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A TEMPLATIC APPROACH TO GEMINATION IN THE IMPERFECTIVE STEM OF TASHLHIYT BERBER*

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Tashlhiyt Berber uses, among other processes, gemination to form the imperfective. Most accounts of this phenomenon make reference to syllabic or prosodic structure. In this paper, I diverge from this trend, claiming that imperfective gemination is better analyzed as a templatic-based phenomenon resulting from morphological activity at the skeletal tier. I will argue for the use in the imperfective of a fixed-shape template over which consonant gemination is realized. Moreover, I will show that tri-, bi- and monoconsonantal verbs share the same template. The surface irregularity that bi- and monoconsonantal verbs display is viewed as the consequence of the identification of templatic positions.

In Tashlhiyt Berber,¹ three processes are involved in the formation of the imperfective:

- (1) a. the gemination of a consonant in the base
- b. the prefixation of the augment *tt-*
- c. the insertion of a vowel in the base

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¹ Tashlhiyt is one of the three main dialects of Berber spoken in Morocco. In this language, facts may differ by dialect or even inside the same dialect. The variety of Tashlhiyt we are dealing with here is the one spoken in Agadir, in the south-west of Morocco.

Some examples² are given in (2) to illustrate these processes:

(2)	<i>Aorist</i>	<i>Imperfective</i>	
a.	nkr	nkk ^r	‘stand up’
	krf	kk ^r rf	‘tie up’
	knu	kn ^u nu	‘lean over’
b.	ak ^w r	ttak ^w r	‘steal’
	r ^{ɔ̣} uħ	ttr ^{ɔ̣} uħ	‘go back’
	rkuku	ttrkuku	‘rot’
c.	sawl	sawal	‘speak’
	skr	skar	‘do’
	smun	smuna	‘collect’

Vowel insertion may operate jointly with prefixation or with gemination to form the imperfective (e.g. *gawr* → *ttgawar* ‘sit’, *gn* → *ggan* ‘sleep’), whereas gemination never combines with prefixation except for few mono-consonantal verbs such as *g* → *tgga* ‘be’.

In this paper, we will focus on the process exemplified in (2a). Attention will be drawn to the templatic mechanism underlying gemination in the imperfective. We shall try to answer the questions, how does gemination operate in the imperfective, and what is the nature of the morphological unit that underlies that operation?

Most accounts of gemination in the imperfective (Dell & Elmedlaoui 1988, 1991, 2002; Jebbour 1996, 1999; Bensoukas 2001; MacBride 2004) make reference to syllabic or prosodic structure. In this paper (see also Louali & Philippon 2003), I diverge from this trend, claiming that this process is better analysed as a templatic-based phenomenon resulting from morphological activity at the skeletal

² No schwa appears in my transcription. The existence of schwas in Tashlhiyt Berber is controversial. For authors such as Coleman (1996, 2001) and Puech & Louali (1999), epenthetic schwas appear between consonants to fill nuclei that would otherwise be empty (in Tamazight Berber, they are even treated as underlying vowels, see Saïb 1976). For others such as Dell & Elmedlaoui (2002) and Ridouane (2003), these schwas are not epenthetic but mere transitions between consonants. We will not go into this issue as it will not affect the analysis proposed here.

tier in the sense of McCarthy (1979, 1981). It is proposed that triconsonantal verbs geminate their consonant in the imperfective by use of a fixed-shape template composed of four CV units. It is also proposed that mono- and biconsonantal verbs use the same template. Their surface irregularity is construed as the straightforward result of the identification of templatic positions.

The paper is organized as follows. In section 1, I briefly survey some principles of Templatic Morphology. In section 2, I present the data. Then, important attempts at understanding geminated imperfective in Tashlhiyt Berber are discussed in section 3. My own analysis is provided in sections 4 to 6. Then, it is generalized in section 7 to other languages in the Berber family. Section 8 concludes the paper.

1. Templates.

1.1. Classical Arabic verb conjugation. Classical Arabic is probably the best known templatic language. Well before McCarthy's work (1979, 1981), which argues for the morphological role of the skeletal tier in Classical Arabic verb conjugation, linguists of the Middle Ages such as Sibawayh used *faʿal* 'to do' as a template model for derivation. The novelty with McCarthy is the way he extends the proposal of autosegmental phonology to Classical Arabic verbal conjugation. He indeed shows that the various forms of the verb are obtained in a natural way from the association of a consonantal root with vocalic melodies to prosodic templates.

In order to reduce the number of templates proposed by McCarthy (1979: 135, 1981: 386), Guerssel & Lowenstamm (1990) and Lowenstamm (2003) suggest that the verbal forms of Classical Arabic are derived by means of a single template, composed of four CV units.³ The template is given below in (3):

$$(3) \quad \boxed{C \ V \ C \ V \ C \ V \ C \ V}$$

³ The idea of reducing the number of templates in the verbal conjugation of Classical Arabic is not new. McCarthy (1979: 135) has already suggested expressing the regularities that the verbal forms and their canonical patterns show by means of two templates: CV((CV)[+seg])CVC and CCV([+seg])CVC. The first template abbreviates the patterns CVCVC, CVCCVC, CVVCVC, CVCVCCVC and CVCVVVCVC. The second one abbreviates the patterns CCVCVC, CCVCCVC and CCVVVCVC.

the usual manner from left to right,⁵ whereas in the second phase the direction of spreading is determined by the position of the head (i.e. the italicized CV) with respect to the neighbouring segments: spreading is left to right in *kaataba* and the opposite in *kattaba*.⁶ With such a structure, Guerssel & Lowenstamm (1990) and Lowenstamm (2003) aim to show that the association of segments with skeletal positions cannot be reduced to purely phonological conditions. Rather, they must be determined by some morphological conditions that allow identifying root positions in the template before C- or V-spreading is performed.⁷

In addition, the proposed template not only offers the tools needed to account for a range of morphological operations internal to the word, but also contributes a perspective on the theory on the phonology-syntax interface, where the prosodic units that constitute the template may project syntactic nodes. Such a hypothesis has been recently investigated in works by Bendjaballah & Heiden (2003 and 2005 on Berber and German), Kihm (2006 on Classical Arabic) and Rucart (2006 a,b on Afar).⁸

1.2. Berber template morphology. The templatic character of the morphology of Berber languages is not as well established as it is in Semitic languages, in spite of important studies (see Guerssel 1992, Bendjaballah 1999, Idrissi 2000 and Lahrouchi 2003) showing that various phenomena such as causatives, inchoatives, reciprocals, passives, negative preterit and internal plurals are better analysed in terms of templatic processes (see also Jebbour 1988, Iazzi 1991, Moktadir 1989 and Dell & Elmedlaoui 1992 for alternative analyses of the same aspects). The imperfective forms given in (2a) are similar to Classical Arabic ver-

⁵ This allows associating the root of biconsonantal verbs such as *madada* to the complement before the corresponding forms II *maddada* and III *maadada* are derived.

⁶ The well-known phenomenon of compensatory lengthening supports the universal tendency for vowels to spread in the opposite direction of consonants: vowels tend to spread to the right into the following empty slot while consonants spread to the left into the preceding empty slot (see Ingria 1980 and Meillet & Vendryes 1963 on Latin, Sezer 1986 on Turkish and Kencsei, Vago & Fenyvesi 1998 on Hungarian).

⁷ In the analysis of gemination in the imperfective of Tashlhiyt Berber, which is the topic of this paper, I will assume, following Yip (1988), that the mapping of segments onto the template proceeds from the edges inward (see section 4.3 below). Further discussions about standard association conventions are given in Dwyer (1978), Hoberman (1988), Odden (1988) and Yip (1988), among others.

