Schwa as a Non-moraic Vowel in Amazigh: An Optimality-theoretic Account [*]

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It has commonly been pointed out that Tamazight and Tarifiyt avoid the appearance of schwa in open syllables. We take this restriction as a starting point and propose a constraint that bans the association of schwa with a mora. This constraint is so pervasive in the grammar of the Amazigh dialects concerned that other apparently unrelated phonological and morpho-phonological phenomena ensue from it. First, schwa never participates in a vowel epenthesis augmentation phenomenon. Second, it does not contribute to the weight of closed syllables for stress reasons. Finally, it does not participate in compensatory lengthening to fill a vacant mora.

Keywords: mora, schwa, non-moraic vowel, syllable weight, Amazigh

Il a été communément souligné que tamazight et tarifiyt évitent l'apparition du chva en syllabe ouverte. Nous prenons ceci comme point de départ et proposons une contrainte qui interdit l'association du chva à une more. Cette contrainte est tellement omniprésente dans la grammaire des parlers amazighes concernés que d'autres phénomènes phonologiques et morpho-phonologiques apparemment non-reliés en découlent. Chva ne participe jamais à un phénomène d'augmentation par épenthèse vocalique, il ne contribue pas au poids des syllabes fermées pour des raisons d'accentuation, et ne remplit pas non plus une more vacante en cas d'allongement compensatoire.

Mots-clés: More, schwa, voyelle non moraïque, poids des syllabes, amazighe

1. Introduction

As opposed to the full vowels [i, u, a], schwa never occurs in open syllables in Amazigh, definitely a particularity of schwa and apparently a commonality of Tamazight and Tarifiyt dialects of Amazigh (Saib, 1976a-b; Guerssel, 1976; Chtatou, 1982; Bensoukas, 2017a among others). To this effect, Saib (1976b) formalizes a constraint *ə]$_\sigma$, spelt out as *Cə, *əCV, *VCə, *əCə, *əGə (where G stands for a geminate consonant).[1]

After further scrutiny, it turns out that schwa is exceptional in further respects: (i) Schwa syllables are treated by the stress system as light, (ii) schwa never participates in augmentation of morphological stems, and (iii) a special compensatory phenomenon never resorts to schwa. Since syllable weight is what these phenomena share, it seems that schwa eschews all contexts where vowel weight is at stake. As a unifying

[*] This paper is an Optimality-Theoretic formalization of the basic idea in "A Note on the absence of schwa from open syllables in Amazighe", a paper I presented at the study day *La Langue Amazighe: Approche Linguistique*, FLHS, Ben M'Sik, Casablanca, 18 March 2004, a complete and updated version of which is published as Bensoukas (2017a). For their comments on a presentation based on this paper, I would like to thank the participants and audience at the conference *Mother Tongues and Linguistics (in honor of Prof. Jilali Saib)*, FLHS, Rabat, 21-22 February 2013. The analyses contained herein have been presented in various places, some in collaboration with N. Amrous and A. Boudlal. At various points, I benefited from discussions with and comments from A. Adnor, N. Amrous, A. Boudlal, M. Chtatou, R. Faizi, N. Fehri, E.M. Iazzi, and M. Marouane. I also benefited from the comments of *Asinag* reviewers. The usual disclaimer applies.

[1] Tashlhit data is not considered in this paper. Tashlhit has been argued to have a different syllable structure, with consonants playing the role of the nuclear element of consonant-only syllables, thus overriding the need for schwa epenthesis (Dell and Elmedlaoui, 1985, 2002; Boukous, 1987, 2009; Prince and Smolensky, 1993/2004; Ridouane, 2008, 2016; Hdouch, 2012, among others). For syllable weight in Tashlhit, see Jebbour (1996, 1999) as well as Dell and Elmedlaoui (2017).

account for the behavior of schwa, the proposal I will advance is that epenthetic schwa is a non-moraic vowel (Bensoukas, 2006/2007, 2017a; Bensoukas and Boudlal, 2012a-b; Shih, 2018).

Using parallel Optimality Theory (OT) (Prince and Smolensky, 1993/2004; McCarthy and Prince, 1993, 1995, 1999), I formalize the proposal in terms of constraint interaction (§2). A markedness constraint against the association of schwa with a mora is high-ranking in the grammar of Amazigh, thus ruling out any configuration containing a moraic schwa. Such a constraint is not relevant to full vowels, the markedness constraints on their being associated to moras being low-ranking. Evidence for my proposal constitutes the bulk of §3 and §4. In §3, syllabification and stress assignment reveal that (i) schwa is an epenthetic vowel which shuns open syllables, and quite interestingly that (ii) schwa syllables, although closed, are treated by the stress system as light. In §4, two weight sensitive phenomena are discussed which never resort to schwa: prosodic augmentation of morphological stems through vowel epenthesis (in most dialects) and the diphthongization ensuing from a compensatory lengthening phenomenon (CL) in Tarifiyt. In §5, I make suggestions for future research.

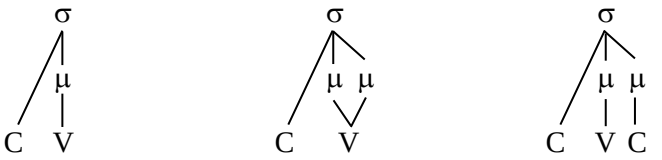
2. The proposal

2.1. Theoretical background

I rely on the standard assumptions of generative prosodic (moraic) phonology. Syllable weight is based on the number of moras dominated by the syllable node (Hyman, 1985; McCarthy and Prince, 1986, 1993; Hayes, 1989; Zec, 1988; Gordon, 2004, 2006, among others): A light syllable contains a single mora (1a), while a heavy syllable contains two (1b-c) (Hyman, 1985; McCarthy and Prince, 1986, 1993; Hayes, 1989):

(1) Light (L) vs. heavy (H) syllables:

a. *L = [σμ]:* b. *H = [σμμ]:* c. *H = [σμμ]:*



A further distinction is drawn between distinctive and coerced weight (Morén, 1999, 2003). Long vowels and diphthongs have distinctive vowel weight underlyingly and are associated with two moras (Rosenthall, 1994; Selkirk, 1990; Katada, 1990), making their syllables heavy. In contrast, coerced weight results from phonological activity, as in the case of (i) augmenting a word to satisfy minimality requirements, (ii) CL, or (iii) assigning a mora to a coda through Weight-By-Position (WBP) (Hayes, 1989).

I also assume the basic tenets of parallel OT (Prince and Smolensky, 1993/2004; McCarthy and Prince, 1993, 1995, 1999), in which the mapping of input onto output is governed by the interaction of potentially violable, universal constraints on output well-formedness. These constraints are basically of two kinds: Markedness constraints and faithfulness constraints. McCarthy (2007: 264) describes OT as having two components. The 'operational component'- the Generator function (GEN) of OT- is claimed to be part of Universal Grammar, to have access to the primitives of phonological representation and to be endowed with Freedom of Analysis. It can thus provide for a given input an infinite set of candidate analyses ({$Cand_1$, $Cand_2$,…, $Cand_n$}). The 'constraint component' of OT, called Evaluation (EVAL), assesses the well-formedness of these candidates against a hierarchy of constraints in a parallel and inclusive fashion. Only one candidate is optimal, the one best satisfying EVAL by incurring minimal violations of the constraints.

