEX. Such a claim has two advantages: first, it resolves the issue of constraint disjunction through securing the ranking argument *COMPLEX>> *μ_h/C. Second, it maintains a consistent analysis of the creation of syllabic consonants, instead of positing that they derive from FT-BIN in some instances and *COMPLEX in others.

Boudlal (2001:66/7) approaches the problem differently. It proposes to divide the labor of creating syllabic consonants between *COMPLEX and FT-BIN, whereby the former creates a minor syllable out of the designated consonant cluster without assigning it a mora, while the latter forces it to be moraic. For this, Boudlal distinguishes between two constraints: *Minor-σ and H-NUC. When *Minor-σ is dominated by *COMPLEX, a member of the consonant cluster becomes a syllable of its own. When H-NUC is dominated by FT-BIN, a consonant becomes moraic. According to Boudlal, both *COMPLEX>> *Minor-σ and FT-BIN>> H-NUC are simultaneously active. The structures CCVμ, C.CVμ and Cμ.CVμ then compete.

(28) FT-BIN wrongly rules out candidate (b)

/CCVμ/	FT-BIN	*COMPLEX	*Minor-σ	H-NUC
☞a. Cμ.CVμ			*	*
b. C.CVμ	(*!)		*	
c. CCVμ	*!	*		

However, Boudlal (2001) misses the point that the interaction *COMPLEX>> *Minor-σ suffices to satisfy word minimality since the form C.CVμ is disyllabic even if the minor syllable is not assigned a mora, meaning that it satisfies FT-BIN under syllabic analysis. Hence, the interaction FT-BIN>> H-NUC becomes redundant and unnecessary. In other words, the constraint FT-BIN would not be able to distinguish between the output structures Cμ.CVμ and C.CVμ as both meet word minimality. The tableau in (29) illustrates this point:

(29) Candidates (a) and (b) cannot be distinguished by FT-BIN

/CCVμ/	FT-BIN	*COMPLEX	*Minor-σ	H-NUC
☜a. Cμ.CVμ			*	*!
☜b. C.CVμ			*	
c. CCVμ	*!	*		

In the current analysis, the constraint *μ_h/C carries the effects of both *Minor-σ and H-NUC. Hence, when dominated, the emergent structure would be a syllabic consonant that is moraic. Besides, our analysis is consistent in using different instantiations of the constraint *μ/C to derive all cases of moraic consonants in MA.

Since FT-BIN cannot always dominate *μ/Coda and *μ_h/C, it is safe to assume that it has no active role in triggering the creation of moraic consonants. Rather, *μ/Coda and *μ_h/C are dominated by *APPENDIX and *COMPLEX, respectively. As we consider words of the shape CCVC, it becomes even clearer that FT-BIN has no direct interaction with *μ/Coda and *μ_h/C. If creating a syllabic consonant or assigning a mora to a coda consonant are indeed done for the purposes of meeting the word minimality threshold, then only one of these options would suffice in the case of CCVC words. If so, Cμ.CVμC, where the coda is nonmoraic, and CCVμCμ, where the onset is complex, could be two possible ways to satisfy FT-BIN. This clearly goes against the fact that closed syllables in MA are independently heavy and margins are not complex.

(30)

CCVC

slaħ	'weapon'
$ɣ^w$laf	'cover'
draʕ	'arm'
ṣḍaʕ	'noise'

(31) *COMPLEX, *APPENDIX >>*μ_h/C>>*μ/C

/CCVμC/	*COMPLEX	*APPENDIX	*μ_h/C	*μ/C
☞a. Cμ.CVμCμ			*	*
b. .CCVμCμ.	*!			*
c. Cμ.CVμ.Cμ			**!	*
d. .CCVμC.	*!	*		
e. Cμ.CVμC		*!	*	

Thus, it is better to think of FT-BIN as an undominated constraint whose only role is to evaluate the prosodic minimality of words without being able to compensate for it. That is, when subminimal inputs such CV and CəC are evaluated, FT-BIN would prohibit them from turning into words for being monomoraic. When subminimal inputs such as CVC or CCV are evaluated, *COMPLEX and *APPENDIX would turn them into bimoraic structures, satisfying FT-BIN as a result.