⁸ Other works investigate the role of the template in syntax (see Banksira 1999 and Lumsden & Halefom 2003).

bal form II. They suggest the existence in Tashlhiyt Berber of a fixed-shape template over which consonant gemination is realized. Though gemination in the imperfective of Tashlhiyt Berber is in an infixed position — it involves either the initial consonant ($krf \rightarrow kkrf$) or the medial consonant ($nkr \rightarrow nkkr$) — it shows one regularity: imperfectives where the final consonant is geminated ($mrd \rightarrow *mrdd$) are excluded. In subsequent sections, I demonstrate two points. First, all verbs that form their imperfective by means of gemination involve the mapping of a root onto a quadrisyllabic template whose second syllable is a derivational site. Second, mono- and biconsonantal verbs use the same template as triconsonantal verbs to form their imperfective. These verbs will prove crucial to my demonstration. They are viewed in the Berber literature as irregular in that they use more than one morphological operation to derive their imperfective: e.g. $nu \rightarrow nwwa$ ‘cook’, $g \rightarrow tgga$ ‘be’, $ut \rightarrow kkat$ ‘beat’, $gn \rightarrow ggan$ ‘sleep’. I will show that their alleged irregularity hides an underlying regular mechanism: identification of templatic positions. However, I will not discuss the origin of the operations they use.

2. Data.

As an imperfectivizing mechanism in Tashlhiyt Berber, gemination concerns verbs containing no more than three consonants and no full vowels⁹ as well as verbs with the following shapes: CCU, CCI. Consider the examples in (5):

(5)	<i>Aorist</i>	<i>Imperfective</i>	
	$g^w mr$	$g^w mmr$	‘hunt’
	$k\text{ʃ}m$	$k\text{ʃ}mm$	‘enter’
	lkm	$lkkm$	‘arrive’
	nkr	$nkkr$	‘stand up, wake up’
	$m\text{sl}$	$m\text{ssl}$	‘fill’
	$m\text{gr}$	$m\text{ggr}$	‘harvest’

These verbs form their imperfective by geminating the second consonant. Most triconsonantal verbs (71% of the data in the appendix) follow this pattern though others as in (6) geminate the initial root consonant.

⁹ Except non-native verbs such as $x\text{dm}$ ‘work’, $s^{\text{ʃ}}\text{br}$ ‘support’ and $h\text{bs}$ ‘stop, jail’, which form their imperfective by means of *tt*-prefixation and vowel insertion, and causative verbs such as $s\text{gn}$ ‘put to bed’ and $s\text{gl}$ ‘fill up’ which use only vowel insertion.

(6)	ħrg	ħħrg	‘burn’
	frn	ffrn	‘pick over’
	krz	kkrz	‘plough’
	krf	kkrf	‘tie up’
	xrb	xxrb	‘scratch’
	x ^w mʒ	xx ^w mʒ	‘scratch’
	k ^w mz	kk ^w mz	‘scrape’

The verbs in (6) reject gemination of the medial consonant. The careful reader will have noticed that the medial consonants of the group are all liquids or nasals. Interestingly, a root medial sonorant will geminate when followed by a more sonorous segment, as shown in (7).

(7)	knu	knnu	‘lean over’
	zru	zrru	‘delouse’
	xlu	xllu	‘destroy’
	rwi	rwwi	‘mix’
	kmi	kmmi	‘smoke’
	bsi	bssi	‘melt’

In addition, two groups of biconsonantal verbs can be distinguished: verbs geminating their second consonant (8a) and those geminating their first consonant (8b). Both groups are subject to vowel insertion.

(8)	a.	ns	nssa	‘stay overnight’
		nz	nzza	‘be sold’
		kl	klla	‘spend the day’
		z ^ʕ r	z ^ʕ rra	‘see’
		ls	lssa	‘wear’
	b.	gn	ggan	‘sleep’
		gl	ggal	‘dry up’
		fl	ffal	‘leave, let’
		dl	ddal	‘cover’
		d ^ʕ r	tt ^ʕ ar	‘fall’

In the following section, I briefly review earlier attempts at handling the facts just described.

3. Earlier Accounts of the Geminated Imperfective.

Earlier treatments of gemination in the imperfective have relied on the idea that prior syllabification is necessary for the explanation of the phenomenon (cf. Dell & Elmedlaoui 1988, 1991, 2002; Jebbour 1996, 1999, Bensoukas 2001 and MacBride 2004). This section reviews the main proposals made therein.

3.1. Dell & Elmedlaoui (2002). Dell & Elmedlaoui draw up a list of conditions that each verb in Imdlawn Tashlhiyt Berber should satisfy in order to undergo gemination in the imperfective, stating (p. 118) “a. the basic stem contains three segments none of which is a geminate; b. if the basic stem contains a vowel, that vowel must be the last segment”. Then they make use of the following syllable rule (p. 119): “the segment which is geminated in the imperfective stem is that segment which is an onset in the basic stem”.¹⁰

The examples in (8), borrowed from Dell & Elmedlaoui (2002: 118), illustrate their hypothesis.

(9)	<i>Perfective</i>	<i>Imperfective</i>	
	<u>k</u> r _z	kk _{rz}	‘plough’
	x <u>ng</u>	xx _{ng}	‘strangle’
	z [◌] <u>l</u> m	zz [◌] _l m	‘peel’
	ʒ. <u>bd</u>	ʒbb _d	‘draw’
	ɸ. <u>m</u> l	ɸmm _l	‘mould’
	<u>x</u> .s _i	xssi	‘extinguish’

The underlined segments in the first column mark syllable nuclei. The period indicates the syllable boundary. In the first three verbs, it is the first consonant which is an onset, while in the other three it is the second consonant.

Dell & Elmedlaoui’s analysis relies entirely on the information provided by their syllabification algorithm. This algorithm states that in Imdlawn Tashlhiyt Berber any segment can act as a syllable nucleus if it is the most sonorous segment¹¹ in the syllabification domain: for instance, *r* is the syllable nucleus in *krz* because it is more sonorous than *k* and *z*. In *ʒbd*, *ʒ* stands for the nucleus of the first syllable, while the remaining segments form another syllable where *d* is the

¹⁰ See also Dell & Elmedlaoui (1988, 1991).

¹¹ Dell & Elmedlaoui (2002: 76) assume the following sonority scale where segments are ranked in a decreasing sonority order: *a*, high vocoids, liquids, nasals, fricatives, stops.

nucleus and *b* the onset. Without the information provided by the syllabification algorithm it would be impossible to identify the targeted segment in the imperfective.

3.2. Jebbour (1999). This author argues that syllable weight has a central role in determining the verbs that undergo gemination in the imperfective. Within a moraic approach à la Hayes (1989) he proposes that for any verb to resort to gemination in the imperfective the output must contain two light syllables (i.e. two moras).

His analysis disputes Dell & Elmedlaoui's conception of syllable weight, specifically the lack in their syllabification algorithm of a distinction between syllables with a vowel as their nucleus and those with a consonant. He has noticed that their analysis of geminated imperfective fails to explain why CVC, VCC and VCV verbs reject gemination in the imperfective. According to him, Dell & Elmedlaoui's statement that each verb must not contain a vocoid in a non-final position for it to undergo gemination

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 composition and the syllabic make-up of the base. [p.107]

This problem, Jebbour argues, is a direct consequence of their model of syllabification that states that CCC verbs have the same syllabic structure as CVC verbs, and C.CC verbs are the same as V.CV verbs (the underlined segments mark syllable nuclei).

The key to understanding why CVC, VCC and VCV verbs fail to geminate in the imperfective relies, according to Jebbour, on the constraint that requires that the output to gemination in the imperfective contains exactly two light syllables. As shown in the table in (10), only the output of CCC and CCV verbs obeys such a constraint:

(10)	<i>Verb base</i>	<i>Onset gemination</i>	<i>Syllabic structure</i>	<i>Type of syllables</i>
a.	frs	ffrs	f.frs <u>C.OCC</u> ¹²	LL
	fsr	fssr	fs.sr <u>OC.OC</u>	LL
	gru	grru	gr.ru <u>OC.OV</u>	LL
b.	mun	*mmun	m.mun <u>C.OVC</u>	*LH
	amr	*ammr	am.mr <u>VC.OC</u>	*HL
	aru	*arru	ar.ru <u>VC.OV</u>	*HL

The verb bases in (10a) undergo gemination since the resulting imperfective has two light syllables. In contrast, those in (10b) cannot geminate because their output would not have the LL syllabic pattern.