Generally, the demands of constraints may result in a 'conflict' which is resolved by ranking the constraints on a language particular basis. Accordingly, a particular grammar may be viewed as a ranked hierarchy of universal constraints. Ranking constraints with each other is based on constraint arguments as in the following two-by-two tableau :

(2)

Input	Constraint A	Constraint B
a. Candidate 1	*!	

☞ b. Candidate 2		*

Two candidates are evaluated. (2a) violates the dominant constraint, the one to the left of the top row. (2b) violates the lower ranked constraint. Each candidate incurs one violation mark indicated by '*' in the corresponding cell. However, violating the higher ranked constraint is fatal (indicated by '*!'). The symbol '☞' indicates the optimal candidate.

With this background in mind, I will show that, instead of treating the constraint *ə]$_\sigma$ as a primitive, its effect is obtained through the interaction of constraints on moraic well-formedness, with the association of schwa to a mora being ruled ill-formed.

2.2. Schwa is not mora-bearing

The proposal consists in treating schwa as a non-moraic vowel. This idea is formalized using the basic tenets of OT (Bensoukas, 2006/7; Bensoukas and Boudlal, 2012a-b; see also the recent work of Shih, 2018).[2]

Crucial at this point is the fact that vowels are underlyingly moraic (Hyman, 1985; Zec, 1988 for example.) Amazigh open syllables with a nuclear schwa would have the representation provided in (3b), which is ill-formed, as opposed to that of open, well-formed syllables with a full vowel (3a). Syllables with a schwa nucleus must have the structure provided in (6c) below.

(3) a. [Ca$^\mu$]$_\sigma$, [Ci$^\mu$]$_\sigma$, [Cu$^\mu$]$_\sigma$ b. * [Cə$^\mu$]$_\sigma$

In my analysis, vowels remain faithful to their underlying moraicity, but I will argue that, in all events, schwa does not have an associated mora. The basic interaction in this context is one between the markedness constraint *μ/V (a family of constraints) and MaxLink-Mora [SEG] (after Morén, 1999, 2003):

(4) Mora structure in Amazigh:

μ/V: Do not associate a mora with a vowel.

MaxLink-Mora [SEG]: A particular segment affiliated with a mora underlyingly should remain affiliated with a mora on the surface.

Since only schwa seems not to be allowed in open syllables, I suggest splitting the constraint *μ/V into more specific markedness constraints as in (5a). The constraint most relevant in the present analysis is *μ/ə, formulated in (5b). The fact that all vowels except schwa can appear in open syllables calls for ranking them with respect to faithfulness as in (5c):

(5) a. *Specific instantiations of *μ/V:* *μ/ə, *μ/a, *μ/u, and *μ/i

b. *μ/ə:* Do not associate a mora with the vowel schwa

c. *Ranking:* *μ/ə » MaxLink-Mora [SEG] » *μ/a, *μ/u, *μ/i

This ranking will ensure that schwas never get moraic, a markedness effect. The full vowels may get associated with moras, given that the relevant markedness constraints are dominated.

The next subsections, devoted to fine-tuning the proposal, will deal with the internal structure of schwa syllables and the issue of variable syllable weight inherent in the proposal.

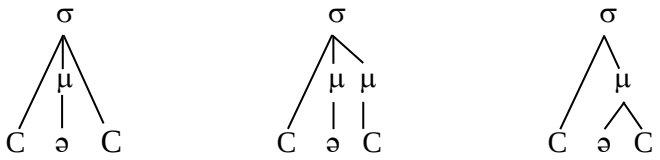
2.3. The internal structure of schwa syllables

Given my moraic interpretation of *ə]$_\sigma$, three possible scenarios can be imagined regarding the internal structure of schwa-syllables:

[2] The idea that schwa is not mora-bearing is also suggested in Al Ghadi (1994) for Moroccan Arabic. For a comparative approach to the facts of schwa in Moroccan Arabic and Amazigh, see Bensoukas and Boudlal (2012a-b) and Bensoukas (2019).

(6) Internal structure of schwa-syllables:

a. *Cə$^{\mu}$C*: b. *Cə$^{\mu}$C$^{\mu}$*: c. *C[əC]$^{\mu}$*:



In (6a), the coda consonant of schwa syllables is appended to the syllable node. As far as our constraint is concerned, this representation is as ill-formed as the one in (6b). As shown further below, (6b) is infelicitous in another respect: Schwa is exclusively associated with a mora, as is the coda consonant. Such a configuration does not match the data to be considered, namely stress assignment, morphological augmentation and CL. We are left with only structure (6c) to consider.

My analyses below will in fact be consistent with a representation such as (6c). On the one hand, although they are closed, schwa syllables are treated as light by the stress system of Goulmima Tamazight (GT). On the other hand, morphological augmentation and CL, both of which involve syllable weight encoded in mora-count, do not resort to schwa. In these very cases, that role is assigned to the full vowel [a], or one of its variants in the case of augmentation. It is crucial that the constraint *μ/ə is violated only when a mora is associated exclusively with schwa, as in (3b) or in (6a-b), for that matter. Contrariwise, when the mora associates with both schwa and a following consonant, the constraint *μ/ə is not violated. This understanding of the constraint *μ/ə is a determining factor in considering [CəC]$_{\sigma}$ to be a light, mono-moraic syllable.

On this understanding, light (closed) schwa syllables contrast with heavy closed syllables headed by a full vowel. This results in a situation of variable closed syllable weight, the concern of the next section.

2.4. Schwa syllables and variable syllable weight

Stress assignment in GT treats syllables with a nuclear schwa as light, as opposed to the heavy syllables with the nuclear full vowels [a, i, u] (see §3.2 below). This results in variable closed syllable weight (Rosenthall and Hulst, 1999 and references therein), as in the two representations in (7):

(7) a. *Schwa syllable:* b. *Full vowel syllable:*

I will now try to sketch an analysis of the moraic constituency of Amazigh syllables, extending and refining that in Bensoukas (2006/7) (see Bensoukas and Boudlal, 2012a-b). I start with the simplest type possible, i.e. open and closed syllables whose nuclei are underlying full vowels. Bear in mind my assumptions that vowels are underlyingly associated with a mora and that weight can be distinctive or coerced. In the case at hand, distinctive weight is contributed by the underlying moras associated with vowels, while coerced weight is the result of WBP, the requirement that codas be moraic.

In the constraint-based analysis I propose, vowels remain faithful to their underlying moraicity and the moraicity of coda consonants leads to a violation of the markedness constraint against consonantal moras. (8) gives the relevant constraints along with their ranking. Ranking (8b) is justified, for one thing, by the fact that an underlying vowel mora is preserved, breaching the markedness constraint against vowel moraicity. For another, coda consonants are associated with a mora, violating the faithfulness constraint and the markedness constraint against consonants being moraic.

