Syllable weight and syllable nuclei in Tachelhit Berber of Tiznit[*]

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L'idée principale défendue dans cet article est qu'en berbère tachelhit, le poids prosodique ne dépend pas seulement de la présence d'une coda mais aussi de la nature segmentale (V ou C) du noyau syllabique: seules les syllabes fermées dont le noyau est une voyelle sont considérées comme lourdes. En revanche, les syllabes à noyau consonantique ne peuvent jamais être lourdes qu'elles contiennent ou non une coda. Pour argumenter en faveur de cette distinction, nous analysons quelques phénomènes phonologiques et morphologiques qui semblent faire appel à cette distinction.

The main idea defended in this paper is that in Tachelhit Berber the prosodic weight of a syllable not only depends on the presence of a coda in the rhyme but depends also on the segmental nature of the nucleus: Only closed syllables with a vocalic nucleus can be heavy. However, the presence or absence of a coda in a consonantal syllable does not change anything to its weight: All consonantal syllables are light. The evidence provided is drawn from quantity alternation and prosodic morphology of Tachelhit Berber.

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[*] This paper reports some of the results achieved in my Doctorat d'Etat Thesis. During my research I have benefited from the help of many persons whom I want to thank here: J. Alderete, A. Boukous, F. Dell, M. Guerssel, J. Lowenstamm, J. McCarthy, M. Plénat, J-F. Prunet, E. Selkirk. I am also indebted to the following organizations: the Fulbright Foundation, Moroccan-American Commission of Cultural and Educational Exchange, AUPELF-UREF, ACCT.

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In this paper we will discuss the relation between syllable weight and the nature of syllable nuclei in Tachelhit Berber of Tiznit (TBT)[1] We will show that there exist good reasons to assume that in TBT the weight of a closed syllable depends on the segmental nature of its nucleus: OV**C** is heavy but O**C**C is light[2].

Syllable weight is one of the most debated problems in phonology. Two questions have usually been addressed:

(1) a. How can the notion of syllable weight be best represented?
b. How can we express the fact that some syllable types (especially CVC) may have a different status in different languages?

Moraic theory (which we will adopt in this paper) is one of the ways in which the first question has been answered. The mora (henceforth **μ**) is a prosodic constituent situated immediately under the syllable node (henceforth **σ**). The weight of a syllable is measured by counting the number of moras it contains: If the syllable contains one mora it is **L**(ight) and if it contains two moras it is **H**(eavy). This is represented as follows:

(2) Light syllable Heavy syllable

The second question raised in (1) has been answered within Moraic theory by such linguists as Hayes (1989), who proposes to account for the variation in weight distinctions by postulating the existence of a rule called Weight-by-Position. The operation of this rule is parametrized in the sense that languages may or may not use it.

The numerous studies devoted to the problem of syllable weight allow us to obtain the following typology, which classifies natural languages into five categories:

(3) a. Languages which do not use syllable weight distinctions. All syllables are treated in the same way (e.g. Diyari).
b. Languages which consider only CVV syllables as heavy and all others as light (e.g. Lardil).

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1 Tiznit is a city situated in the Southwest of Morocco.

2 Symbols: σ=Syllable, μ=Mora, !=pharyngalization, Cw=Labialised consonant, N=any nucleus (V or C), G=Glide, **C**= consonantal nucleus, O=Onset, V=Vowel, C=Consonant, L=Light syllable, H=Heavy Syllable, C_iC_i = geminate.

c. Languages where CVV and CVC have the same weight: They are equally heavy (Latin, Egyptian Arabic).
d. Languages where CVV is heavy but CVC is heavy only if the coda has certain features (e.g. Lithuanian where CVC is heavy if the final C is a sonorant).
e. Languages which lack long vowels and where only CVC syllables are heavy (e.g. Aklan)[3].

Some scholars[4] have assumed that Tachelhit Berber syllable structure can be best accounted for if we assume that any segment can occupy the nuclear position of the syllable. Despite the divergences in the conception of syllabification and in the syllable types assumed, these works share the assumption that there is no difference between syllables with a vocalic nucleus (henceforth **Vσ**) and syllables with a consonantal nucleus (henceforth **Cσ**). These two types of syllable are supposed to have exactly the same structure and they are treated equally by phonological or morphological phenomena, which make reference to syllabic structure. This means in fact that syllabic structures which are possible with a vowel as the nucleus are equally possible with a consonant as the nucleus.

In this paper, we will show that the conception defended in Dell & Elmedlaoui (1985, 1988) and in Boukous (1987) makes wrong predictions. We will analyze various phonological and morphological phenomena which explicitly make reference to prosodic weight to demonstrate that TBT phonology needs to distinguish between <u>closed Vσ</u> (henceforth O<u>**V**</u>C) and <u>closed Cσ</u> (henceforth O<u>**C**</u>C). The main idea which will be defended is that only the former can be heavy (bimoraic) while the latter are always light (monomoraic).