However, as noticed by Dell & Elmedlaoui (2002:123), Jebbour's weight-sensitive analysis still has problems. It fails to account for the imperfective of biconsonantal verbs that use gemination despite the fact that they contravene the LL syllable pattern (e.g. *gn* → *ggan* 'sleep', *fl* → *ffal* 'leave, let', *dr^s* → *ttar^s* 'fall' and *d^si* → *tt^say* 'take out'). Note that biconsonantal verbs raise another type of problem regarding Dell & Elmedlaoui's analysis. It fails to explain why these verbs use both gemination and vowel insertion to form their imperfective (see section 6 below).

3.3. Bensoukas (2001). Like Jebbour, Bensoukas adopts Dell & Elmedlaoui's hypothesis that vowelless syllables have consonantal nuclei. His Optimality Theoretic account¹³ begins with the observation that gemination is in complementary distribution with *tt-* prefixation in the imperfective. Then, he proposes that "imperfective formation in Tashlhiyt consists in affixing a consonantal mora to the verb root" (p. 122). This affixation is claimed to be the underlying morpheme of the imperfective. *tt-* prefixation¹⁴ and gemination are merely variant realizations of this morpheme. The choice of either realization relies, according to

¹²The underlined segment stands for the nucleus and O stands for the onset. The second syllable in *f:s* (OCC) is analyzed by the author as a light syllable whose last C does not count in weight. It can be linked either to the preceding μ or directly to the node σ (see Jebbour 1999: 104).

¹³See MacBride (2004) for an alternative account of the facts within the framework of OT.

¹⁴Bensoukas assumes, on the basis of Hayes (1989) and Davis (1995, 1999) among others, that geminates are underlyingly mono-moraic. The prefix *tt-* in the imperfective is thus counted as mono-moraic.

the author, on the interaction of specific well-formedness constraints: (i) a bimoraicity constraint, similar to that proposed in Jebbour (1999), which is responsible for the choice between gemination and *tt-* prefixation, and (ii) a sonority contour constraint that determines which consonant geminates in the verb. The first constraint prevents CCC and CCV verbs from using the prefix *tt-*. The second constraint chooses the candidate that has the optimal sonority contour: for instance, in the case of competing candidates such as *kkrz* and *krz*, the sonority contour of the syllable *krz* in the first form (syllabified as *k.krz*) is preferred to that of the syllable *rz* in the second form (syllabified as *kr.rz*).

In sum, the syllable-based approaches to geminated imperfective as stated in Dell & Elmedlaoui (1988 and 2002) and amended in Jebbour (1999) and Bensoukas (2001) focus on characterizing the kind of interrelation that exists between prosody and morphology in Tashlhiyt Berber. They predict the correct output for almost all triconsonantal verbs, but they leave out mono- and biconsonantal verbs such as *g* ‘be’, *kk* ‘pass by’, *ʃʃ* ‘eat’ and *rg* ‘grind, stone’ which are morphologically complex, using gemination and affixation to derive *tgga*, *tkka*, *ʃtta* and *rrag* respectively. The authors show among other things how the geminated consonant is selected in the base, but the relation that may exist between gemination as a derivational device and the syllabic status of segments is left as an open question. In addition, their analyses limit themselves to the case of Tashlhiyt Berber where the gemination involves either C₁ or C₂. Once extended to Berber languages other than Tashlhiyt (see section 7 in this paper), their analysis becomes unnecessarily complicated, since the geminated consonant is invariably C₂ regardless of its syllabic status. In my own account, I will try to bring out more explicitly the templatic mechanism responsible for gemination as well as the relationship between consonant gemination and the structure of the template.

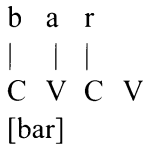
4. Templatic Account of Gemination.

This section outlines the main assumptions about the representation of the skeletal tier and the syllable structure in the framework of Government Phonology.

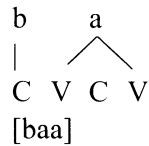
4.1 CVCV model. All examples handled in this paper use the CVCV model (Lowenstamm 1996), which falls within the framework of Government Phonology as outlined in Kaye, Lowenstamm & Vergnaud (1985, 1990). This approach to syllable structure stipulates that the skeletal level of phonological representations consists of strict alternations of onset and nucleus positions, i.e. C and V positions. Only consonantal segments are linked to C positions and only vocalic

segments appear in V positions. Moreover, within this model, different surface syllable types such as a ‘closed syllable’, a ‘branching onset’, a ‘branching nucleus’ and a ‘geminate’ share the same skeletal material: two CV units.

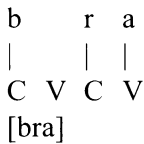
(11) a. *closed syllable*



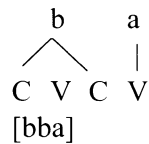
b. *branching nucleus*



c. *branching onset*



d. *geminate*



The differences in the surface syllabic structures obtained in (11) lie in the way segments are associated to the skeletal tier:

- The geminate in (11d) has an empty V position between its members whereas the long vowel in (11b) contains an empty C position.
- The branching onset in (11c) has an empty V between its consonants.
- The consonant located in the coda of the surface closed syllable in (11a) appears in the onset of the second syllable whose nucleus is empty.

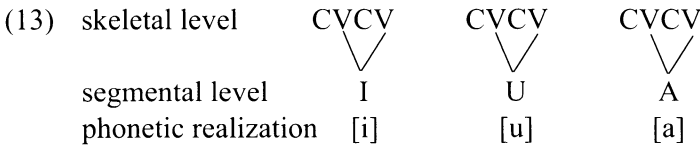
Skeletal positions that have no phonetic realization are said to be licensed to remain empty by virtue of the government relation that they share with the neighbouring segments. Proper Government is one such relation which allows a vocalic position to remain empty when followed by a vowel. This particularly accounts for the distribution of schwas and the well-known V/Ø alternation such as in Moroccan Arabic *kətəb* ‘he wrote’, where the V position between /k/ and /t/, properly governed by the schwa that appears between /t/ and /b/, remains empty opposed to *kətəbu* ‘they wrote’, where the same V position, non-governed, surfaces as schwa (see Kaye 1990). The same phenomenon occurs in certain Berber varieties such as Kabyle Berber: for instance, the vocalic position between /x/ and /ð/ remains empty in *xəðəm* ‘work!’ but not in *xəðəməx* ‘I worked’. Interestingly, this position is properly governed by the following schwa in the first form but not in the second one (see Bendjaballah 2001: 188). For more

details about this model, the reader will refer to the work mentioned above and Scheer (2004).

4.2 Representation of Berber peripheral vowels. In Kabbaj (1990), Bendjaballah (1999, 2001) and Idrissi (2000), it is argued on the basis of Lowenstamm's hypothesis (1991) about the vocalic system of Maghribi Arabic and Ethio-Semitic, that the peripheral vowels of Berber are associated with 'branching nuclei'. The same parameter is adopted here:

- (12) In Tashlhiyt Berber, peripheral vowels must be associated with two V positions.

According to this parameter, the representation of the three peripheral vowels of Tashlhiyt Berber follows under (13):



Note that the parameter in (12) is a condition on the association of vocalic elements to the skeletal level. It does not affect the segmental level. Thus, the three vowels of the language surface as short vowels, viz. [i], [a] and [u].

The correspondences between Tashlhiyt Berber and Classical Arabic endorse the above proposal. Indeed, in a number of items shared by these languages there is a regular change whereby the long vowels of Classical Arabic correspond to phonetically short vowels in Tashlhiyt Berber. Short vowels in Classical Arabic disappear in Tashlhiyt Berber. By contrast, singleton and geminate consonants in Classical Arabic are preserved as such in Tashlhiyt Berber. The examples in (14) illustrate these correspondences:

(14)	<i>Classical Arabic</i>	<i>Tashlhiyt Berber</i>	
a.	zaahada	zahd	'to fight'
	saafara	safir	'to travel'
	laahaqa	lahg	'to reach, pursue'
	alkitaab	lktab	'the book'
	albahr	lbhr	'the sea'

b. farraqa	frrq	‘to divide’
ʔaððaba	ʔddb	‘to torture’
ʔallama	ʔllm	‘to teach’
fakkara	fkkrr	‘to think’
ʒazzaar	a-gzzar	‘butcher’

The parameter in (12) characterizes these correspondences by distinguishing the vowels that occupy two vocalic positions from those that have access to only one position. The first surface as short in Tashlhiyt Berber, the latter disappear. For instance, in the Classical Arabic form *saafara* in (14a), the long vowel is associated with two vocalic positions while the remaining vowels connect to only one position. In the corresponding form in Tashlhiyt Berber, the first vowel surfaces as [a], the others remain silent (further discussion of this proposal is provided in Bendjaballah 2001: 190).