To reiterate, three instances of moraic consonants could be identified in MA. These come in two main flavors: underlying (i.e. distinctive) or derived (i.e. coerced). Despite the apparent differences, our account unifies the emergence of moraic consonants in MA by positing different instantiations of the markedness constraint prohibiting consonants from being moraic. The basic constraint interactions that govern the occurrence of moraic consonants in MA are restated below:

(32) Moraic Consonants and word-minimality in MA

a. Geminates: IDENT-W-C>>*μ/C

/CμVμ/	IDENT-W-C	*μ/C
☞a. CμVμ		*
b. CVμ	*!	

b. Syllabic consonants: *COMPLEX >>*μ_h/C

/CCVμ/	*COMPLEX	*μ_h/C
☞a. Cμ.CVμ		*
b. .CCVμ.	*!	

c. Moraic codas: *APPENDIX >>*μ/CODA

/CVμC/	*APPENDIX	*μ/CODA
☞a. .CVμCμ.		*
b. .CVμC.	*!	

When considered in the context of monosyllabic words, moraic consonants give rise to two basic types of word minimality:

(33) Types of moraic consonants in MA

a. Inherent word minimality: CVG IDENT-W >> *μ/C

GV IDENT-W >> *μ/C

b. Derived word minimality: CVC *APPENDIX>> *μ/CODA

CCV *COMPLEX>> *μ_h/C

This distinction rests on the assumption that the distributional equivalence between geminates, on the one hand, and clusters or singletons, on the other, is not a determinant of their prosodic nature. Despite the apparent similarities prosody-wise, each structure is the result of a unique constraint interaction.

3. Evidence from syllable structure and moraic structure

The next piece of evidence to support the moraic conception of geminates in MA will be drawn from data pertaining to syllable and moraic structures. This section will be divided into two subsections. While both subsections would share the purpose of introducing further evidence from MA in favor of geminate moraicity, they will be offering two different analyses of the same phonological phenomenon. The data in question involves a case of consonant lengthening that seems to be triggered by the affixation of the vocalic 3rd person pronoun /u/ to past tense triliteral feminine verbs. Some examples are given below:

(34) Gemination in the context of prosodic structure

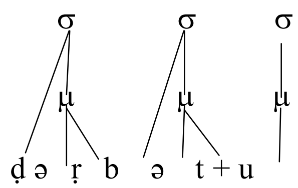
/ḍəṛbət-u/	ḍəṛbə**tt**u	'she hit him'
/ʃəṛbət-u/	ʃəṛbə**tt**u	'she drank it
/qətlət-u/	qətlə**tt**u	'she killed him'
/nəʃṛət-u/	nəʃṛə**tt**u	'she hung it'

3.1. Gemination by syllabification analysis

The gemination in the items on the right in (34) could be thought of as following from syllable well-formedness, in that the affixal segment [t], in forms such as *ḍəṛbət* 'she hit', lengthens after attaching to the third person pronoun [u] for the sake of supplying the ensuing syllable with an onset. This process can be illustrated as follows:

(35)

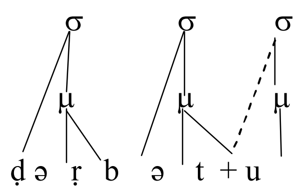
a.



Affixation

/ḍəṛbə**t**-u/ 'she hit- him'

b.



Lengthening

[ḍəṛbə**tt**u] 'she hit him'

In dealing with this case of gemination, we choose to refer to the constraints shown in (36) below:

(36) Constraints responsible for gemination by syllabification

a. **ONSET**: syllables must have onsets.

b. ***GEM**: geminate consonants are banned.