If our analysis is correct, this means that the typology given in (3), which does not say anything about languages like TBT, needs to be refined, and that the parametrized character of Hayes` Weight-by-Position may also depend on the segmental content of the nuclear mora.

This paper is organized as follows. In section 1, we review some explicit assumptions about the TBT syllable structure which are necessary to understand the discussion that follows. In section 2, we give evidence which proves that TBT really makes a distinction between monomoraic and bimoraic syllables. In section 3, we analyze phenomena which show clearly that O<u>**V**</u>C and O<u>**C**</u>C syllables have different weight in TBT. In section 4, we address the question of the syllabification of geminates.

[3] For a survey, see Blevins (1995), Hayes (1994).
[4] See especially Boukous (1987), Dell & Elmedlaoui (1985, 1988).

1. TBT Syllable Structure: Basic Assumptions

The structure of TBT syllables is determined as follows:

(4) a. Any segment (glides excepted) can be a syllable nucleus.
b. The competition between segments is governed by sonority requirements and by the following well-formedness conditions:
i. Branching onsets are prohibited
ii. Onsetless syllables exist only at the beginning of a syllabification domain
iii. The first member of a geminate can never be an onset (henceforth *CS-GEM)
iv. A coda may branch only if it dominates a geminate and belongs to a Vσ[5].
c. Syllabification can be conceived as an algorithm using a variable which takes different sonority values. The algorithm scans a form and builds a syllable every time it encounters a segment whose sonority index corresponds to the value of the variable.
d. Syllables built by the algorithm must respect the conditions stated in bi-iv even when this leads to syllables which do not respect sonority constraints.

Possible syllable types in TBT are the following[6]:

(5)

C	*g*	**V**	*a*
O**C**	*fl*	O**V**	*su*
CC	*!rz*	**V**C	*ut*
O**C**C	*krz*	**V**C_iC_i	*add*
		O**V**C	*mun*
		O**V**C_iC_i	*bidd*

In this article, we will also address the problem of syllabification of geminates. We will show that there are serious reasons to believe that a geminate is not always treated exactly as a sequence of two consonants.

2. Evidence for Syllable Weight Distinction

We present here two phenomena which prove that TBT distinguishes between monomoraic and polymoraic syllables[7]. The first one concerns the quantity

5 We differ here from Dell and Elmedlaoui, who allow branching codas in Cσ-syllables as well as in Vσ-syllables.

6 The meanings of Tachelhit words are given in a glossary at the end of the article.

7 The problem of prosodic weight in Tachelhit Berber has been addressed in many studies: Adnor (1995) for the problem of stress assignment, Boukous (1987) for sentence phonology, Jouad (1983) and Dell & Elmedlaoui (1988, 1997) for Tachelhit versification. The problem of how to reconcile our analysis with the evidence presented by these authors is left for further research.

alternation of the causative prefix and the second concerns glide epenthesis in a class of derived nouns.

2.1. The Causative Prefix and Quantity Alternation

In TBT (and in Berber in general) the causative is formed by the adjunction of the prefix **[s(s)-]** to a verbal base. The following table sums up the behavior of this prefix when added to different types of verbal bases[8].

(6)

Characteristics of the verbal base to which the prefix is adjoined				Selected variant		Example		
				s-	ss-	Base	Causative	
contains a geminate		Monosyllabic		+	-	*fss*	*s-fss*	1
		Disyllabic		+	-	*ħuddu*	*s-ħuddu*	2
		Trisyllabic		+	-	*bufillu*	*s-bufillu*	3
does not contain a geminate	begins with an empty onset	Monosyllabic		-	+	*aɣ*	*ss-aɣ*	4
		Disyllabic		-	+	*aru*	*ss-aru*	5
		Trisyllabic		+	-	*ngiri*	*s-ngiri*	6
	does not begin with an empty onset	Mono-syllabic	O**V**	-	+	*nu*	*ss-nu*	7
			O**C**	-	+	*ɣr*	*ss-ɣr*	8
			O**C**C	**-**	**+**	***frɣ***	***ss-frɣ***	9
			O**V**C	**+**	**-**	***mun***	***s-mun***	10
		Disyllabic		+	-	*ɣuʒbu*	*s-ɣuʒbu*	11
		Trisyllabic		+	-	*mrkuku*	*s-mrkuku*	12

Table (6) shows that the quantity alternation of the prefix is sensitive to:

a. The presence of a geminate in the base: The simplex variant is always selected when the base contains a lexical geminate (rows 1, 2 and 3 of (6))
b. The number of syllables in the base: All trisyllabic bases select the simplex variant (rows 3, 6, 12)
c. The presence of an onsetless syllable at the beginning of the base: If the base begins with an onsetless syllable and does not contain a

[8] The causative prefix exhibits other alternations which are disregarded here (cf. Boukous 1987, Iazzi 1991, Lasri 1991, Dell & Elmedlaoui 1991, Jebbour 1992).

geminate or has more than two syllables, the geminated variant is selected (rows 4, 5).

d. If the base does not begin with an onsetless syllable and does not contain a geminate,
   i. the geminated variant is selected when the base is O**V**, O**C**, O**C**C (rows 7, 8, 9),
   ii. the simplex variant is selected when the base is O**V**C, or when it is polysyllabic (rows 10, 11, 12).