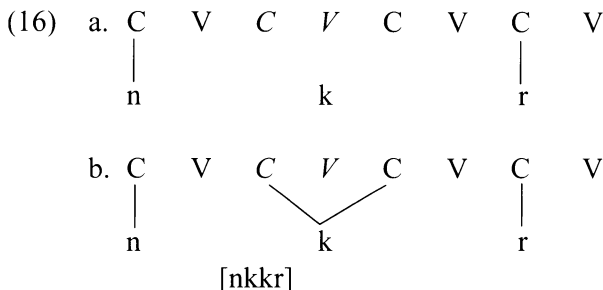
4.3 Imperfective template. In terms of templatic morphology, the imperfective of the triconsonantal verbs given in (5) and (6) is derived by means of a quadri-consonantal template that allows geminating the initial or medial consonant. For the sake of uniformity, I propose that these verbs use the same template as in Classical Arabic verb conjugation, repeated in (15) for convenience:

(15) *Imperfective template*

C	V	C	V	C	V	C	V
---	---	---	---	---	---	---	---

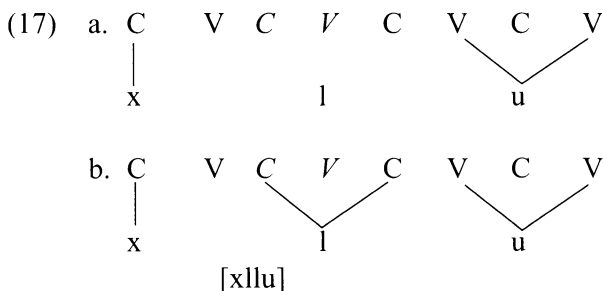
Segments are mapped onto this template from the edges inward (cf. Yip 1988).¹⁵ This direction of association predicts that if there are fewer consonants in the root than consonantal positions in the template, the medial consonant is likely to spread, since after associating the initial and final consonants with the edges of the template, the medial consonant automatically fills the remaining consonantal positions. Thus, for example, the verb *nkr* ‘stand up’ gets its medial consonant geminated in the imperfective as shown in (16):

¹⁵The same direction of association is used by Moktadir (1989) in the analysis of the passive formation in Tashlhiyt Berber.



In (16a), the consonants /n/ and /r/ are associated to the initial and final consonantal positions in the template. Then, in (16b), the consonant /k/ fills the remaining C positions.

The verbs given in (7) behave like those ones in (5) in that they geminate the second consonant to form their imperfective. Moreover, they display a high vocoid; /u/ or /i/ in the final position. Given the parameter in (12), these vocoids connect to two V positions. The imperfective form of *xlu* 'be crazy' is represented below in (17):



The first segment /x/ is associated to the first C position in the template and the last segment /u/ is associated to the last two V positions. Then, the medial consonant /l/ geminates by use of the remaining consonantal positions in the template.

In the following section, we will see that initial consonant spreading in verbs such as in (6) is not automatic. Rather, it requires a rightward spreading rule that compensates for prohibited spreading of certain consonants in the medial position.

4.4 Sonority effect. The verbs in (6) undergo the same morphological operation as those ones in (5): they geminate one consonant by use of the template in (15). However, their particular behaviour with respect to gemination — i.e. geminating

C_1 instead of C_2 — has to be explained at the phonological level. Admittedly, this is what Dell & Elmedlaoui (1991:85) suggest: “geminate that consonant which is a syllable onset”. This would be sufficient if all Berber languages geminate either C_1 or C_2 . But apart from Tashlhiyt all other varieties invariably geminate C_2 . The reason why C_1 geminates in a number of imperfective forms in Tashlhiyt Berber is related to the nature of consonants that appear in the medial position. Thus, we notice that the verbs in (6) contain sonorants (liquids and nasals) in this position. One could ask if Tashlhiyt Berber prohibits geminating liquids and nasals in the imperfective. The answer appears in the examples in (7) where such consonants geminate. Therefore, another question arises: is there any phonological constraint that prohibits geminating sonorants in the verbs in (6)?

The answer to this question involves examining the segmental environment of sonorants occurring in the medial position of both groups of verbs in (6) and (7). In terms of sonority hierarchy (cf. Sievers 1881, Jespersen 1904, Clements 1990), each sonorant in the verbs in (6) is surrounded by less sonorous segments, i.e. obstruents, whereas in (7) it is followed by a more sonorous segment, i.e. a vocoid. At the same time, these sonorants geminate in (7) but not in (6). For instance, the liquid /r/ geminates in *zru* ‘delouse’ where it is followed by a more sonorous segment, but not in *krz* ‘plough’ where it is the most sonorous segment.

The sonority hierarchy or sonority scale is a ranking of segments along a scale on the basis of their sonority. This scale explains, in particular, the organization of segments within the syllable: more sonorous segments stand closer to the peak of the syllable than less sonorous segments. In the present analysis, I am assuming the following sonority scale where segments appear in order of increasing sonority: Obstruent > Nasal > Liquid > Glide/Vowel (see Clements 1990). In this scale, stops and fricatives are assumed to be sonority-equal. So do glides and vowels. This is all the more tenable in the first case that in Tashlhiyt Berber fricatives have no effect on determining the geminating consonant in the imperfective. That is to say, a fricative in the medial position does not imply the gemination of the preceding stop: verbs such as *bsr* ‘spread’, *gzm* ‘cut’ and *kʃm* ‘enter’ geminate their medial fricative despite the fact that it is preceded by a stop. On the other hand, I assume following Angoujard (1990: 15) that gutturals (h, ħ, ʕ, ʔ) are lower in sonority than nasals, i.e. they have the same sonority as obstruents. This is supported in Tashlhiyt Berber by the imperfective of verbs that contain such consonants in the initial or medial position. Verbs such as *hrf* ‘feel slightly ill’, *ħrf* ‘be smart’, *ħrg* ‘burn’, *zhr* ‘blaze up’ *mħdʕ* ‘poison’ and *lħm* ‘solder’ form their imperfective by geminating the guttural while it is adjacent to a sonorant. They would not do so if gutturals were higher in sonority.

Let us return now to the behavior of sonorants with respect to gemination. A phenomenon similar to that present in the imperfective of the verbs in (6) is found in the action noun formation. In Tashlhiyt Berber, nouns of this type show a uniform pattern *aCCaC* where the medial consonant is either simple or geminated, depending on its sonority. For instance, the action nouns corresponding to the verbs *rdʿl* ‘lend’, *bzg* ‘swell up’ and *ntl* ‘hide’ are *arttʿal*, *abzzag* and *anttal*, respectively. In contrast, the verbs *frg* ‘tighten’, *mrg* ‘be ashamed’, *srħ* ‘free (ebb tide)’ and *frn* ‘sort out’ form their action noun as *afrag*, *amrag*, *asrah* and *afran*, respectively. As we can see, in the first group of verbs the medial consonant is an obstruent preceded or followed by a more sonorous segment, while in the other group it is a sonorant surrounded by less sonorous segments. In the corresponding action nouns, the first group geminates the medial consonant, and not the second group.

These facts suggest that there is a relationship of cause and effect between the sonority of segments and their behaviour towards gemination. Sonorants do not geminate in the imperfective if their neighbouring segments are less sonorous. Consequently, I propose that the following constraint is active in the imperfective derivation:

- (18) Any segment is prohibited to geminate in the imperfective if it is the most sonorous segment in the root.