The constraint in (36a) prohibits the existence of geminate consonants in the language. (36d) stipulates that syllables must have an onset. The tableau in (37) demonstrates how these two constraints interact to yield the expected structure. It shows that in the wake of affixing the vocalic 3rd person personal pronoun, the constraint ONSET demands that the subsequent syllable must have an onset. If the mora is linked to a consonant, a geminate structure is derived. For this to be possible, ONSET should outrank the constraint against long consonants, *GEM.

(37) ONSET >>*GEM

/ḍərbət-u/	ONSET	*GEM
☞a. ḍəṛ.bət.tu		*
b. ḍəṛ.bət.u	*!	

The optimal candidate lengthens the consonant /t/ to create an onset for the subsequent syllable. Creating an onset this way happens at the expense of violating the low-ranking *GEM. The candidate in (37b) loses for violating ONSET. The way we think this supports a moraic conception of geminates lies in the fact that the created geminate ends up being associated with a mora, whose role changed from being purely prosodic to being segmentally relevant.

In this piece of work, it is assumed that derived geminates in MA acquire the same phonological structure that characterizes underlying geminates. In particular, a true geminate, be it derived or lexical, should be marked for length both moraically and segmentally. In OT, derived geminates can acquire a moraic two-root node structure thanks to the interaction between the constraint representing the condition on consonantal length to be moraic and segmental, written as W-to-L Corr (short for Weight-to-Length Correlation) and the faithfulness constraint DEP-RN, militating against the insertion of empty root nodes:

(38)W-to-L Corr>>DEP-RN

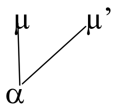
μ RN	W-to-L Corr	DEP-RN
a. μ RN	*!	
☞b. μ RN RN		*

3.2. Compensatory lengthening analysis

This subsection attempts to offer a quite different perspective on the same case of gemination analyzed above. What is new is that we are going to think of the case of gemination illustrated in (34) as emerging from a process of compensatory lengthening. Thinking of this as a case of CL is done for the purpose of pointing out to an even stronger evidence for the moraic nature of geminates. Therefore, for the sake of argument, we are going to assume that a form like [ḍəṛbət] is derived from the output form of the Standard MA dialect (i.e. ḍəṛbat), through a process of vowel deletion. Only by making this assumption can we develop a compensatory lengthening analysis. The process of lengthening is then activated when the form [ḍəṛbət] is attached to the suffix -u.

CL generally involves the deletion of the melodic features of a moraic segment, leading to the lengthening of a nearby segment in order to preserve the mora left behind by the deleted melodic element (Hayes, 1989). The most typical case of CL consists in the lengthening of a vowel upon the deletion of a weight carrying coda.

(39) Compensatory Lengthening in Moraic Phonology (Hayes, 1989):



where μ’ is a segmentally unaffiliated mora

Arguably, we will assume that the deletion of the vowel /a/ of the feminine suffix /-at/ triggers a word internal process of consonant lengthening. Such an analysis requires reference to what is believed to be the canonical form of the derived structure. This can be exemplified by the relation between the following forms:

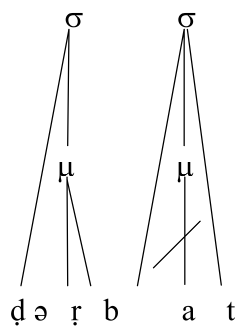
(40) Gemination by compensatory lengthening:

ḍəṛb**at**	ḍəṛbət-u	ḍəṛbə**tt**u	‘she hit him’
ʃəṛb**at**	ʃəṛbət-u	ʃəṛbə**tt**u	‘she drank it
qətl**at**	qətlət-u	qətlə**tt**u	‘she killed him’
nəʃṛ**at**	nəʃṛət-u	nəʃṛə**tt**u	‘she hung it’

Specifically, it is being assumed that in the wake of the deletion of the /a/ of the feminine suffix /-at/, the consonant /t/ turns into a geminate by spreading to the mora left behind. The deletion of the /a/ first yields a structure with a lingering mora (41b). The lingering mora stays unparsed and unfilled until the affixation of the pronoun /u/, which, first, triggers a resyllabification of the form it attaches to (41c). The affixation of the pronoun /u/ also provides the right conditions for filling and parsing the lingering mora (41d). The derived structure then creates an environment that requires an additional schwa epenthesis. These processes are illustrated by the following representations:

(41) Gemination as compensatory lengthening in MA[3]

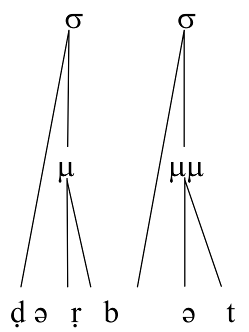
a.