To establish our first argument in favor of L/H syllable distinction, let us concentrate our attention on the cases reported in the rows 7, 8, 10, 11 and 12 in the table (6). A careful examination of these cases raises the following questions:

(7)
- Why do O**C** and O**V** bases attract the geminated prefix [ss-] while O**V**C and polysyllabic bases attract the simplex prefix [s-]?
- Is there a natural way to account for the difference between O**C**, O**V** on the one hand, and O**V**C and polysyllables on the other hand?

To answer these two questions, let us suppose that the difference between O**V** and O**C** bases *versus* O**V**C and polysyllabic bases resides in the number of moras they contain: Codaless syllables O**V** and O**C** are universally monomoraic, polysyllables are universally polymoraic and if we consider that in TBT all O**V**C forms are polymoraic, it becomes easy to account for the distribution of the causative prefix variants.

(8)

Type of base	**Number of μ**	**Selected prefix**		**Examples**
O**V**	1	ss-	*nu*	*ss-nu*
O**C**	1	ss-	*ɣr*	*ss-ɣr*
O**V**C	2	s-	*mun*	*s-mun*
O**V**.O**V**	2	s-	*ħidi*	*s-ħidi*
O**V**C.O**V**	3	s-	*gusmu*	*s-gusmu*

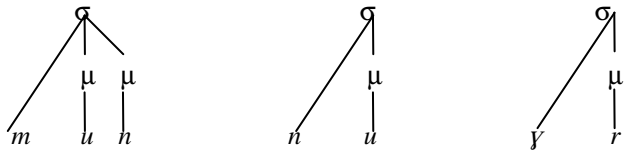
etc.

The obvious explanation then is given in (9):

(9) The causative prefix is
i. geminated [ss-] if it is adjoined to a monomoraic base.
ii. simple [s-] if it is adjoined to a polymoraic base.

At this point, we can say that the distribution of the causative prefix shows that TBT does distinguish monomoraic syllables (O**C** and O**V**) from bimoraic syllables (O**V**C).

(10)



We will return to the comparison of these bases with O**C**C bases in 3.1.

2.2. Glide-Insertion in Abnakli-Derivatives

Abnakli-Derivatives (cf. Dell & Elmedlaoui 1992) are a type of derivative words which can function either as nouns or as adjectives. They "denote persons with a certain occupation or habitual activity". For example, from *agrtil* « carpet » we obtain *agratli* « the person who sells and/or makes carpets ». All Abnakli-Derivatives are of the form **a-(C)CCaCC-i**, i.e. they are minimally **a-CCaCC-i**, and maximally **a-CCCaCC-i**. The following cases are to be distinguished:

(11) i. If the base provides more than 4 consonants, the result is:
a-CCCaCC-i (e.g. *afrskil→afrsakli,!amħnʒr →!amħnaʒri*)
ii. If the base provides 4 consonants the resulting derivative has the form:
a-CCaCC-i (e.g. *abnkal →abnakli , agrtil →agratli*)
iii. If the base provides 3 consonants, the result is:
a-CCaGC-i (G is the epenthetic glide [j]) (e.g. *ħlas → aħlajsi, skr → askajri*)

The behavior of Abnakli-Derivatives raises several problems, but, in this section, we will focus on one issue only:

(12) **Why is a glide inserted in some cases and not in others?**

To answer this question, we will first assume (following partially Dell & Elmedlaoui 1992, p. 99) that the thematic vowel of these derivatives is an independent affix, and so the stem is what remains if we subtract this vowel from the whole derivative.

(13)

Base	Abnakli-Derivative	Stem	Shape of the stem
agrtil	*a-gratli*	*gratli*	CCaCCi
afrskil	*a-frsakli*	*frsakli*	CCCaCCi
aɬlas	*a-ɬlajsi*	*ɬlajsi*	CCaGCi

Second, let us suppose that a well-formed Abnakli-Stem must respect the following constraint:

(14) All Abnakli-Stems must be **LHL**.

Bearing the constraint (14) in mind we can make the following predictions:

(15) Glide insertion will occur only with bases which do not provide enough consonants to ensure a LHL stem;

The possibilities illustrated in table (16) show that these predictions are borne out.