This constraint prevents all sonorants which appear in the medial position of the verbs in (6) from geminating. Given the configuration of the template, it is the initial consonant that geminates through spreading into the derivational CV. The gemination of the initial consonant can thus be seen as a subsidiary operation that compensates for prohibited gemination of the medial consonant. This is somewhat similar to the strategy used in the Tiberian Hebrew morphology. In this language, a number of noun derivations involve C_2 gemination as in *naggār* ‘carpenter’ and *sippuur* ‘story’. Opposed to these forms are *paaraaf* ‘horseman’ and *baaheret* ‘white spots on skin’ where the second consonant is not geminated. Instead, the preceding vowel lengthens. The same phenomenon is found in the verbal conjugation (binyanim): *kitteb* ‘write’ vs. *beerak* ‘bless’. In fact, /r/ and /h/ belong to a class of consonants that never geminate in Tiberian Hebrew. Therefore, vowel lengthening is but a ‘subsidiary’ operation that compensates for prohibited gemination of certain consonants (cf. among others Gesenius 1881, Bauer & Leander 1922 and Lowenstamm & Kaye 1986). Note that compensatory lengthening in Tiberian Hebrew should not be understood in the sense that the

lengthened segment compensates for the loss of another segment. Rather, lengthening occurs to preserve the number of slots in the skeleton (cf. De Chene & Anderson 1979, Ingria 1980 and Hayes 1989 among others about the standard version of compensatory lengthening).

The imperfective form of *xrb* ‘scratch’ illustrates the whole derivation.

- (19)
- | <i>Aorist</i> | | | | <i>Imperfective</i> | | | |
|---------------|---|---|---|---------------------|---|---|---|
| C | V | C | V | C | V | C | V |
| | | | | | | | |
| x | | r | | b | | | |
- a.
- | C | V | C | V | C | V | C | V |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| x | | | | r | | b | |
- b.
- | C | V | C | V | C | V | C | V |
|---|---|---|---|----|---|---|---|
| | | / | | | | | |
| x | | | | *r | | b | |
- *[xrrb]
- c.
- | C | V | C | V | C | V | C | V |
|---|---|---|---|---|---|---|---|
| | | / | | | | | |
| x | | | | r | | b | |
- [xxrb]

The segments are associated to the template from the edges inward. In (19b), the segment /r/ fails to geminate since it is the most sonorous segment in the root. The correct form geminating the first consonant /x/ is given in (19c).

However, three observations are in order. Firstly, the constraint in (18) does not necessarily imply the gemination of the least sonorous segment in the root. If this were the case, many verbs in (5) such as *g^wmr*, *frn*, *knu* and *kmi* would geminate their initial consonant. The important thing is that (18) allows the gemination of the medial consonant in any case, except when it is the most sonorous segment in the root.¹⁶ Secondly, there are few verbs such as *xwu* ‘empty’, *fwu*

¹⁶Only one counter-example to this constraint, *rwl* ‘run away’, is found in the data. In the imperfective, this verb either geminates the medial glide (though it is the most sonorous segment) or surfaces with a geminated *g^w* in place of geminated *w*. The latter form may suggest that *rg^wl* is the underlying form of the verb. In Dell & Elmedlaoui’s syllable-based analysis (2002), the first form, viz. *rwwl*, is analyzed with reference to ranked constraints: in the verbal base *rwl*, the medial glide is first syllabified in the onset of the second syllable by virtue of a highly ranked constraint that prohibits onsetless syllables in the non-initial position.

‘roast’ and *z^fwi* ‘left-handed’ where the medial and final consonants are sonority-equal (see the sonority scale on page 36). These verbs all geminate the medial segment. So do the verbs that end with two obstruents such as *nff* ‘scrape’, *ngd^f* ‘drown’ and *nfd* ‘be stirred up’ and those that begin with two obstruents such as *bdr* ‘mention’, *fsr* ‘spread’ and *fsi* ‘melt’.¹⁷ Thirdly, there exist in the language a number of verbs that are entirely made of obstruents and others that contain only sonorants. Five native verbs of the latter type are found in the data: *nru* ‘defeat’, *rwi* ‘make dirty’, *rwl* ‘flee’, *mlu* ‘be limp’ and *rmi* ‘be tired’. Apart from *rwl* that contradicts (18) by geminating the medial glide (see footnote 16) and *mlu* that forms its imperfective by means of the prefix *tt-*, the remaining verbs geminate, as expected, their medial consonant. In contrast, verbs with only obstruents, such as *bdg* ‘be wet’, *bzg* ‘enflate’ and *zdk* ‘inhabit’ (nine verbs in the data are of this type) all form their imperfective by means of *tt-*-prefixation and vowel insertion. Given their segmental make up, one may expect them to undergo gemination.¹⁸

In sum, the template in (15) and the constraint in (18) ultimately allow distinguishing two classes of triconsonantal verbs:

- a. verbs as in (5) that geminate the second root consonant,
- b. verbs as in (6) that geminate the first root consonant.

However, both of these classes are shown to be underlyingly similar in that their consonant geminates by use of the same template, the one as in (15).

Then, it is geminated in the imperfective. Without such a constraint, the medial /w/ would have been syllabified in the nucleus and the resulting imperfective would have been **rrwl*.

¹⁷Only 3 verbs that begin with two sonorants are found in the data. They are of the type NLO or LNO (where N = nasal, L = liquid and O = obstruent): *mrz* ‘wound’, *mrg* ‘be ashamed’ and *lmz^f* ‘swallow without chewing’. The first verb geminates the initial consonant and the others use the prefix *tt-* with the vowel *a* inserted between the last two consonants.

¹⁸Dell & Elmedlaoui (2002:119) gave the example of *fsd* ‘be spoiled’ that forms its imperfective in Imdlawn Tashlhiyt Berber either by geminating the initial consonant or by prefixing *tt-* and inserting the vowel *a* between the last two consonants. The fact that the authors “have not found more is not surprising, for there are not many CCC verbs with only obstruents.” In the dialect we are examining here (see also Boumalk 2003 and El Mountassir 2003), the verb *fsd*, which is borrowed from Arabic, has only one imperfective form: *tt-fsad*.

It is unknown why verbs of this type behave in this way. What we observe, however, is that unlike the other verbs, they do not contain any sonorant in their root.

5. **tt- Prefixation and Vowel Insertion in the Imperfective.**

Before we discuss the imperfective of mono- and biconsonantal verbs, let us examine briefly the imperfective formation involving *tt-* prefixation and vowel insertion. Some aspects of this outline fall within the analysis presented so far. As noticed in the first section, gemination and *tt-* prefixation never co-occur in the same form in the imperfective. In addition, *tt-* prefixation involves verbs whose base shows one of the following properties:

- (20) a. It is vowel-initial or medial.
 b. It contains a lexical geminate.
 c. It contains more than three segments.
 d. It is a loan word.

Moreover, the prefixation of *tt-* is accompanied by the insertion of a prefinal vowel in verbs that end with two consonants. The inserted vowel is a copy of the preceding vowel in the base; otherwise, it is *a*. The examples in (21) illustrate these processes.

(21)	<i>Aorist</i>	<i>Imperfective</i>	
a.	awk	ttawk	‘pull’
	anf	ttanf	‘withdraw, move away’
	aru	ttaru	‘give birth’
b.	ddz	ttddz	‘cram’
	brrm	ttbrram	‘turn’
	k ^w mmʃ	ttk ^w mmaʃ	‘crease, crumple’
c.	ɤndf	ttɤndaf	‘swindle’
	kr ^ʃ fs	ttkr ^ʃ fas	‘exhaust’
	rfufn	trrfufn	‘go through hardships’
d.	xdm	ttxdam	‘work’
	ʃbr	ttʃbar	‘weigh’
	fhm	ttfham	‘understand’

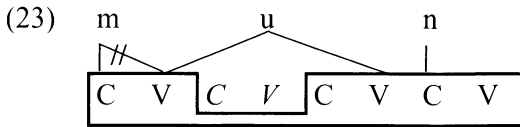
The verbs in (21a) are vowel-initial. Those in (21b) contain a lexical geminate. Quadriconsonantal verbs appear in (21c) and loan verbs are in (21d). The

reason that verbs of this type reject gemination has been a matter of debate in the literature. One noticeable explanation, provided in Jebbour (1999) and Bensoukas (2001), makes reference to weight. The first author suggests that for any verb to undergo gemination in the imperfective it must contain two light syllables in the output. Outputs that contravene this condition resort to *tt*-prefixation. The second author proposes that gemination and *tt*-prefixation are but variant realizations of an underlying consonantal mora affixed to the verb (see section 3 above).