Deletion

[ḍəṛbat] ‘she hit’

b.

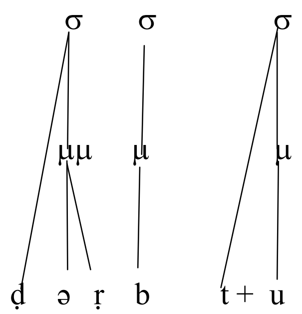


(lingering mora)

Resyllabification

[ḍəṛbət] ‘she hit’

c.

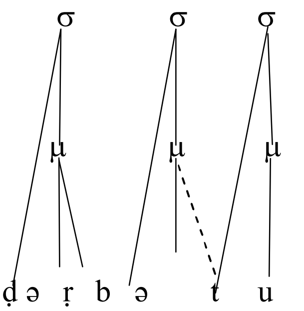


Affixation and resyllabification

/ḍəṛ.b.tu/ ‘she hit+ him’

[3]These representations serve an illustrative purpose only. In our OT analysis, we will only be concerned with output forms. The intermediate representations can be thought of as possible output candidates.

d.



Compensatory lengthening and resyllabification

[ḍəṛbə**tt**u] 'she hit him'

At the representational level of the created geminate, a structure-motivated empty root node is inserted to attain segmental length, reflecting the new weight of the spreading consonant. One caveat to emphasize is that CL as seen here takes place only world internally. The reason why this is the case will be explained later in this subsection. With this background in mind, we believe that in order to entertain a constraint-based CL analysis, we first have to account for the deletion of the vowel /a/. To do so, we will make use of the constraints shown in (42) below:

(42) Constraints responsible for CL in MA

a. ***a**: Avoid the vowel /a/ in the output.

b. **MAX-V$_{\text{-at}}$**: The input vowel of the affix /-at/ must have a correspondent in the output. (No deletion)

(42a) is a markedness constraint that simply disfavors candidates with the vowel /a/. The constraint in (42b) is a faithfulness constraint prohibiting the deletion of input vowel in the affix /-at/. The tableau in (43) showcases the interaction responsible for the deletion of the vowel /a/ subsequent to the suffixation of the affix /-at/ to a verb stem:

(43) Vowel deletion: *a>>MAX-V$_{\text{-at}}$

/ḍəṛbat/	*a	MAX-V$_{\text{-at}}$
☞a. ḍəṛ.bət.		*
b. ḍəṛ.bat	*!	

The faithful candidate in (43b) incurs a fatal violation of *a. The latter happens to be the dominant constraint in the hierarchy, favoring the unfaithful candidate in (43a). Thus, (43a) emerges as the winner.

At this stage, the syllabification shown in (41c) should be justified. In particular, we have to clarify why /ḍəṛ.bət-u/ has been intermediately syllabified as /ḍəṛ.b.tu/ instead of directly syllabified as [ḍəṛ.bət.tu]. We argue that the reason behind this is to maintain a level of consistency in the syllable structure of MA. One known fact about the 3rd person pronoun /u/ is that it triggers the resyllabification of trisegmental verbs as well as quadrisegmental ones for the sake of providing the /u/ with an onset (Boudlal, 2001:171). This is illustrated by the following examples:

(44) Resyllabification of quadrisegmental verbs in MA

/ṭəṛ.ʒəm+u/	ṭəṛ.ʒ.mu	*ṭəṛ.ʒəm.mu	‘he translated it’
/kər.kəb+u/	kər.k.bu	*kər.kəb.bu	‘he rotated it’
/ʒəṛ.ʒəṛ+u/	ʒəṛ.ʒ.ṛu	*ʒəṛ.ʒəṛ.ṛu	‘he dragged it’
/dər.dəb+u/	dər.d.bu	*dər.dəb.bu	‘he rolled it’

Therefore, we believe that the same should be done with forms such as [ḍəṛ.bət], which happen to have the same phonological shape as the quadrisegmental verbs above.