(16)

	Stem				Comment
Base	**without j-epenthesis**		**With j-epenthesis**		
a-frskil	*fr.sak.li*	LHL	**fr.sa.jk.li*	LLLL	The consonantal material provided by the base is sufficient to ensure LHL. Furthermore, j-epenthesis will always lead to incorrect stems
a-grtil	*g.rat.li*	LHL	**g.ra.jt.li*	LLLL	The consonantal material provided by the base is sufficient to ensure LHL. However, the language does not trigger j-epenthesis even in the cases where it may produce a correct stem (e.g. **gr.taj.li*)
skr	**s.ka.ri*	LLL	*s.kaj.ri*	LHL	The consonantal material provided by the base is not sufficient to ensure LHL. j-epenthesis is unavoidable

In other words, we can say that glide epenthesis in Abnakli-Derivatives appears to be prosodically motivated: It occurs only to provide a coda for the second syllable which must be heavy. Note that this straightforward account is possible only if we assume that there is a L/H contrast in TBT.

3. Evidence for OCC / OVC Distinction

Having demonstrated that TBT exhibits phenomena which need to make reference to syllable weight, let us now try to provide evidence which suggests that a difference in weight should be made between closed syllables with a consonantal nucleus (O**C**C) and closed syllables with vocalic nucleus (O**V**C).

3.1. Causative Quantity Alternation: O**V**C vs. O**C**C Bases

In section 2.1, we established that monomoraic bases attract the geminated variant of the causative prefix while polymoraic bases select the simple variant of the causative prefix. Now, if O**C**C and O**V**C do really have different moraic structures, we should expect that the bases which exhibit these structures will attract different variants of the causative prefix. The most relevant data must be drawn from the behavior of O**V**C and O**C**C bases (i.e. bases consisting of only one closed syllable and do not contain a geminate nor begin with an onsetless syllable).

(17)

ONC BASES				ON BASES (for comparison)			
OVC BASES		OCC BASES		OV BASES		OC BASES	
Base	***Causative***	***Base***	***Causative***	***Base***	***Causative***	***Base***	***Causative***
mun	*s-mun*	*frs*	*ss-frs*	*nu*	*ss-nu*	*ɣr*	*ss-ɣr*
ʕum	*s-ʕum*	*!ʕrg*	*!ss-ʕrg*	*fi*	*ss-fi*	*fl*	*ss-fl*
gun	*s-gun*	*!dms*	*!ss-dms*	*!di*	*ss-di*	*gr*	*ss-gr*
1		**2**		**3**		**4**	

A close examination of (17) reveals the following generalizations:

(18)
- O**V**C and O**C**C bases attract different variants of the causative prefix.
- O**C**C bases behave exactly as O**V** and O**C** bases.

To account for these observations, we propose that O**V**C and O**C**C bases have different structures: The former is bimoraic, in the sense that its final C is associated with a mora, while the latter is monomoraic, in that its final C does not constitute a mora in itself.

Given this distinction, the distribution of the two variants of the causative prefix becomes very transparent: [ss-] is selected by O**C**, O**V** and O**C**C bases because these are all monomoraic, and [s-] is selected by O**V**C and polysyllabic bases because they all are polymoraic.

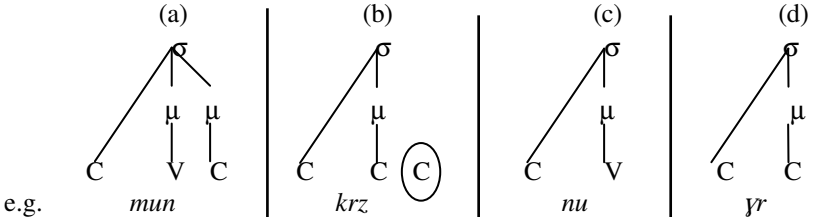
(19)

	Monomoraic bases			Polymoraic bases	
	O<u>C</u>	**O<u>V</u>**	**O<u>C</u>C**	**OVC**	**OV.OV ...**
[s-]	-	-	-	+	+
[ss-]	+	+	+	-	-

This constitutes a strong argument in favor of our proposition that O**<u>V</u>**C and O**<u>C</u>**C syllables have different weight. We suggest that the four syllable types O**<u>C</u>**, O**<u>V</u>**, O**<u>C</u>**C, and O**<u>V</u>**C have the following representations:

(20)

<u>Heavy syllable</u> **<u>Light syllables</u>**



The last C in (20)b can be linked to the preceding μ or directly to the node σ. What is important for our purpose is the fact that it does not constitute a second mora.

Boukous (1987) and Dell & Elmedlaoui (1985, 1988) do not distinguish between O**<u>C</u>**C and O**<u>V</u>**C syllables. Their models therefore cannot explain why O**<u>V</u>**C and O**<u>C</u>**C bases behave differently, or if they do, they need arbitrary statements which cannot relate in a natural way the behavior of O**<u>V</u>**, O**<u>C</u>** and O**<u>C</u>**C bases, on the one hand, to the behavior of O**<u>V</u>**C and polysyllabic bases, on the other hand.