In the present analysis, the weight constraint can be defined in terms of the number of CV units that the imperfective form contains. Many of the verbs in (21) would exceed the quadrisyllabic template in (15) if their imperfective were formed by means of gemination. The forms represented in (22) illustrate this situation:

- (22) a. C V C V C V C V C V
- b. C V C V C V C V C V
- c. C V C V C V C V C V C V

In comparison with the above verbs, many other verbs such as *luħ* 'throw', *mun* 'accompany', *sgn* 'put to bed', *sgl* 'bury', *x_dm* 'work' and *f_hm* 'understand' use the prefix *tt*- though their imperfective would fit the template if it were derived by means of gemination. The first two verbs, *luħ* and *mun*, are vowel-medial, the following two are causative and the remaining are borrowed from Arabic. An alternative analysis for *mun*-like verbs can hold that the branching medial vowel blocks the identification of the derivational syllable by means of consonant spreading, provided that the segments of the base are first associated to the boxed positions in the template. The situation is illustrated below in (23).



The radical vowel /u/ branches over the derivational syllable, thus blocking gemination of the initial /m/.

In the following section, we show that the irregularity of the imperfective of mono- and biconsonantal verbs results from the use of the same template as in triconsonantal verbs.

6. The Imperfective of Bi- and Monoconsonantal Verbs.

6.1. Biconsonantals. Verbs grouped in (8a) and (8b) are more complex; they belong to those verbs which use more than one morphological operation to derive their imperfective. Moreover, their behaviour with respect to these operations seems to differ from one category to the next. This calls for a more extensive examination. First of all, let us examine their conjugation paradigm including the aorist, imperfective and preterit in comparison with CCU verbs:

(24)

	<i>Aorist</i>	<i>Imperfective</i>	<i>Preterit</i>		
			<i>3^{pl}ms</i>	<i>1^{pl}s</i>	
a.	ns	nssa	nsa	nsiɛ	'stay overnight'
	ls	lssa	lsa	lsiɛ	'wear'
	nz	nzza	nza	nziɛ	'be sold'
	kl	klla	kla	kliɛ	'spend the day'
	z ^r	z ^r ra	z ^r ra	z ^r riɛ	'see'
b.	gn	ggan	gn	gnɛ	'sleep'
	dl	ddal	dl	dlɛ	'cover'
	gl	ggal	gl	glɛ	'dry up'
	d ^r	tt ^r ar	d ^r	d ^r riɛ	'fall'
	fl	ffal	fl	flɛ	'leave, let'

c. ml	mmal	m ^h la	mliɣ	‘show’
sɛ	ssɛ	sɛa	sɛiɣ	‘buy’
zd ^h	zzad ^h	zd ^h a	zd ^h iɣ	‘grind’
rg	rrag	rga	rgiɣ	‘grind, stone’
ɛz	qqaz	ɛza	ɛziɣ	‘dig’
d. bnu	bnnu	bna	bniɣ	‘build’
rbu	rbbu	rba	rbiɣ	‘carry in the back’
ɣlu	ɣllu	ɣla	ɣliɣ	‘loose’
rku	rkku	rka	rkiɣ	‘be dirty’

The verbs in (24a) behave in a similar way to CCU verbs: they geminate the medial consonant. They also use the vowel *i* in the preterit 1st person singular, and end with the vowel *a* in the preterit 3rd person masculine singular. In contrast, the verbs in (24b) form their imperfective by geminating the initial consonant and infixing the vowel *a*. Their preterit merely exhibits the two radicals.

On the basis of these similarities, Iazzi (1991) has suggested that biconsonantal verbs as in (24a) contain an underlying vocalic segment that has no more than one distinctive feature, namely [+vocalic]. According to Iazzi this underlying vowel stands for an ancient segment that went out of use, revealing a state of the language where a vowel, probably *u*, occupied the final position of the verb. Certain Berber varieties (cf. Basset edition 2004: 64) actually use the vowel *u* instead of *a* at the Preterit 3^{pm}s: e.g. *i-nsu* ‘stay overnight’ in Snous, Menacer and Ouargla varieties, *i-lsu* ‘wear’ in Ghadames variety, *i-rz^hu* ‘break’ in Seghroushen, Snous, Menacer, Ouargla and Ghadames varieties, and *i-nzu* ‘be sold’ in Menacer and Ouargla varieties.

An alternative explanation is proposed in Prasse (1972) and Kossmann (2002, 2003), and taken up by Louali and Philippson (2003). According to the authors, the difference between verbs infixing the vowel *a* and those suffixing it is diachronic: it is due to the loss of a root consonant, the medial consonant in the first type of verbs and the final consonant in the second type.

Given the morphophonological similarities discussed above, I assume that biconsonantal verbs such as those in (24) are underlying trisegmental. The vowel they display in the imperfective is phonologically well motivated. It compensates for the unexpressed root segment and allows them to fit the same template as triconsonantal verbs. The imperfective form of *kl* and *gl* illustrate the proposal below in (25).

- (25) a. $\begin{array}{ccccccc} C & V & C & V & C & V & C & V \\ | & & \diagdown & / & \diagdown & / & & \\ k & & l & & a & & & \end{array}$
 [klla]
- b. $\begin{array}{ccccccc} C & V & C & V & C & V & C & V \\ & \diagdown & / & & \diagdown & / & | & \\ & g & & & a & & l & \end{array}$
 [ggal]

6.2 Monoconsonantals. So far we have seen that the structure of the template that bi- and triconsonantal verbs use in the imperfective causes gemination of the initial or medial consonant. In this section, we examine the imperfective formation of monoconsonantal verbs. The reader's attention is drawn to the template that their imperfective forms use.

Monoconsonantal verbs form their imperfective with a combination of different operations including affixation and gemination.

<i>Aorist Imperfective</i>			<i>Aorist Imperfective</i>		
g	tgga ¹⁹	'be, become'	bbi	tbbi	'cut'
ʃ	ʃtta	'eat'	su	ssa	'drink'
nu	nwwa	'cook'	zu	zwwa	'dry'
fi	tfay	'suppurate'	d ^h i	tt ^h ay	'drive away'
ɛ ^w i	qq ^w ay	'catch'	ut	kkat	'hit'
aɛ	ttɛ	'bark'	af	ttaf	'be better'

Traditionally, linguists who have examined these kinds of formations have often been discouraged by the number and nature of the operations used to form imperfectives. Indeed, we distinguish different types of verbs in these examples:

¹⁹In Tashlhiyt Berber, there is a dialectal variation as to the shape of the prefix that monoconsonantal verbs use in the imperfective. For example, the imperfective forms of the verbs g 'be', *kk* 'pass through', *ddu* 'go' and *bbi* 'cut' are given with a non-geminated prefix in the dialect described in Elmoutassir (2003), whereas in the dialect described in Boumalk (2003) they are given with a geminated prefix. In other Berber varieties such as Tamashek, the prefix is always non-geminated: e.g. *t-áɣɣ* 'do', *t-áræbba* 'raise young', *t-íru* 'bray' (cf. Heath 2004).

- i. a verb using gemination, vowel insertion and prefixation (*tgga*)
- ii. verbs using both gemination and vowel insertion (*ssa*, *tt^say*, *qq^way*)
- iii. a verb using both prefixation and vowel insertion (*tfay*)
- iv. verbs using vocalic and consonantal insertion (*ftta*, *kkat*)
- v. verbs using only prefixation (*tddu*, *tbbi*, *ttaκ*, *ttaf*)

The verbs *nu* and *zu* behave differently, and are analysed as underlying bi-consonantal. Their second consonant is a glide /w/ that surfaces as [u] word-finally and preceded by a consonant (see also /y/ which surfaces as [i] in *kmi* ‘smoke’ and *d^fi* ‘drive away-aorist’ but as [y] in *akmmay* ‘smoker’ and *tt^say* ‘drive away-imperfective’). In addition, the vowel *u* in *su* ‘drink’, which alternates with *a* in the imperfective, seems to be a lexical vowel. Most linguists treat glides and high vowels in Berber as phonetic reflexes of the same phonological set (cf. among others Destaing 1920, Appelgate 1970 and Guerssel 1986).²⁰

Returning to the imperfective of monoconsonantal verbs, many linguists discuss lexical idiosyncrasy since some verbs change completely (*ut* → *kkat*) while others use unusual infixes (*ff* → *ftta*). My claim does not concern the origin of such affixes or other changes in the form. Rather, I show that the size of their imperfective depends on their base: the shorter the base is, the more numerous the operations used to transform the verb are. This idea seems to lead us toward a template-based explanation of these phenomena. It appears that the verbs in (26) form their imperfective with the same template as triconsonantal verbs, similar to (15). A short verb like *g* ‘be, become’ must use all operations possible to fill a template with four CV units, while a triconsonantal verb such as *nkr* ‘stand up’ merely geminates its medial consonant. Below are represented some of the verbs in (26) with some bi- and triconsonantal verbs, using the template given in (15).