(45) ONSET >> FAITH-OOσ

/ḍəṛ.bət+u/ Base:[ḍəṛ.bət]	ONSET	FAITH-OOσ
☞a. ḍəṛ.b.tu		*
b. ḍəṛ.bət.u	*!	

In order to complete the picture, we will have to introduce two additional constraints: LINK-μand *GEM.The interaction between these two constraints is what captures the CL process.The constraint in (46a) prohibits the existence of geminate consonants in the language. (46b) stipulates that input moras should be preserved in the output.

(46)

a. ***GEM**: geminate consonants are banned.

b. **LINK-μ**: an input mora must be realized in the output.

To elaborate, the constraint LINK-μ demands that the lingering mora should associate to some other melodic element. Since the mora gets linked to a consonant, a geminate structure is derived. For this to be possible, LINK-μ should outrank the constraint against long consonants, *GEM.

(47) LINK-μ>> *GEM

/ḍəṛ.b.tu/	LINK-μ	*GEM
☞a. ḍəṛ.bət.tu		*
b. ḍəṛ.b.tu	*!	

The optimal candidate lengthens the consonant /t/ to fill the lingering mora. This leads to the violation of the low-ranking *GEM. The candidate in (47b) loses for being unable to preserve the mora left over upon the deletion of /a/. Note that the lengthening of the /t/ creates a new environment for the application of schwa epenthesis. This conventionally ensues from the ranking of PARSE-Seg>> DEP-ə. The lengthening of the affix consonant in lieu of the stem consonant is decided by independent constraints on syllabic well-formedness. That is, if the /b/ in [ḍəṛbatu] lengthens instead, any possible candidate would be harmonically bounded by the winner for incurring extra violations. For instance, the candidates *[ḍəṛ.b.b.tu],*[ḍəṛ.bəb.tu], *[ḍəṛ.b.bə.tu] and *[ḍəṛ.b.bət.u] would violate *μ/C, GEM-Integrity, *μ/ə and ONSET, respectively.

Now, we move on to explain why compensatory lengthening does not take place when the suffix /-at/ is not followed by the vocalic 3rd person pronoun marker (i.e. [-u]). Consider the following examples:

(48)

ḍəṛbat	ḍəṛbət	*ḍəṛbətt	'she hit'
ʃəṛbat	ʃəṛbət	*ʃəṛbətt	'she drank'
qətlat	qətlət	*qətlətt	'she killed'
nəʃṛat	nəʃṛət	*nəʃṛətt	'she cleaned'

What this data shows is that even when the /a/ of the affix deletes, the /t/ does not undergo lengthening. Our account for this relies on a markedness distinction between internal geminates and peripheral geminates, whereby the latter happen to be more marked, hence more disfavored even in languages that allow geminates. We posit a constraint against the occurrence of edge geminates, which we believe has to dominate LINK-μ. This constraint can be articulated as follows:

(49) ***EDGE-GEM**: peripheral geminates are not allowed.

The following tableau illustrates how *EDGE-GEM interacts with the other relevant constraints:

(50) **Antigemination effect:** edge geminates are disfavored

ḍəṛbat	*EDGE-GEM	LINK-μ	*GEM
☞a. ḍəṛ.bət		*	
b. ḍəṛ.bət.t	*!		*

The ranking of LINK-μ between *EDGE-GEM and *GEM means that the phonology of MA prefers leaving the mora unlinked over creating a geminate at the edge. The subsequent tableau summarizes all the interactions at play:

(51) *EDGE-GEM >>LINK-μ, *a>> *GEM, MAX-V_{at}

ḍəṛbat	*EDGE-GEM	LINK-μ	*a	*GEM	MAX-V_{at}
☞a. ḍəṛ.bət		*			*
b. ḍəṛ.bat			*!		
c. ḍəṛ.bət.t	*!			*	*

The view that this CL process stands as evidence to the moraic nature of geminates in MA is based on the idea that CL patterns are best described in moraic terms. Therefore, since we have a case of consonant lengthening that is moraically motivated, it is more reasonable to assume that all cases of consonant length in MA, be they underlying or derived, are moraic in nature.