(8) Mora structure in Amazigh:

a. *Weight constraints:*

μ/V: Do not associate a mora with a vowel (after Morén, 2003)

μ/C: Do not associate a mora with a consonant (after Morén, 2003)

WeightByPosition (WBP): Coda consonants must surface as moraic (after Hayes, 1989)

MaxLink-Mora [V]: (stated in (4) above with SEG but repeated here with V for ease of exposition) A particular vowel segment affiliated with a mora underlyingly should remain affiliated with a mora on the surface.

DepLink-Mora [SEG]: A segment that does not have a mora underlyingly should not have a mora on the surface (after Morén, 2003)

b. *Ranking:*
MaxLink-Mora [V], WBP » *μ/V, DepLink-Mora [C], *μ/C

Tableau (9) for the word [açal] 'soil' shows that the candidate incorporating the underlying vowel mora and simultaneously assigning a mora to the coda consonant is the winner (the dotted line indicates constraints that are not ranked with respect to one another):

(9)

/aᵘçaᵘl/		MaxLink-Mora [V]	WBP	*μ/V	DepLink-Mora [C]	*μ/C
a.	a . ç á l	*!*	*			
b.	aᵘ. ç áᵘ l		*!	**		
☞ c.	aᵘ. ç áᵘ lᵘ			**	*	*

In order that the bimoraicity of a closed syllable with a full vowel be ensured, we need to rank the constraint *APPEND, which bans syllabifying segments as syllable appendices (represented as CəᵘC**)**, over *μ/C, as in Rosenthall and Hulst (1999: 503) (after Sherer, 1994). Next, we need to account for what it is that prevents a closed syllable with a full vowel from having a branching mora and, therefore, sparing violation of *μ/C. For this purpose, I incorporate into the hierarchy IdentLink-Mora, which demands identity between input and output association to moras.[3] IdentLink-Mora plays a different role from MaxLink-Mora, which requires that an underlying mora link be present in output forms. IdentLink-Mora is violated whenever an underlying association to a mora is altered, as in the case where one mora is doubly associated to two segments. A case in point is a vowel associated underlyingly with a mora and sharing its mora with a following consonant (represented below as C*[VC]*$_{\mu}$). This is in favor of high-ranking IdentLink-Mora with respect to *μ/C, as in (10). APPEND and IdentLink-Mora are not ranked with respect to one another.

(10) a. *Constraints:*

**APPEND (APP):* Do not syllabify segments as syllable appendices.

IdentLink-Mora: An underlying mora link and its output correspondent must be identical.

b. *Ranking:* APPEND, IdentLink-Mora » *μ/C

(11) Weight of underlying full vowel syllables:

/…CVᵘC…/		IdentLink-Mora	*APP	*μ/C
☞ a.	CVᵘCᵘ			*
b.	CVᵘC		*!	
c.	C[VC]$_{\mu}$	* !		

With respect to the ranking (10b), only candidate (11a), whose coda is associated with a mora, wins as it satisfies both IdentLink-Mora and *APPEND, while only minimally violating the dominated constraint *μ/C.

[3] The constraint IdentLink-Mora is inspired from Morén (1999, 2003), in which the constraints DepLink-Mora and MaxLink-Mora are proposed.

The next issue in relation to variable syllable weight in Amazigh is the source of the mora that surfaces in a closed schwa syllable. I will contemplate three scenarios. First, the vowel has its own mora in compliance with the precept of moraic theory that vowels are underlyingly associated with a mora. In my account, even candidates that come underlyingly with a moraic schwa, in compliance with Richness of the Base (Prince and Smolensky, 1993/2004), will be ruled out by the constraint *μ/ə dominating MaxLink-Mora[V]:

(12)

Input: a^{μ} z $ə^{\mu}$ n	*μ/ə	MaxLink-Mora[V]
a. a^{μ} . z $ə^{\mu}$ n	*!	
☞ b. a^{μ} . [z ə n]$_{\mu}$		*

As the description and analysis of stress facts below will show, a closed syllable with schwa is light. The only representation consistent with this behavior is to have schwa and the following consonant share a mora as in (12b). This sharing calls for the low ranking of the constraint against branching moras, namely NoSharedMora:

(13) *NoSharedMora:* A mora must not be doubly linked to segments. (Morén, 1999 and references therein)

A markedness constraint on the types of mora-to-segment association, NoSharedMora is violated by any doubly associated mora. The work this constraint does is different from the one IdentLink-Mora does, since IdentLink-Mora requires faithfulness to underlying mora associations, while NoSharedMora simply rules out a doubly associated mora. In the present case, epenthetic schwa and the following consonant share a mora. In this specific instance, faithfulness is not at stake; accordingly, IdentLink-Mora is not relevant. On the basis of the ranking IdentLink-Mora, *APP » *μ/C, to which NoSharedMora is added as a dominated constraint, let us compare the candidates in (14) for optimality:

(14) Weight of epenthetic schwa syllables: *μ/C » NoSharedMora

/…CC…/	IdentLink-Mora	*APP	*μ/C	NoShared Mora
☞ a. C*[əC]*$_{\mu}$				*
b. C$ə^{\mu}C^{\mu}$			* !	
c. C$ə^{\mu}$C		* !		

According to this ranking, the optimal candidate is the one with mora-sharing since the candidate that has schwa and a coda to each of which a mora is associated incurs a fatal violation of *μ/C.

The second possibility consists in treating schwa as moraless and the mora of the closed syllable as being contributed by the coda through WBP. Recall my assumption that schwa's being associated with a mora together with the following consonant does not violate *μ/ə, violation of which is only incurred by a one-to-one mapping of schwa to a mora:

(15) Weight of schwa syllables: *μ/C » NoSharedMora

/…CC…/	IdentLink-Mora	*APP	*μ/ə	*μ/C	NoSharedMora
☞ a. CəC$^{\mu}$				*	*
b. C$ə^{\mu}C^{\mu}$			*!	*	
c. C$ə^{\mu}$C		*!	*!		

One objection to this analysis is that it does not conform to the essence of WBP as postulated in Hayes (1989), whereby the presence of a first mora is a prerequisite for the assignment of a second mora. OT not being based on such serialism, one might regard WBP as a constraint on output forms. In this case, what matters more is whether the output has a moraic coda or not, without worrying about the process behind this association. I do still reject the second possibility on the basis of its not conforming to the essence of WBP, and also because the third possibility seems to me to be simpler.

The third possibility is to consider the presence of the mora as a requirement of prosodic licensing. Given the Strict Layer Hypothesis (Selkirk, 1984), Zec (1988) argues that the relationship between the root node and the higher syllabic node has to be mediated by the moraic node. In moraic theory, onsets are associated directly to the syllable node in the models proposed by Hayes (1989) and McCarthy and Prince (1993). The rime constituent should be dominated by a mora. In this case, schwa and the following consonant are both parsed by the mora, and that is the way they get associated with the syllable node. The point here is that if no mora is supplied to parse the unsyllabified consonants, the Parse-Seg constraint is violated. I have demonstrated above that this constraint is high-ranking in the hierarchy. Schwa is needed because consonant clusters are not tolerated in the varieties of Amazigh resorting to schwa epenthesis (i.e. Tamazight and Tarifiyt).[4]

In the remainder of the paper, I will show that *μ/ə is so pervasive in the grammar of the language that weight-sensitive activity in various phonological and prosodic morphological areas (see for example Ryan, 2016) ensues from it, as I show in §3.2, §4.1, and §4.2.