²⁰ The underlying form of verbs with high vowels relates to the question of the segmental content of the root in Berber. There is no consensus as to the content of the root in Berber. Some (Basset 1929, Cantineau 1950 and Galand 1988) conceive the root as the minimal meaningful unit, entirely composed of consonants, while vowels have a grammatical role. Others, mostly working within the generative tradition (see also Kossman 1997:130) claim that in certain cases, consonants and vowels should not be separated as they share lexical information.

- (27) a. $\begin{array}{ccccccccc} C & V & C & V & C & V & C & V \\ | & & \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup \\ \int & & & t & & & & a \end{array}$
[ʃtta]
- b. $\begin{array}{ccccccccc} C & V & C & V & C & V & C & V \\ | & & \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup \\ t & & & g & & & & a \end{array}$
[tgga]
- c. $\begin{array}{ccccccccc} C & V & C & V & C & V & C & V \\ \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup & | & \\ & t & & a & & & y & \end{array}$
[t^ʰay]
- d. $\begin{array}{ccccccccc} C & V & C & V & C & V & C & V \\ \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup & | & \\ & g & & a & & & n & \end{array}$
[ggan]
- e. $\begin{array}{ccccccccc} C & V & C & V & C & V & C & V \\ | & & \diagdown & \diagup & \diagdown & \diagup & \diagdown & \diagup \\ n & & & s & & & & a \end{array}$
[nssa]
- f. $\begin{array}{ccccccccc} C & V & C & V & C & V & C & V \\ | & & \diagdown & \diagup & \diagdown & \diagup & | & \\ n & & & k & & & r & \end{array}$
[nkkr]

No segregation between consonants and vowels is assumed in the representations above.²¹ That is, consonants and vowels connect to the template at the same level.

²¹Unless an argument is made that Berber displays Semitic-like roots, entirely composed of consonants, we maintain that the root in Tashlhiyt Berber may contain consonants and vowels as well (see footnote 20). This allows us to prevent certain problems related to the direction of associations, which would have risen if consonants and vowels are associated separately to the template.

7. Geminated Imperfective in Other Berber Languages.

The templatic account of gemination as suggested in Tashlhiyt Berber can be easily generalized to other Berber languages. All Berber languages which use gemination as an imperfectivizing mechanism geminate one root consonant. Gemination in the imperfective is also found in Semitic languages such as Ge'ez (cf. Gragg 1997 and 2004) and Akkadian (cf. Kouvenberg 1997). Many other languages outside of the Afroasiatic family use gemination as a morphological operation: e.g. Alabama and Choctaw (Muskogean family), Balangao and Keley-I (Austronesian family). The reader is referred to Samek-Lodovici (1992) and references therein.

However, while Tashlhiyt Berber geminates either the initial or the medial consonant, the remaining languages invariably geminate the medial consonant. Thus for example, a verb like *krz* 'plough' geminates the medial consonant /r/ in the imperfective in all Berber languages except in Tashlhiyt where it is the first consonant /k/ that is geminated. In parallel, a verb like *lkm* 'arrive' geminates its medial consonant /k/ in all Berber varieties including Tashlhiyt. Another example is *lməd* 'learn', which forms its imperfective as *ləmməd* in Tarifit (cf. Kossmann 1997 and 2000) and *lammæd* in Tamashek (cf. Heath 2004). Further examples from Kabyle, Tamazight, Tamashek and Tarifit²² are given in the table below.

(28) a. Kabyle (Naït-Zerrad 1994)	b. Tamazight (Iazzi 1991)
<i>Aorist</i> <i>Imperfective</i>	<i>Aorist</i> <i>Imperfective</i>
frən fərrən 'choose'	nkər nəkkər 'stand up'
krəz kərrəz 'plough'	krəm kərrəm 'get cold'
xðəm xəddəm 'work'	k ^w məd k ^w əmməd 'burn'
brəc bərrəc 'crush'	krəz kərrəz 'plough'
bzəg bəzzəg 'make swell'	kməz kəmməz 'scratch'
gdəl gəddəl 'forbidden'	zləf zəlləf 'be grilled'

²²Tamazight and Tarifit are spoken in Morocco. Kabyle is spoken in north-east Algeria. Tamashek is spoken in north Mali.

c. Tamashek (Heath 2004)

<i>Aorist</i>	<i>Imperfective</i>	
əlməd	lám̄məd	'learn'
əlkəm	lúkkəm	'follow'
ərgəh	rúggəh	'walk'
əzræw	zár̄ræw	'get'
ək̄nəs	kánnəs	'fight'
əhlək	hállək	'destroy'

d. Tarifit (Kossman 2000)

<i>Aorist</i>	<i>Imperfective</i>	
d ^h həç	d ^h əhhəç	'laugh'
lməd	ləmməd	'learn'
r̄bu	rəbbu	'carry'
kri	kərri	'rent'
nkər	nəkkər	'stand up'
crəs	cərrəs	'tie, knot'

Apart from Tashlhiyt, which is sensitive to sonority in choosing the consonant candidate for gemination, all Berber languages show a fixed geminated consonant. Rather than stating a language-particular analysis, I suggest that in all Berber languages, including Tashlhiyt, gemination is performed through the use of the same template as stated in (15). In most cases, it is the medial consonant that spreads. Otherwise, it is the first consonant. The imperfective forms mentioned above are all represented in the same manner as *nkkr* 'stand up' in (16). In addition, mono- and biconsonantal verbs behave in a templatic fashion across Berber languages. They use various morphological operations to form their imperfective, including the gemination of one consonant or affixation, and sometimes both of them. In terms of templatic analysis, these verbs use the same template as triconsonantal verbs, which they fill by means of both gemination and affixation. The following examples in Tamashek (cf. Heath 2004) illustrate this point.

(29) *Imperative* *Long Imperfective*

	<i>Positive</i>	
ə̀bs	báss	'vomit'
ə̀t ^f	d ^h áff	'be poured'
ə̀lh	háll	'weep'
ə̀nʃ	náʃʃ	'excuse'
ə̀kk	t-ákk	'go to'
ə̀kʃ	tátt	'eat'
ə̀nn	jánn	'say'

Three morphological strategies are observed in long imperfective positive forms:

- i. insertion of /a/ after C₁ and gemination of C₂ (e.g. *bááss*, *d^hááff*, *hááll*, *nááff*)
- ii. addition of /t-/ prefix, then insertion of /a/ after the prefix (e.g. *t-ákk*)
- iii. replacement of the prefix /t-/ by an apparent epenthetic /j-/ (e.g. *jáánn*, *táátt*) followed by an infix /a/ and a geminated consonant.

All enumerated operations above are traditionally analysed as being idiosyncratic. Under a templatic approach, these operations are used to fill the whole template in the imperfective. In addition, the imperative vs. long imperfective positive derivation shows a vocalic ablaut that replaces the input /æ/ by an /a/ in the imperfective. /æ/ is analysed in the Tamashek vocalic system as a short vowel, whereas /a/ is a full vowel. Below in (30) three derivations illustrate the templatic behaviour of mono- and biconsonantal verbs in Tamashek.

- (30) a.
- | | | | | | | |
|---|-------|---------|--|---|-------|---------|
| b | a | s | | t | a | k |
| | / \ | / \ | | | / \ | / \ |
| C | V C V | C V C V | | C | V C V | C V C V |
- [bááss] [t-ákk]
- c.
- | | | |
|---|-------|---------|
| j | a | n |
| | / \ | / \ |
| C | V C V | C V C V |
- [jáánn]

In a biconsonantal verb such as (30a), the imperfective template is filled by means of vowel insertion and consonant lengthening. In contrast, monoconsonantal verbs as in (30b) and (30c) use prefixation in addition to vowel insertion and C₂ spreading.