4. Evidence from word-formation

The third type of evidence for the moraic analysis of geminates comes from word formation. Specifically, we argue that the process of morphological gemination, which consists in utilizing consonant lengthening as a morphological marker, is best accounted for if length is expressed in moraic terms. The forms that are derived through this process include: the causative verb, the agent noun and the instrument noun. For convenience, some examples are provided below:

(52) Morphologically derived geminates:

(i) The causative

ktəb	‘to write’	kəttəb	‘to make write’
ħṛəb	‘to run away’	ħəṛṛəb	‘to cause to run away’
xsər	‘lose’	xəssər	‘to cause to lose’
zləq	‘slip’	zəlləq	‘to cause to slip’

(ii) The agent noun

fləħ	‘to farm’	fəllaħ	‘farmer’
nʒəṛ	‘to sharpen’	nəʒʒaṛ	‘carpenter’
gzər	‘to butcher’	gəzzar	‘butcher’
bni	‘to build’	bənnaj	‘mason’

(iii) The instrument noun

ɣsəl	‘to clean’	ɣəssala	‘a washing machine
sməʕ	‘to listen’	səmmaʕa	‘headset’
kwi	‘to weld’	kəwwaja	‘a welding machine’
sqi	‘to water’	səqqaja	‘fountain’

There are three possible ways to account for morphological gemination in these forms. We will take the causative form as our illustrative case. The agent and the instrument rely on other vocalic material in their derivation. To start with, the causative can be analyzed as a case of mapping a tri-segmental root (e.g. rkb ‘ride’) to a quadrisegmental template (e.g. CCCC) (Bennis and Iazzi, 1995). Since templatic slots outnumber the segments of the root, four to three, the second segment of the root associates to two positions, creating a geminate structure. The mapping analysis is undermined by the fact that the spreading direction of Arabic, which operates from left to right, fails to derive the right form (e.g. *rkbb). Actually, neither can right to left spreading yield the desired forms (e.g. *rrkb). The analysis, as presented in Bennis and Iazzi (1995), ad-hocly resorts to the pre-association of the second root segment to the second slot in the template to resolve this issue.

Second, it was suggested that morphological causatives in MA could be better accounted for through a process of partial reduplication of the base (Boudlal, 2001). The reduplicative morpheme is set to target the left edge of the base by an alignment constraint. The reduplicant consists of one single segment, which then gets infixed under the pressure of higher-ranking constraints, causing the doubling of the second segment of the root (see Noamane (2018d) for more on this). Based on the nature of these two above-mentioned analyses, they will be jointly dubbed the segmental analysis.

The reduplication analysis of morphological gemination in MA seems to be unrestricted, in the sense that the reduplicant is not specified in terms of a well-defined phonological entity. Within current prosodic morphology, namely templatic morphology (McCarthy and Prince, 1986/1996, 1990a, 1990b), restrictions on the size and shape of reduplicants were found to be cross-linguistically defined in prosodic terms, viz. phonological word, foot or syllable. On this view, the analysis of morphological gemination as a case of segment reduplication appears to be inconsistent with this generalization since it does not refer to a constituent of the prosodic hierarchy. In other words, it is not possible to consider morphological gemination a result of segment duplication since a segment is obviously not a prosodic constituent.