3. Evidence for the proposal

3.1. Schwa epenthesis and open syllables

Two pieces of evidence show that schwa is epenthetic in Amazigh: (i) in words that are morphologically related, schwa is either absent or located in different places in the words in question (16); and (ii) with a few exceptions, schwa has a very predictable distribution (17). The data is from Faizi (2002: 100-11).

(16) Schwa in different morphologically related forms:

a.	*Verb*	*Action n.*	
	zəḍ	iziḍ	‘grind’
	nçər	tanəçra	‘get up’
b.	*Verb*	*Agentive n./ Adj.*	
	çməḍ	anəçmuḍ	‘burn’
	lwiɣ	aməlwaɣ	‘be soft’
c.	*Sg. n.*	*Pl. n.*	
	iflu	ifəlwan	‘door’
	amda	imədwan	‘lake’
	ifiɣər	ifaɣriwən	‘snake’

(17) a. Schwa in consonant-only words:

/sɣ/	səɣ	‘to buy’
/bdr/	bdər	‘to mention’
/ssn/	ssən	‘to know’
/t-rẓm/	tər.ẓəm	‘she opened’

b. Schwa in words with vowels and consonants:

i. Schwa appears between last two Cs

/azn/	a.zən	‘to send’
/udm/	u.dəm	‘a face’
/zijzl/	zij.zəl	‘to shorten’
/adfl/	ad.fəl	‘snow’
/uʃʃn/	uʃ.ʃən	‘a jackal’
/azuzzr/	a.zuz.zər	‘winnowing’

ii. Schwa between word-medial Cs

/azuçnni/	a.zu.çən.ni	‘thyme’

[4] Shih (2018) distinguishes three types of schwa syllables: (i) a minor syllable with non-moraic schwa [Cᵊ], (ii) the mono-moraic schwa syllable [Cə], and (iii) the bi-moraic schwa syllable [Cəː]. Commenting on the phonetic properties of moraless schwa, the author states that it has minimal duration and largely varies in vowel quality as opposed to the other two types. In terms of representation, syllables with non-moraic schwa can have one of three configurations, in which schwa is directly dominated by the syllable node, in conformity with Itô and Mester’s (2003) “hierarchical locality restriction on markedness constraints”, according to which “if a markedness constraint mentions prosodic node *p*, it may mention nodes at *p-1* and *p-2*, but not nodes at other levels” (ibid.: 16). The configurations are: [σCᵊ], [σCᵊC] [σCᵊCᵘ]. Shih’s representations differ largely from mine in two respects. First, schwa can be dominated directly by the syllable node, which is not possible under the Strict Layer Hypothesis assumed in this paper. Second, the consonant closing a schwa syllable can bear a mora.

/axʷdmi/	a.xʷəd.mi	‘a knife’
/amrwas/	a.mər.was	‘debt’
/iɣzdis/	i.ɣəz.dis	‘rib’
/awssar/	a.wəs.sar	‘an old person’
/tamɣra/	ta.məɣ.ra	‘marriage ceremony’

The analysis in this section and the next one is a summary of the analysis in Bensoukas and Boudlal (2012a-b). The constraints involved are provided in (18), and their interaction in evaluating the syllabification of a word without schwa is given in (19).

(18) Syllable structure constraints

Onset (Prince and Smolensky, 1993/2004): Syllables must have onsets.
No-Coda (Prince and Smolensky, 1993/2004): Coda consonants are prohibited.
Parse-Seg (Prince and Smolensky, 1993/2004): Segments must belong to syllables.
Align-L (McCarthy and Prince, 1993): The left edge of the stem must be aligned with the left edge of the prosodic word.
MAX (McCarthy and Prince, 1995): Segments in the input must have correspondents in the output.
DEP (McCarthy and Prince, 1995): Segments in the output must have correspondents in the input.

(19)

/iflu/		Align-L	MAX	DEP	ONS	No-Coda
☞	a. if.lu				*	*
	b. ʔif.lu	*!		*		*
	c. i.lu		*!		*	
	d. lu	*!	*!*			

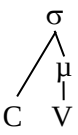
Because MAX is ranking higher than DEP, vowel epenthesis is favored over segment deletion. The constraint ONS is dominated by Align-L so that it does not ban word-initial onsetless syllables. Finally, the constraint No-Coda is not ranked with respect to ONS.

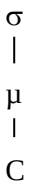
Now, I deal with syllables with schwa as a nucleus. Again, consonants are not deleted when unsyllabifiable; rather, schwa is epenthesized. Schwa epenthesis reveals that both Parse-Seg and MAX dominate the faithfulness constraint DEP, which militates against vowel epenthesis.[5] In (20), the competing candidates for the word [azən] ‘to send’ are assessed:

(20)

/azn/		Parse-Seg	MAX	DEP	No-Coda
	a. az		*!		
	b. az.n	*!			*
	c. a.zn	*!			
☞	d. a.zən			*	*

I assume that complex margins are not allowed, in compliance with *Complex. Following Boudlal (2001), I establish a distinction between (i) a major syllable (21a), whose nuclear element is a full vowel (schwa included), and (ii) a minor syllable (21b), consisting exclusively of a moraic consonant:

(21) a. 

b. 

What interests us at the moment is the light minor syllable in (21b) which is dominated by a consonantal mora, and which leads to the violation of a constraint banning minor syllables (i.e. *Min-σ). To ensure

[5] Both the constraints MAX and PARSE-Seg are needed since they perform different functions. MAX ensures that all input segments appear in the output, while PARSE-Seg requires them to belong to syllables and, thus, triggers schwa epenthesis between consonants that would otherwise remain unsyllabified and, consequently, be adjoined to the foot or PrWd. In [az.n], for example, Parse-Seg is violated by the final consonant not belonging to a syllable.

that schwa is epenthesized before the final consonant in CCC roots, I posit an alignment constraint (Align-R-Maj-σ) requiring that the right edge of the stem be aligned with the right edge of a major syllable. The constraints needed to account for epenthesis in CCC roots as well as their respective ranking are given in (22) below:

(22) MAX, Parse-Seg, *Complex, Align-R-Maj-σ » DEP » *Min-σ » No-Coda.

I assume that the constraint Align-R-Maj-σ must dominate DEP to force schwa epenthesis between the last two consonants of triconsonantal words. Ranking DEP above *Min-σ ensures that a form such as *Cə.CəC is ruled out (a form that could also be ruled out, as in (25) because it contains schwa in an open syllable); a form such as C.CəC, which attributes the minor syllable status to the initial consonant is ruled in, in spite of its violating the lower ranked constraint *Min-σ.

The result of this constraint interaction is shown in the GT word *bdər* 'mention'. The winner is candidate (23b), with a minor syllable, while candidates (23c-d) lose, both breaching *Complex. To save space, I do not include in the tableaux the high-ranking constraints MAX and Parse-seg.