3.2. Trisegmental Bases and Imperfective Gemination

In this section we deal with a classical problem in Tachelhit Berber verbal morphology (cf. Dell & Elmedlaoui 1985, 1988, 1991): Imperfective gemination. We will show that the distinction we propose to make between O**<u>C</u>**C and O**<u>V</u>**C syllables allows for a very simple account of the imperfective gemination in TBT.

3.2.1. Imperfective Formation in TBT

In TBT, three different processes are involved in the formation of the imperfective form. These processes are:

a) Onset-Gemination (henceforth O-Gem): Geminate the onset in the verbal base.
b) tt-prefixation: Add the prefix [tt-] to the verbal base.
c) V-Insertion: Insert a vowel before the last segment of the base. This vowel is a copy of a preceding vowel of the base; otherwise, the default vowel **a** is inserted.

These processes co-operate in some cases but not in others. Yet, only V-Insertion may combine with one of the two others. There are no imperfectives formed by co-operation of O-Gem and tt-Prefixation. Thus, there are five types of imperfective:

(21)

	Base	Imperfective
a. **Imperfective by O-Gem**	*gru*	*g**rr**u*
	krz	***kk**rz*
	!rzm	*!r**zz**m*
b. **Imperfective by tt-Prefixation**	*ddu*	***tt**-ddu*
	aru	***tt**-aru*
	mun	***tt**-mun*
c. **Imperfective by V-Insertion**	*skr*	*sk**a**r*
	zzgr	*zzg**a**r*
d. **Imperfective by V-Insertion + O-Gem**	*dl*	***dda**l*
	!di	*!ttaj /!ddai/*
e. **Imperfective by V-Insertion +tt-Prefixation**	*!lmz*	***tt**-!lm**a**z*
	!bukd	***tt**-!buk**u**d*

In this section we deal only with the process illustrated in (21)a, i.e. O-Gem. The examination of the relevant data reveals that the behavior of O-Gem with different types of verbal bases is conditioned by the following factors:

(22) i. The presence or absence of a geminate in the base: O-Gem never applies to bases containing a geminate,
ii. The number of segments in the base: O-Gem never applies to bases containing more than 3 segments.

In what follows, we restrict the discussion to the behavior of trisegmental bases which do not contain a geminate. Table (23) sums up this behavior.

(23) **Trisegmental bases**

Shape	Syllabic structure	Examples	
CCC	O<u>N</u>C	1. *krz → kkrz* 2. *ħlb → ħħlb* 3. *frd → ffrd*	Geminating bases
	<u>N</u>.O<u>N</u>	4. *!ngd → !nggd* 5. *!lmz →!lmmz* 6. *rgl → rggl* 7. *kʃm → kʃʃm* 8. *fsr → fssr*	
CCV	<u>N</u>.O<u>N</u>	9. *rku → rkku* 10. *fsi → fssi* 11. *gnu → gnnu* 12. *zdi → zddi*	
CVC	O<u>N</u>C	13. *mun → tt-mun* 14. *zur → tt-zur* 15. *fʉl → tt-fʉl*	Non geminating bases
VCC	<u>N</u>.O<u>N</u>	16. *amn → tt-amn* 17. *!amz → !tt-amz* 18. *ag^{w}l → tt-ag^{w}l*	
VCV	<u>N</u>.O<u>N</u>	19. *ag^{w}i → tt-ag^{w}i* 20. *amu → tt-amu* 21. *ara → tt-ara*	

An examination of table (23) shows that trisegmental bases which do not contain a geminate behave differently:

- All the bases constituted exclusively of consonants can form their imperfective with O-Gem (see examples 1-8).
- The bases containing a vowel may form their imperfective with O-Gem, only if they are of the form CCV (see examples 9-12).
- The bases containing a non final vowel or two vowels never form their imperfective with O-Gem (see examples 13-21).

The question which will be addressed in what follows is:

(24) Why do the bases which apparently have the same syllabic structure (e.g. C**C**C vs. C**V**C, **C**.C**C** vs. **V**.C**V** and **V**.C**C**) behave differently?

Let us first briefly review the analysis that Dell & Elmedlaoui propose to account for O-Gem and note some problems related to that analysis.

3.2.2. Dell & Elmedlaoui's Analysis of Onset-Gemination

Dell & Elmedlaoui (1988, 1991) base their analysis on two elements. First, they propose two conditions, which define what a potential geminating base may be (Dell & Elmedlaoui 1991, p. .85). These are given in (25).

(25) *"If a verbal base is to be subject to gemination in the imperfective it must:*
a. not contain any geminate in stem I[9]*,*
b. not contain syllabic vocoids in non final position."

Second, the authors suggest a rule which describes the changes accomplished by O-Gem in the bases satisfying the condition (25). This rule is formulated in (26).