The inadequacies that characterize the segmental accounts of mapping and reduplication can be interpreted as arguments for a moraic theory of length. A moraic analysis can account for morphological gemination more straightforwardly, namely through the affixation of a morphologically induced mora (Lombardi and McCarthy, 1991; Samek-Lodovici, 1992; Bensoukas, 2001; Noamane, 2013/2014). The two analyses can be schematically contrasted as follows:

(53) a. Moraic analysis

$$\begin{array}{c}\text{ALIGN-L } \mu c\\ \downarrow\\ \mu\\ |\\ \text{C}\end{array}$$

b. Segmental analysis

$$\begin{array}{c}\text{Mapping/RED}\\ \downarrow\\ \text{Ci+Ci}\end{array}$$

Unlike the segmental analysis, the moraic analysis of morphological gemination has the advantage of using a well-defined phonological unit that has been theoretically and typologically established. This allows for a generalized crosslinguistic account of morphological gemination. The fact that morphologically derived geminates favor a moraic analysis may work as suggestive evidence that lexical geminates are moraic too (for an elaborate treatment of morphological gemination using a moraic model, see Noamane (2018d)).

5. Defusing the nonmoraic view of geminates

Moraic phonology predicts that CVV and CVG syllables should always pattern as heavy thanks to their bimoraic nature. Therefore, both of these syllable shapes are expected to attract stress in languages where the latter is weight sensitive. Contrary to this prediction, it has been reported that there exist languages where CVV syllables alone qualify as bimoraic for stress. This means that CVG syllables, in this case, pattern as monomoraic as they get ignored by stress rules, suggesting that the geminate is nonmoraic.

One such a language, where stress ignores CVG syllables in a weight sensitive system, is Selkup (Tranel, 1991). In Selkup, stress typically falls on the rightmost heavy syllable. If there is no heavy syllable, stress falls on the first syllable instead. The problem is that CVG syllables are systematically ignored by the stress rule in the same way monomoraic CV and CVC syllables are. This is demonstrated by the data below, where the last item shows that a syllable closed by a geminate is not recognized as bimoraic, hence skipped by stress:

(54) Stress in Selkup

quˈmo:qi	‘two human beings’
ˈu:cɨqo	‘to work’
qumo:qliˈlɪ:	‘your two friends’
ˈu:cɨkkak	‘I am working’

To explain this, Tranel (1991) proposes the Principle of Equal Weight for codas. This principle states that in a language like Selkup, where Weight-by-Position is not applicable, all coda consonants should be equally weightless regardless of being singletons or geminates. Davis (1994, 1999) offers a different view from that of Tranel (1991). Davis defends the moraic conception of geminates by showing that Selkup may just be a language where only a subset of moras are relevant for stress. To elaborate, for Selkup, it may be that only moras dominating vowels are relevant for stress placement while those linked to geminates are ignored. In OT, this effect can be easily obtained through the work of some high-ranked constraints. Therefore, languages in which geminates pattern as nonmoraic with regards to their stress systems do not constitute conclusive evidence against the underlying moraic nature of geminates.

6. Conclusion

This paper has been concerned with providing pieces of evidence from MA that can support the moraic conception of geminates, and hence further justify our decision to represent geminates as underlyingly moraic. The pieces of evidence that we have presented in the course of this paper consist of arguments from word minimality, compensatory lengthening and word formation. First, it has been shown that, despite being monovocalic, GV words in MA are possible. This was argued to follow from the underlying moraic nature of their initial geminates, meaning that GV words meet the word minimality condition by virtue of being underlyingly bimoraic.

Second, we have used a case of dialectal compensatory lengthening to demonstrate that a moraic approach to geminate representation is needed. We have argued that the mere fact that compensatory lengthening exists in MA, leading to the creation of geminate instances, constitutes a strong argument in favor of the moraic analysis since CL is a mora preserving phenomenon par excellence. Third, a moraic approach to gemination was shown to be preferable in accounting for morphologically geminated forms such as MCs, ANs and INs. The moraic analysis of morphological gemination in MA was compared to the segmental analyses of reduplication and template mapping, which were revealed to rely on ad-hoc assumptions. The moraic analysis has the advantage of being cross-linguistically generalizable and theoretically supported.

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