(23)

/bdr/		*Complex	Align-R-Maj-σ	DEP	*Min-σ	No-coda
	a. bəd.r$^{\mu}$		*!	*	*	*
☞	b. b$^{\mu}$.dər			*	*	*
	c. bdər	*!		*		*
	d. bədr	*!		*		*

Not considered in this tableau is the candidate **bədər*. It could readily be ruled out because of the double violation of DEP it incurs. More importantly, it would not survive as it has schwa in an open syllable, an issue I take up immediately with a clearer case in (24).

Although schwa is inserted to ensure proper syllabification, it is never inserted if an open syllable is the result. The constraint hierarchy established thus far makes the wrong prediction as to the optimal output of a word like *taməɣra* 'marriage ceremony':

(24)

/tamɣra/		*Complex	Align-R-Maj-σ	DEP	*Min-σ	No-coda
	a. tamɣ.ra	*!	*			*
☞	b. ta.məɣ.ra			*		*
☞	c. tam.ɣə.ra			*		*

As it stands, the hierarchy yields two optimal analyses which tie on all constraints including DEP. This calls for an additional constraint to untie the situation by ruling in a syllable like [məɣ] while ruling out one like [ɣə].

In explaining this incongruity, I build on the idea that schwa is not mora-bearing (as in (5b) above). There, I suggested splitting the constraint *μ/V into *μ/ə, *μ/a, *μ/u, and *μ/i, with *μ/ə being undominated since only schwa does not seem to be allowed in open syllables. With the constraint *μ/ə, the tie is resolved as in (25):

(25)

/tamɣra/		*μ/ə	*Complex	DEP	*Min-σ	No-coda
☞	a. ta.məɣ.ra			*		*
	b. tam.ɣə.ra	*!		*		*

To sum up, the fact that schwa eschews open syllable contexts is accounted for through a markedness constraint against the association of schwa to a mora: Schwa occurring in an open syllable is the equivalent of having a moraic schwa, a fatal violation of the high-ranking *μ/ə. I now turn to another type of evidence for the proposal.

3.2. Stress assignment in Goulmima Tamazight

3.2.1 Goulmima Tamazight stress facts: An OT analysis

Syllable weight is clearly shown by word stress, a process sensitive to moraic structure. Amazigh heavy syllables generally attract primary stress (Adnor, 1995; Marouane, 1997; Faizi, 2002, 2009, 2011, 2017; Hdouch, 2004). The GT facts in (26) indicate that, when co-occurring with (a) light syllable(s), a heavy syllable is stressed regardless of its position:

(26) Heavy syllable attracts stress (Faizi 2002: 203-212):

a. Word initial heavy syllable:

áx.bu	'hole'	áq.mu	'mouth'
túk.ki	'donation'	tíd.di	'height/stature'
áɣ.ba.lu	'spring"	tíz.wi.ri	'beginning'

b. Word medial heavy syllable:

ti.wír.ǰa	'dreams'	i.síǰ.nu	'cloud'

c. Word final heavy syllable:

u.ʃúf	'swimming'	a.çál	'soil'
a.zu.rár	'big'	a.ʃì.ʃáw	'chick'
ti.su.ri.fín	'small steps'	ti.wu.ri.wín	'occupations'

According to Faizi (2002), when the word contains two heavy syllables, the last heavy syllable is stressed (27a); whereas when the word consists of more than one light syllable, the first syllable is stressed (27b):

(27) Stress in Amazigh:

a. Two heavy syllables: Last heavy syllable is stressed

ar.ráw	'children'	an.ǰáẓ	'pain'
tiǰ.da.tín	'female dogs'	taw.ma.tín	'sisters'
aʃ.mám.mu	'kind of stick'	al.ǰám.mu	'rein'
ti.maz.da.rín	'low (fem. pl.)'	ti.mar.ẓa.ǰín	'bitter ones (fem. pl.)'
i.məd.duk.kál	'friends'		

b. Light syllables: Initial syllable is stressed

í.zi	'fly'	ú.di	'butter'
á.ǰa.ri	'bullet'	í.ǰu.ta	'ropes'
tá.ra.za	'sort of hat'	í.mu.la	'shadows'

Quite amazingly, words with schwa-syllables are special. When the schwa syllable co-occurs with a closed syllable with a full vowel, stress is assigned to the syllable with the full vowel (28a), even if this syllable precedes the schwa syllable. When a schwa syllable co-occurs with an open syllable that has a full vowel, stress is on the initial syllable (28b):

(28) Stress in words with full vowel syllables and schwa syllables:

a. Schwa closed syllable and heavy syllable:

ád.fəl	'snow'	a.zúz.zər	'winnowing'
íç.ni.wən	'twins'	áw.ma.tən	'brothers'

b. Schwa closed syllables and light syllables:

í.nəɣ.mi.sən	'news'	í.ma.zi.ɣən	'Amazigh people'
í.xa.ta.rən	'great (masc. pl.)'	í.ɣər.ḍa.jən	'mice'
tí.səl.li	'stone'	tú.dərt	'life'

í.ɣən.ça	‘illness’	tá.məɣ.ra	‘marriage’
í.məg.gu.ra	‘last (masc. pl.)’	í.məz.wu.ra	‘first’
á.ʒən.ʒa.ṛi	‘blue (masc. sg.)’	tí.məg.gu.ra	‘last (fem. pl.)’
tí.ɣəm.mu.ṛa	‘corners’		

In (28a), for instance, we expect at first blush the last syllable in each one of the words to bear primary word stress. However, this seems never to be the case in GT. This issue is addressed in § 3.2.2.

Given the hypothesis that schwa is not mora-bearing, the facts of GT word stress are systematic and receive a simple account. In (28a), as in (26), the heavy syllable attracts stress. In (28b), when the word contains more than one light syllable, the initial syllable is stressed, which is quite reminiscent of (27b). On the opposite assumption that schwa is moraic, on a par with the full vowels, GT stress facts will be extremely difficult, if not impossible, to account for.

Following Walker (1996), who assumes a foot-free account using relative prominence to locate syllable heads, the analysis of the GT stress facts I present (essentially that in Bensoukas and Boudlal, 2012a-b) relies on syllable weight, peripherality and non-finality to determine prominence. The constraints needed to account for stress facts are given in (29a) and their ranking is provided in (29b):

(29) Stress in GT (Bensoukas and Boudlal, 2012a-b):

a. *Constraints:*

Pk-Prom (Prince and Smolensky, 1993: 39): Peak (x) > Peak (y) if |x| > |y|: An element (x) makes a better peak than an element (y) if the intrinsic prominence of (x) is greater than that of (y).

Align-L($\acute{\sigma}_{\mu}$, PrWd) (Zoll, 1995; see Walker, 1996): For all stressed light syllables, there exists some prosodic word such that the left edge of the stressed light syllable and the left edge of the PrWd are shared.

Align-R(Pk, PrWd) (McCarthy and Prince, 1993): The right edge of the peak must coincide with the right edge of the PrWd.

Non-finality (Prince and Smolensky, 1993: 30): The prosodic head of the word does not fall on the word-final syllable.

b. *Ranking:* Align-L($\acute{\sigma}_{\mu}$, PrWd), Pk-Prom » Align-R(Pk, PrWd) » Non-finality

Ranking (29b) is justified as follows. The stress facts presented in (26) and (27) above show that PkProm is undominated, and this follows from the requirement that heavy syllables attract stress in Amazigh (Faizi, 2002; Hdouch, 2004). Word-final stressed heavy syllables breach Non-finality without this affecting in the least their being optimal. This argues for ranking Align-R(Pk, PrWd) above Non-finality. To allow for stressed initial syllables in words consisting of light syllables alone, Align-L($\acute{\sigma}_{\mu}$, PrWd) is undominated.