(26) Onset-Gemination = *[...] geminate that segment which is a syllable onset*. (Dell & Elmedlaoui 1991, p. 86)

It is important to note that rule (26) needs the information provided by the syllabification algorithm; otherwise, it would be impossible to identify the targeted onset.

The statement in (25)b is curious in two regards: first, it is nothing else than the formulation of surface characteristics of geminating bases; second it needs to make reference both to the segmental and the syllabic make-up of the base. The authors themselves were aware of this, since they found it necessary to make the following remark:

[9] « STEM I » is the perfective (or preterit) form of the verb.

(27) *« Condition* [(25)b] *simultaneously takes into account the feature content of segments (it refers to the value of the feature [cons]) and their location within syllables (it refers to syllabicity).* ***It is not possible to reformulate that condition so as to refer to one only of these two factors****. […]* ***On the other hand condition*** [(25)b] ***cannot be reformulated so as to prohibit gemination in the imperfective of all the verbs which contain a syllable peak in non final position, for as a result it would incorrectly prohibit it in all those verbs where the syllabic peak in question is a contoid****, as in !hrʃ(!hhrʃ), rgm (rggm)* [...] *»* (Dell & Elmedlaoui 1991, pp. 85-86).

The problems depicted by Dell & Elmedlaoui are a direct consequence of their model of syllabification which does not distinguish between O**C**C syllables and O**V**C syllables. In their model CVC and C**C**C verbal bases for example have exactly the same syllabic structure. Our contention here is that it is possible to propose an account which avoids the anomalies described in the passage cited above.

First, we claim that the statement in (25)a is superfluous: Tachelhit Berber generally prohibits the contiguity of homomorphemic geminates, so O-Gem cannot apply to bases which already contain a geminate because it would create a new geminate near the one contained in the base. Second, a close examination of all the imperfectives obtained by O-Gem from trisegmental bases reveals a striking property of these imperfectives: **They all are composed of two light syllables** (as defined in (20)). Let us assume that the result of O-Gem must respect the following constraint:

(28) $\text{O-Gem}_{\text{output}} = \text{LL}$

Given the constraint (28) and given that contiguous homomorphemic geminates are prohibited, it becomes easy to account for the behavior of trisegmental bases with O-Gem, without making reference to (25). The only thing we need to say is: **Geminate the onset if the resulting imperfective is LL**.

Now, we are able to answer the question in (24). As we can see in the examples given in (29), the analysis proposed above (especially (20) and (28)) makes the right predictions:

- O**C**C, **C**.O**C** and **C**.O**V** bases can undergo O-Gem since the resulting imperfective has the prosodic structure LL (see (29)a).
- By contrast, O**V**C, **V**.O**C** and **V**.O**V** bases cannot undergo O-Gem because the resulting imperfective would not be LL ((29)b).

(29)

	O-Gem	Syllabic structure		Types of syllable
a.	*ffrs*	*f.frs*	**C**.O**C**C	LL
	fssr	*fs.sr*	O**C**.O**C**	LL
	grru	*gr.ru*	O**C**.O**V**	LL
b.	**mmun*	*m.mun*	**C**.O**V**C	*LH
	**ammr*	*am.mr*	**V**C.O**C**	*HL
	**arru*	*ar.ru*	**V**C.O**V**	*HL

This straightforward account cannot be achieved in a model (like that adopted by Dell & Elmedlaoui and by Boukous) which does not assume (20). In our model, the difference between (29)a and (29)b is the logical consequence of the syllable structure (in Dell & Elmedlaoui's account, it was a pure accident). This constitutes a strong argument for our model which distinguishes O**C**C and O**V**C syllables by assigning them different weights.

4. Evidence for CS-GEM Prohibition:

In the preceding sections, we assumed, following Dell & Elmedlaoui (1985, 1997), that the first member of a geminate is never syllabified in the onset of a syllable (cf. (4)b-iii). We now give a new argument in favor of this assumption.

4.1. The Site of Gemination in Tirrugza-Nouns

Tirrugza-Nouns (cf. Dell & Elmedlaoui 1992) are a type of derivative noun that "denotes a state or a property". For example, *tirrugza* (from *argaz*) means "manhood". Tirrugza-Nouns can take one of the following forms, depending on the base from which they are derived:

(30) **ti-$C_1C_1uC_2C_3a$** : *timmuzɣa* (from *amaziɣ* "free man")
ti-$C_1C_2C_2uC_3C_4a$: *tinmmuɣra* (from *anmɣur* "notability")
ti-$C_1C_1u\ C_2C_2C_3a$: *timmukksa* (from *imkkisi* "heir")

The initial ***ti-*** is made of two independent morphemes[10], and consequently the stem is constituted of the vowels ***u*** and ***a*** together with the consonants surrounding them. A well-formed stem of a Tirrugza-Noun must contain the sequence C_iC_iu, i.e. the vowel [u] preceded by a geminate, and must end with the vowel [a].

[10] For more information on the morphology of TBT, see Dell and Jebbour (1991, 1995), Jebbour (1988, 1991, 1996).

The appearance of one of the stems given in (30) depends on the consonantal make-up of the base. We can identify the following situations:

(31) (Please, use table (32) to identify cases)

1) Case 1: The base does not contain a geminate.
   a. if it contains 3 consonants: **C_1** is geminated and the stem of resulting derivative is **C_1C_1uXa** (X=remaining consonants of the base)
   b. if it contains 4 consonants or more: **C_2** is geminated and the stem is **$C_1C_2C_2$uXa**

2) Case 2: The base contains one geminate. This geminate is always transferred to the resulting derivative noun under the following conditions:
   a. when **C_1** is the geminate in the base, no additional gemination occurs and the stem is **C_1C_1uXa**.
   b. when **C_2** is the geminate in the base,
      i. if the base contains 3 different consonants, then **C_1** is geminated and the stem is **C_1C_1u$C_2C_2C_3$a**
      ii. if the base contains 4 different consonants, then no additional gemination occurs and the stem is **$C_1C_2C_2$uC_3C_4a**.

3) Case 3: The base contains 2 geminates. The two geminates are transferred, no additional gemination occurs and the stem is:
   a. **C_1C_1u$C_2C_2C_3$a** if **C_1** is the first geminate in the base, and
   b. **$C_1C_2C_2$uC_3C_3a** if **C_1** is **not** the first geminate in the base.

(32)

Some Tirrugza-Nouns and their bases

Case	Base	Tirrugza-Noun	Stem	Shape	additional gemination
(31)1-a	*ʃrk*	*tiʃʃurka*	*ʃʃurka*	C_1C_1u C_2C_3a	**YES**
	rgaz	*tirrugza*	*rrugza*		
	mɣar	*timmuɣra*	*mmuɣra*		
	maziɣ	*timmuzɣa*	*mmuzɣa*		
(31)1-b	*nmɣur*	*tinmmuɣra*	*nmmuɣra*	C_1 C_2C_2 u C_3C_4a	**YES**
	nflus	*tinffulsa*	*nffulsa*		
	msafri	*timssufra*	*mssufra*		
(31)2-a	*ʃʃrif*	*tiʃʃurfa*	*ʃʃurfa*	C_1C_1u C_2C_3a	**NO**
	!ddʒar	*!tidduʒra*	*!dduʒra*		
	!ttalb	*!tittulba*	*!ttulba*		
(31)2-b-i	*mkkisi*	*timmukksa*	*mmukksa*	C_1C_1u$C_2C_2C_3$a	**YES**
	!dggal	*!tidduggla*	*!dduggla*		
	mazzal	*timmuzzla*	*mmuzzla*		

(31)2-b-ii	*!mʃʃardu*	*timʃʃurda*	*mʃʃurda*	$C_1C_2C_2uC_3C_4a$	**NO**
	nqqarfu	*tinqqurfa*	*nqqurfa*		
	nttalfu	*tinttulfa*	*nttulfa*		
(31)3-a	*ddukkl*	*tiddukkla*	*ddukkla*	$C_1C_1u\ C_3C_3C_4a$	**NO**
(31)3-b	*nzzammu*	*tinzzumma*	*nzzumma*	$C_1C_2C_2uC_3C_3a$	**NO**

Examination of the facts in (31) and (32) raises the following questions:

(33) a. Why does gemination affect sometimes the initial consonant and sometimes the second consonant?
b. Why do bases which already contain a geminate sometimes undergo additional gemination and sometimes not?

Our answer to these questions relies on the following assumption.

(34) The stem of a Tirrugza-NOUN must satisfy these constraints:
a. It must be LHL.
b. Its first and second syllables must share a segment (the onset of the second syllable must be linked to the last segment of the first syllable).

If we consider all the possibilities, we observe that the attested forms are exactly those which satisfy both (34)a and (34)b**.** This is illustrated by the following examples:

(35)

a. Possibilities for *argaz*			Constraint (34)a	Constraint (34)b
	Poss.1	*r.gu.za*	violated because the stem is LLL	violated because the first σ and the second σ do not share a segment
	Poss.2	*rg.gu.za*	violated because the stem is LLL	OK
	Poss.3	*rug.za*	violated because the stem is HL	violated because the first σ and the second σ do not share a segment
☞	Poss.4	*r.rug.za*	OK (LHL)	OK

(36)

	b. Possibilities for *anmɣur*		Constraint (34)a	Constraint (34)b
	Poss.1	*n.muɣ.ra*	OK (LHL)	violated because the first σ and the second σ do not share a segment
☞	Poss.2	*nm.muɣ.ra*	OK (LHL)	OK
	Poss.3	*n.nu.mɣ.ra*	violated because the stem is LLLL	OK
	Poss.4	*nn.muɣ.ra*	OK (LHL)	violated because the first σ and the second σ do not share a segment

As we can see in (35), the only way to get a well-formed Tirrugza-noun from *argaz* is to geminate C_1 (see Poss.4), because it is the only way to ensure that both constraints are respected.