Ranking (29b) accounts for both heavy stressed syllables and light ones. When the word contains only one heavy syllable, stress falls on the heavy syllable as a result of the high rank of Pk-Prom in the constraint hierarchy. The cases involving more than one heavy syllable, with final stress, are accounted for by the constraint Align-R(Pk, PrWd). When Pk-Prom is satisfied by all the syllables, only the rightmost, stressed, heavy syllable is optimal. These interactions are illustrated in (30). When the syllables are all light, the initial syllable receives stress. This is accounted for by the ranking of Align-L($\acute{\sigma}_{\mu}$, PrWd) as in tableaux (31).

(30)

/afar/	Pk-Prom	Align-L ($\acute{\sigma}_{\mu}$, PrWd)	Align-R (Pk, PrWd)	Non-finality
☞ a. a.fár				*
b. á.far	*!		*	
/tiwirja/				
☞ a. ti.wír.ja			*	
b. tí.wir.ja	*!		*	
c. ti.wir.já	*!	*		*
/arraw/				
☞ a. ar.ráw				*

	b. ár.raw			*!	

(31)

/taraza/		Pk-Prom	Align-L (σ_μ, PrWd)	Align-R (Pk, PrWd)	Non-finality
☞	a. tá.ra.za			*	
	b. ta.rá.za		*!	*	
	c. ta.ra.zá		*!		*
/tama/					
☞	a. tá.ma			*	
	b. ta.má		*!		*

Ranking (29b) also accounts for words with schwa syllables, with one proviso: the inclusion of *μ/ə in the hierarchy. This will be shown in the following section.

3.2.2 Schwa syllables and stress in Goulmima Tamazight

In GT, when closed schwa syllables co-occur with closed syllables with full vowels, it is always the syllables with full vowels that are stressed. This reveals that schwa syllables are light, their being closed notwithstanding. We see this in the examples in (32), reproduced from (28) above:

(32) The stress pattern of GT schwa syllables:

a. *$\sigma_ə$ and σ_H: σ_H attracts stress*

ád.fəl ‘snow’
a.zúz.zər ‘winnowing’

b. *$\sigma_ə$ and σ_L: Stress on the initial syllable*

í.nəɣ.mi.sən ‘news’
tá.məɣ.ra ‘marriage’

Now, let us consider one word from each of the classes in (32). First is the word *azúzzər* ‘winnowing’, which consists of a medial heavy syllable flanked by a light syllable on the left edge and a schwa syllable on the right edge. Candidate (33d), which has a bimoraic, heavy schwa syllable mistakenly emerges as optimal instead of the correct candidate, (33a). As it stands, the stress constraint hierarchy cannot rule this candidate out:

(33)

/azuzzr/		Pk-Prom	Align-L (σ_μ, PrWd)	Align-R (Pk, PrWd)	Non-finality
☹	a. a.zúz.zər$^\mu$			*!	
	b. á.zuz.zər$^\mu$	*!		*	
	c. a.zuz.zər$^\mu$	*!			*
☞	d. a.zuz.zə$^\mu$r$^\mu$				*

In words such as *táməɣra* ‘marriage ceremony’, the ranking selects the optimal candidate (34a) so long as we assume that the schwa syllable is light. If it is heavy, the winner is the candidate with stress on the schwa syllable, i.e. (34d).

(34)

/tamɣra/		Pk-Prom	Align-L (σ_μ, PrWd)	Align-R (Pk, PrWd)	Non-finality
☞	a. tá.məɣ$^\mu$.ra			*	
	b. ta.məɣ$^\mu$.ra		*!	*	
	c. ta.məɣ$^\mu$.rá		*!		*
☜	d. ta.mə$^\mu$ɣ$^\mu$.ra			*	

Recall from my discussion above that schwa never occurs in an open syllable, in satisfaction of the high-ranking constraint *μ/ə, which rules out schwas that carry a mora. If the two cases above are reconsidered

with the constraint *μ/ə included in the evaluation, candidates (33d) and (34d) are now ruled out because of their fatally violating *μ/ə:

(35)

/azuzzr/		*μ/ə	Pk-Prom	Align-L (σ́μ, PrWd)	Align-R (Pk, PrWd)	Non-finality
☞ a.	a.zúz.zərμ				*	
b.	á.zuz.zərμ		*!		*	
c.	a.zuz.zə́rμ		*!			*
d.	a.zuz.zəμrμ	*!				*

(36)

/tamɣra/		*μ/ə	Pk-Prom	Align-L (σ́μ, PrWd)	Align-R(Pk, PrWd)	Non-finality
☞ a.	tá.məɣμ.ra				*	
b.	ta.məɣμ.ra			*!	*	
c.	ta.məɣμ.rá			*!		*
d.	ta.məμɣμ.ra	*!			*	

I now deal with the second type of evidence in support of the proposal, i.e. augmentation and CL.

4. Augmentation and compensatory lengthening

4.1. Prosodic augmentation of morphological stems

The purpose of this section is to show that, in a morphologically-governed vowel epenthesis in Amazigh (Bensoukas, 1994, 2001a, 2017b; Jebbour, 1996; Lahrouchi, 2001), the vowel is never specified as schwa, but rather as a full vowel. The reason, I will argue, is that the full vowel provides an additional mora to the stem, which schwa cannot bear, another instantiation of *μ/ə.

(37) illustrates this general process by examples from intensive aorist (IA) verb morphology. In most cases, [a] is epenthesized stem-prefinally, with a vowel copying process sometimes replicating the root vowel (Basset, 1929; Dell and Elmedlaoui, 1991; Bensoukas, 2001a-b, 2002, 2004, 2017b among others).[6]

(37) Morphologically motivated epenthesis in intensives

UR	IA		
/frɣ/	ttfraɣ	'be crooked'	Abdelmassih (1968: 166)
/βzg/	ttβzag	'be wet'	Boukhris (1986: 52)
/ħlls/	ttħllas	'saddle'	Abdelmassih (1968: 169)
/gn/	ggan	'sleep'	Iazzi (1991: 210)

The core idea of the analysis is that this morphologically governed epenthesis aims at making the last syllable of the stem heavy (Bensoukas (2001a), which itself is built on the insight in Bensoukas (1994) and Jebbour (1996)). This illustrates weight coercion driven by a prosodic morphological requirement. The process applies minimally; accordingly, it crucially fails to apply to bases whose ultimate syllable is heavy as well as to those in which a hiatus would ensue from vowel epenthesis. Additionally, stem-final syllable heavy weight is ensured by assigning a mora to the final consonant through WBP (Hayes, 1989; Rosenthall and Hulst, 1999).