By contrast, (36) shows that $\mathbf{C_1}$ cannot be geminated because this gemination will produce a form which violates either (34)a or (34)b. This is why gemination skips to $\mathbf{C_2}$ (see Poss.2)

Now let us return to *CS-Gem and clarify why the behavior of Tirrugza-Nouns constitutes evidence for this constraint. The relevant observation is as in (37).

(37) i. $\mathbf{C_1C_1u\ C_2C_2C_3\ a}$ are possible Tirrugza-Stems
ii. $\mathbf{*C_1C_1u\ C_2C_3C_4\ a}$ are not possible Tirrugza-Stems.

This is exactly the situation expected under the assumption that TBT does not allow a geminate to form a syllable by itself. In (37)ii, $\mathbf{C_2C_3}$ can form a syllable, this gives a form with four light syllables $\mathbf{C_1.C_1u.C_2C_3.C_4a}$ which cannot be a Tirrugza-Stem (recall constraint (34)a). In (37)i, the sequence $\mathbf{C_2C_2}$ cannot be syllabified as O$\underline{\mathbf{C}}$ (by virtue of *CS-Gem). Thus, the whole geminate is syllabified with the preceding syllable, this gives us a form with three syllables $\mathbf{C_1.C_1uC_2C_2.C_3a,}$ a perfect Tirrugza-Stem since it is LHL.

To summarize, we can say that the discrepancies observed in the behavior of Tirrugza-Nouns are straightforwardly accounted for if one adopts our assumptions about the syllable structure of Tachelhit Berber in general, and *CS-Gem in particular.

5. Conclusion

In this work, we tried to defend three main ideas.

1. Tachelhit Berber makes reference to syllable weight.

2. The moraic structure (mono- or bi-moraic) of a syllable depends on its head:
- If its head is a vowel, the syllable can potentially be bimoraic.
- If its head is a consonant, it can only be monomoraic.

In other words heaviness is restricted to syllables with a vocalic nucleus.

3. A homomorphemic geminate never forms a CS syllable by itself.

The evidence provided for claim #2 is drawn from quantity alternation and prosodic morphology of TBT. But there are other phenomena which support this claim (degemination in plural stems and in intensive stems, noun phonotactics, nominal derivation..., cf. Jebbour 1996).

This particular behavior of syllable weight in TBT has two major implications for phonological theory:

First, the typology given in (3) needs to be refined, in that it must include a new category which contains languages where prosodic weight is sensitive to the segmental content of the nuclear mora.

Second, the WBP rule proposed by Hayes must be modified and take into consideration the segmental content of the nuclear mora.

Glossary:

ʃʃrif	Sharif
ʃrk	To join together
ħidi	To be close to
ħlb	To eat greedily
ħuddu	To delimit
ʃul	To worry
ʕum	To swim
ɣr	To read
ɣuʒbu	To feel sick
a	Vocative
aɣ	To bark
aħlas	Packsaddle
abnkal	Snake
add	Day
!addʒar	Neighbor
!adggal	In-law
afrskil	Type of shrub
agrtil	Mat
ag^{w}i	To refuse
ag^{w}l	To hang up
!amʃʃardu	Rural policeman
amɣar	Head of a tribe
!amħmʒr	Type of arsenic
amaziɣ	Free man
amazzal	Errand man
amn	To believe
amr	To try
amsafri	Student studying far away from home
amu	To hold (a certain capacity)
!amz	To take
anflus	Wealthy person
anmɣur	Notability
anqqarfu	Scraggy person
anttalfu	Lost soul
anzzammu	Stinking person
ara	To write
argaz	Man
aru	To give birth
bidd	To get up
bufillu	To be silly
!bukd	To be blind
ddu	To go
ddukkl	To take as a friend
!di	To drive away
dl	To cover
fi	To suppurate
fl	To leave
frɣ	To bend
frd	To graze
frs	To be sharpened
fsi	To melt
fsr	To hang out
fss	To be silent
fssr	To explain
g	To be
gnu	To sew
gr	To string, tread
gru	To glean
gun	To sleep
gusmu	To be full up
imkkisi	Heir
kʃn	To come in
krz	To plough
!lmz	To swallow
mrkuku	To be exhausted
mun	To accompany
!ngd	To drown
ngiri	To split up
nu	To cook
rgl	To lock
rku	To be dirty
!rz	To break
!rzm	To open
skr	To do
su	To drink
!ttalb	Man in charge of a mosque
ut	To hit
zdi	To be/put side to side
zur	To be thick
zzgr	To cross

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