In my account, forms like those in (38a) are well-formed by virtue of having a prefinal epenthetic vowel that supplies a mora. This mora and the one gained through WBP make the stem achieve the mandatory augmentation:

(38) Amazigh morphologically motivated epenthesis:

a. Stem: $\sigma_{\mu\mu}$# b. Stem: σ_{μ}#

[6] The epenthetic vowel is [a] (*frɣ*/*tt-fraɣ* 'be crooked') or a copy of a root vowel (*bbaqqi*/*tt-baqqaj* 'explode'; *xinss*/*tt-xinsis* 'sob'; *susm*/*tt-susum* 'be silent'). The items in (37) will be further subject to schwa epenthesis, and the output form of *ttfraɣ*, for example, is [*ttəfraɣ*].

/frɣ/	ttfraɣ	*ttfrəɣ
/βzg/	ttβzag	*ttβzəg
/ħlls/	ttħllas	*ttħlləs
/gn/	ggan	*ggən

On the contrary, unattested forms like **ttfrəɣ* (38b) have an epenthetic non-moraic vowel. Although the syllables ultimately associate with a mora, this is not sufficient enough moraic material to satisfy augmentation.

An OT formalization of the idea is possible on the basis of the analysis in Bensoukas (2001a). The constraint $\sigma_{\mu\mu}]_{Stem}$ (39a), claimed to drive this epenthesis, aims at making the stem end in a heavy syllable and conflicts with DEP-V, which bans vowel epenthesis. Recall that the constraint *μ/ə, is high-ranking, and I have no evidence for ranking it with respect to $\sigma_{\mu\mu}]_{Stem}$. The tt-prefix in all candidates is not relevant to the discussion.

(39) a. $\sigma_{\mu\mu}]_{Stem}$: The right edge of the stem must correspond to a heavy syllable.

b. *Ranking:* *μ/ə, $\sigma_{\mu\mu}]_{Stem}$ » DEP-V

(40)

/frɣ, IA/		*μ/ə	$\sigma_{\mu\mu}]_{Stem}$	DEP-V
a.	tt-frɣ		*!	
☞ b.	tt-fra$^{\mu}$ɣ$^{\mu}$			*
c.	tt-frəɣ$^{\mu}$		*!	*
d.	tt-frə$^{\mu}$ɣ$^{\mu}$	*!		

(40a), the faithful candidate, does not satisfy the augmentation requirement. The candidates with schwa are both ill-formed: (40c), with an epenthetic schwa, falls short of final bimoraicity, and (40d) satisfies it by fatally having an underlying moraic schwa. Candidate (40b), with only a minimal violation of DEP-V, is the optimal candidate.

In short, my argument is that schwa's incapacity to bear a mora is far from being concomitant with the prosodic morphological coerced weight requirement. Accordingly, schwa epenthesis, as an option to coerce prosodic morphological weight, is largely eschewed, once again an effect of *μ/ə.

4.2. Compensatory lengthening in Tarifiyt

The third piece of evidence for my proposal comes from Tarifiyt CL, another weight sensitive process. According to this process, a would-be coda [r] is deleted and the preceding vowel is lengthened (when V=a) or diphthongized (when V=i, u). The purpose of this section is to show that, due to its being non-moraic, schwa does not participate in Tarifiyt CL.[7]

(41a-b-c) stand for the three classes of Tarifiyt CL. The first column of (41) contains what I assume to be the URs. The second column contains items deleting coda [r] and lengthening or diphthongizing the

[7] The way I conceive of CL is concomitant with the widely held view of the process (DeChene and Anderson, 1979; Hayes, 1989 among others). The process is considered unitary, involving segment loss followed by the lengthening of an adjacent segment. This situation has been referred to as 'local CL', as opposed to 'non-local CL', a process that involves the lengthening of a vowel that is not adjacent to the deleted segment. In light of this distinction, the Tarifiyt case is characterized as a case of local CL. Tarifiyt dialects show variation with respect to CL. The diphthongization facts are those of Ait Oulichek Tarifiyt and Ath Sidhar Tarifiyt. In Iharassen Tarifiyt, for example, long mid vowels ɛ: and ɔ: are attested instead of the diphthongs (see Amrous and Bensoukas, 2004, 2006/2007; Iazzi, 2001, 2018 for a more detailed analysis and further references). Also, the [r] in question is totally different from the [r] which is the phonetic realization of an underlying /l/. In /ul/ 'heart', phonetically realized as [ur], the coda-r is maintained (for details, see the aforementioned references).

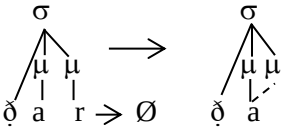
preceding vowel.[8] The third column shows that [r] in an onset position is maintained. In (42), autosegmental representations show how the Tarifiyt CL process applies.

(41) CL in words with an underlying /..Vr../ sequence:

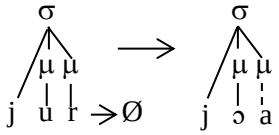
a.	/ðar/	ðaː	ðarinu	'foot/ my foot'
b.	/aʕʃmir/	aʕʃmɛa	aʕʃmira	'beard/ this beard'
c.	/jur/	jɔa	jura	'moon/ this moon'

(42)

a. Vowel lengthening:



b. Diphthongization:



In the OT conception of CL, which is basically that in Amrous and Bensoukas (2006/7) with minor modifications, CL is basically the outcome of the interaction of the constraints in (43a), which are ranked as in (43b).

(43) Tarifiyt CL: Amrous and Bensoukas (2006/7) (slightly revised)

a. *Constraints*

**Coda-r:* Coda r is banned.

PosCorr: An input segment must have an output correspondent either segmentally, by means of a root node or prosodically by means of a mora (after Topinzi, 2006).

**Vowel Weight (*VWT):* Vowels associated with two moras are banned.

b. *Basic ranking for Tarifiyt CL:*

*Coda-r, PosCorr » *VWT

*Coda-r, a coda condition, bans the occurrence of coda [r]. According to PosCorr (Topinzi, 2006, 2012 and references therein), an input segment may delete, but its position is preserved through a mora. These interact with *VWT, a markedness constraint banning long vowels and diphthongs (this constraint is split into *Diph(thong) and NoLongVowel[Low] in (44) below). Two more higher-ranking markedness constraints not listed for space reasons, along with the candidates incurring their violation, are NLV[High] and NLV[Mid], which ban long high and long mid vowels.

Tableaux (44a-b-c) show how the constraint hierarchy works with respect to both vowel lengthening and the two cases of diphthongization:

(44) a. Vowel lengthening: a:

/ðar/	*Coda-r	PosCorr	*Diph	NLV [Lo]	ID-WT
a. ðar	*!				
b. ða		*!			
☞ c. ðaː				*	*

b. Diphthongization: ɔa

/jur/	*Coda-r	PosCorr	*Diph	NLV [Lo]	ID-WT
a. jur	*!				
b. ju		*!			
☞ c. jɔa			*		*

c. Diphthongization: ɛa

/aʕʃmir/	*Coda-r	PosCorr	*Diph	NLV [Lo]	ID-WT

[8] Vowel lengthening and diphthongization subsequent to r-drop seem to be different, yet I think of them as a unitary process to which I refer as CL for the lack of a better term (see Amrous and Bensoukas, 2006/7). This position is founded since in moraic theory, long vowels and diphthongs form a 'natural class' by virtue of their being associated with two moras (e.g. Rosenthall, 1994; Selkirk, 1990; Katada, 1990).

	a.	aʕʃmir	*!				
	b.	aʕʃmi		*!			
☞	c.	aʕʃmɛa			*		*

The two cases of diphthongization are the ones relevant to the behavior of schwa. Although Tarifiyt has schwa epenthesis as a phonological process for syllabification purposes (e.g. Chtatou, 1982, 1991), schwa is not used in CL. If the high-ranking *μ/ə is included in the hierarchy, this behavior is immediately predictable. Illustration is provided in tableaux (45a-b):

(45) a. ɔə diphthongization

/jur/		*μ/ə	*Coda-r	PosCorr	*Diph	ID-WT
	a. jur		*!			
☞	b. jɔa				*	*
	c. jɔə	*!			*	*

b. ɛə diphthongization

/aʕʃmir/		*μ/ə	*Coda-r	PosCorr	*Diph	ID-WT
	a. aʕʃmir		*!			
☞	b. aʕʃmɛa				*	*
	c. aʕʃmɛə	*!			*	*

As I have just shown, Tarifiyt CL provides additional support for the proposal that schwa is not moraic. It is worth mentioning at this point that there is another facet of Tarifiyt CL, which I omitted from the discussion so far. Although presenting a complexity, this aspect of CL gives credence to the non-moraicity of schwa. A sequence /Cr/ is never syllabified as [Cər]: [r] is deleted and compensated for by a long vowel. Examples are /amrwas/ [ama:was, *amə:was] 'debt/dowry', /asrðun/ [asa:ðun, *asə:ðun] 'mule' and /aɣrḍa/ [aɣa:ḍa, *aɣə:ḍa] 'mouse'. Crucially, a /CC/ sequence in which C is any consonant other than /r/ is syllabified with schwa epenthesis between the two consonants. Whatever analysis is provided for this case, it remains certain that schwa does not participate in the weight-sensitive phenomenon of CL. Again, a situation in which schwa is moraic is banned in Amazigh.

To sum up, in addition to syllabification and word stress facts, which treat schwa as being non-moraic (§3), two prosodic phenomena provide additional support to my proposal. First, the prosodic morphological operation of vowel epenthesis never resorts to schwa to augment Amazigh stems. Second, schwa never participates in the CL phenomenon of Tarifiyt. What these two aspects have in common is their being weight-sensitive phenomena.

5. Suggestions for future research

Research on 'vowel intrusion' (e.g. Hall, 2006) opens up the possibility for an alternative analysis of the facts of schwa presented in this paper.

Hall (2006: 391) (see also the references therein) claims that intrusive vowels, or 'phonologically invisible inserted vowels' as she alternately calls them, are distinguished from epenthetic vowels in various respects. For example, intrusive vowels can have either the quality of schwa or that of a nearby vowel (through copying). An intrusive vowel is also characterized by optionality, a highly variable duration and absence in fast speech. Finally, intrusive vowels apparently play no role in repairing ill-formed structures. Hall (2006: 424) concludes that "in vowel intrusion, the articulatory gestures associated with existing segments are phased in a way that creates an acoustically vocalic period, but no phonological segment is inserted, and hence no new syllable is created."

This idea is implemented in Gafos (2002) with respect to Moroccan Arabic (MA). The claim is that in MA, "for example…the active participle of the verb 'to write' is [katᵊb], with a schwa-like vocalic transition in the final CC cluster… There is a period of no constriction in the transition between /t, b/ that is identified as a schwa-like vocalic element." (Gafos, 2002: 271-2). Accordingly, what is perceived as a schwa vowel is just an effect of

temporal organization of gestures, according to the author. The facts of MA are more complicated by the generalization reached in the instrumental study in Ali, Lahrouchi and Ingleby (2008). Their exploratory study reveals that schwa in MA occurs in open syllables.

Let us now clarify how relevant this research on MA is to the facts of Amazigh analyzed in this paper. In Bensoukas and Boudlal (2012a-b), a lengthy comparison of the behavior of schwa in GT and MA is undertaken. The authors claim that the behavior of schwa is more or less similar in the two languages with respect to syllable structure, stress and syllable weight. One aspect that is emphasized is the fact that schwa does not occur in open syllables in either language. The research undertaken by Gafos (2002) and Ali, Lahrouchi and Ingleby (2008) seems to belie the findings in Bensoukas and Boudlal (2012a-b).

It may as well be the case that the schwa I treat in this paper as epenthetic is in fact an intrusive vowel, an idea which is not novel to the literature on Amazigh phonology; an example is Idrissi (1992), who entertains the idea that schwa is an excrescent (intrusive) vowel. A conception of the problem along these lines will treat the presence of the schwa-like sound as an articulatory requirement. Accordingly, the seemingly schwa-like sound is not a phonological unit, let alone one that is associated with a mora, a concept used to encode vowel weight. It is clear that further investigation is in order in this respect.

The more serious challenge is that an analysis in terms of vowel intrusion may require a whole-sale revision of the available models of Amazigh syllable structure. One very intricate aspect of syllabification is the fact that Tashlhit resorts to consonant syllabicity, so that some words may consist entirely of consonants only, syllabified around consonantal syllable peaks (Boukous, 1987, 2009; Dell and Elmedlaoui, 1985, 2002, among others). The even interesting generalization that the dialects of Amazigh differ along this dimension needs revision. In Ridouane (2008, 2016) and Hdouch (2012), for example, it is suggested that the dialects not resorting to schwa epenthesis as a means of improving syllable structure resort to consonant syllabicity to avoid clusters of unsyllabifiable consonants. Findings of recent research about Tashlhit by Ridouane and Cooper-Leavitt (2019) relating to schwa also have to be taken in to consideration. One immediate implication of the intrusion analysis is that Tashlhit syllable structure and that of Tamazight/Tarifiyt are the same, more or less. Guerssel (1985), for instance, deals with the syllable structure of Ait Seghrouchen Tamazight using the model of consonant syllabicity. In addition, a wholesale revision of the work in prosodic morphology is required under such a move, and only future research can enlighten us about these issues.

6. Conclusion

The present paper has dealt with the so often pointed out fact that schwa never occurs in an open syllable in Amazigh in general. The proposal I have argued for is that, unlike the full vowels of the language, schwa is a non-moraic vowel. This is encoded in a constraint against the association of schwa to a moraic node.

This constraint is so pervasive in the grammar of the language that activity in various phonological and prosodic morphological areas ensues from it. First, it bans schwa from occurring in open syllables. Second, it inhibits schwa from contributing to the weight of closed syllables for the sake of stress assignment. Third, it makes schwa ineligible for participating in morphological-prosodic weight sensitive vowel epenthesis. Last, it hampers schwa from filling a vacant mora to satisfy a requirement of CL. As a result, the proposal brings together Amazigh prosodic and prosodic morphological phenomena that seem at first sight to be quite unrelated.

Finally, the analysis in terms of vowel intrusion seems to open other paths for explaining the behavior of schwa in Amazigh. To what extent this option works for Amazigh and what changes it will induce on the whole gamut of prosodic (including morphological) phenomena in the language is an issue left for future research.

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