8. Conclusions.

This paper has been an attempt to provide a new analysis of geminated imperfective in Tashlhiyt Berber. I have proposed that the triconsonantal verbs which geminate one root consonant to form their imperfective use a fixed-shape template of the form *CVCVCVCV*. I have also argued that irregular verbs (mono- and biconsonantals) derive their imperfective by means of the same template. Their derived forms combine more than one morphological operation (gemina-

tion, vowel insertion, prefixation and epenthesis) in order to fill the whole template offered by the imperfective formation. The templatic approach to geminated imperfective is then generalized to other languages, including Tamashek, Tarifit, Tamazight and Kabyle.

Appendix

The data below were collated from various sources including El Mountassir (2003), Boumalk (2003) and Dell & Elmedlaoui (1988).

1. Verbs Geminating C2

Triconsonantals

Aorist Imperfective

bdr	bddr	'mention'
bxl	bxxl	'be stingy'
bsr	bssr	'spread'
bzr	bzzr	'pluck'
d ^ʃ fr	d ^ʃ ffr	'follow'
fsr	fssr	'spread'
ftl	fttl	'roll'
ħsr ^ʃ	ħssr ^ʃ	'stop'
g ^w mr	g ^w mnr	'fish'
gzm	gzzm	'cut'
gZR	gzZR	'slaughter (animal)'
bdr	bddr	'mention'
kʃm	kʃʃm	'enter'
xmr	xmnr	'ferment'
xsr	xssr	'be damaged'
xtl	xttl	'feint'
xzr	xzzr	'look nastily'
zhr	zhhr	'blaze up'
ɛ ^w bn	ɛ ^w bbn	'lash'
ɛml	ɛmml	'mould'
ʒdr	ʒddr	'burn'
lgr	lggr	'knock'

Aorist Imperfective

mgr	mggr	'harvest'
md ^ʃ l	mtt ^ʃ l	'bury'
mSl	mssl	'plug'
nkr	nkkrr	'stand up'
ndr	nddr	'suffer'
nd ^ʃ r	ntt ^ʃ r	'jump'
nfr	nffr	'blow one's nose'
nsr	nssr	'graze'
ntl	nttl	'take shelter'
nzl	nzzl	'prick'
n3m	n33m	'remain unharmed'
rdm	rddm	'demolish'
rd ^ʃ l	rtt ^ʃ l	'borrow'
rgl	rggl	'knock'
rgm	rggm	'insult'
r ^ʃ ʃm	r ^ʃ ʃʃm	'mark'
rkm	rkkm	'rot'
rwl	rwwl	'flee'
z ^ʃ br	z ^ʃ bbr	'prune'
zdm	zddm	'gather firewood'
zdr	zddr	'lower'
zgr	zggr	'go across'
bri	brri	'scratch'

bsi	bssi	‘melt’	dru	drru	‘eat together’
dhi	dħhi	‘push’	fru	frru	‘pay off’
fsi	fssi	‘melt, dissolve’	fsu	fssu	‘vegetate’
gli	glli	‘push’	ftu	fttu	‘walk, go’
g ^w mi	g ^w mmi	‘read slowly’	gnu	gnnu	‘sew’
gzi	gzzi	‘vaccinate’	gru	grru	‘collect’
ħri	ħrri	‘be toughless’	ɜlu	ɜllu	‘loose’
k ^w li	k ^w lli	‘tint, blacken’	ɛlu	ɛllu	‘be expensive’
kmi	kmmi	‘smoke’	ɛmu	ɛmmu	‘dyed’
kti	ktti	‘blaze up’	ɟwu	ɟwwu	‘toast’
k ^w ti	k ^w tti	‘remember’	ħbu	ħbbu	‘hide’
kri	krri	‘shrink’	ħsu	ħssu	‘learn’
ldi	lddi	‘pull’	ħɟu	ħɟɟu	‘stick, shove’
mdi	mddi	‘trap’	xlu	xllu	‘destroy, be insane’
md ^ɕ i	mdd ^ɕ i	‘taste’	kbu	kbbu	‘pierce’
msi	mssi	‘be tepid’	kd ^ɕ u	kdd ^ɕ u	‘smell’
mzi	mzzi	‘mill, grind’	knu	knnu	‘lean over’
nfi	nffi	‘jostle, shove’	kru	krru	‘rent’
ngi	nggi	‘pour’	mdu	mddu	‘loose weight’
rwi	rwwi	‘soil’	ndu	nddu	‘strain’
rɟi	rɟɟi	‘mix’	nd ^ɕ u	ntt ^ɕ u	‘jump’
rz ^ɕ i	rzz ^ɕ i	‘thread’	nru	nrru	‘defeat’
xsi	xssi	‘be extinct’	rbu	rbbu	‘carry on the back’
zbi	zbbi	‘hasten’	rku	rkku	‘be dirty’
z ^ɕ wi	z ^ɕ wwi	‘left-handed’	rzu	rzzu	‘crawl’
bdu	bddu	‘start’	sdu	sddu	‘be side by side with something’
bd ^ɕ u	bdd ^ɕ u	‘divide’			
bgu	bggu	‘pierce’			
bnu	bnnu	‘build’	zru	zrru	‘delouse’
dlu	dllu	‘soak’	zwu	zwwu	‘dry’

Biconsonantals*Aorist Imperfective*

kl	klla	‘spend the day’
ks	kssa	‘graze’
z ^ɕ m	z ^ɕ mma	‘wring’
z ^ɕ r	z ^ɕ rra	‘see’
ls	lssa	‘wear’

Aorist Imperfective

ns	nssa	‘stay overnight’
nɛ	nqqa	‘kill’
nz	nzza	‘be sold’
rɛ	rqqa	‘be lightened, hot’
rz ^ɕ	rzz ^ɕ a	‘break’

2. Verbs Geminating C1

Triconsonantals

<i>Aorist</i>	<i>Imperfective</i>		<i>Aorist</i>	<i>Imperfective</i>	
frd	ffrd	‘nibble’	k ^w ms	kk ^w ms	‘tie into a neat bundle’
frk	ffrk	‘guess’			
frg	ffrg	‘enclose’	k ^w mz	kk ^w mz	‘scrape’
frʃ	ffrʃ	‘deceive’	knd	kknd	‘dupe’
frn	ffrn	‘pick over’	krz	kkrz	‘plough’
frs	ffrs	‘be sharp’	krf	kkrf	‘tie’
h̄lb	h̄h̄lb	‘eat (liquid food)’	krm	kkrm	‘be dried out’
h̄r ^ʃ g	h̄h̄r ^ʃ g	‘burn’	krs	kkrs	‘tie’
h̄rm	h̄rm	‘ignore’	krd ^ʃ	kkrd ^ʃ	‘comb’
h̄r ^ʃ ʃ	h̄h̄r ^ʃ ʃ	‘be rough’	ʋrs	qqrs	‘slaughter’
hrd	hhrd	‘eat entirely’	ʋns ^ʃ	ʋʋns ^ʃ	‘lose a bad habit’
hrʃ	hhrʃ	‘feel slightly ill’	qlb	qqlb	‘knock out’
xrb	xxrb	‘scratch’	qrs ^ʃ	qqrs ^ʃ	‘reopen (wound)’
x ^w mʒ	xx ^w mʒ	‘scratch’	smd	ssmd	‘add’
xng	xxng	‘choke’	srg	ssrg	‘have a miscarriage’
ʋrd ^ʃ	ʋʋrd ^ʃ	‘lie down’			
kls	kkls	‘slash (meat)’	trm	ttrm	‘shimmy down’
kms	kkms	‘hold in the hand’	zlf	zzlf	‘singe’
			z ^ʃ lm	zz ^ʃ lm	‘peel’

Biconsonantals

<i>Aorist</i>	<i>Imperfective</i>		<i>Aorist</i>	<i>Imperfective</i>	
dl	ddal	‘cover’	ml	mmal	‘show’
fl	ffal	‘leave’	zd ^ʃ	zzad ^ʃ	‘mill, grind’
gn	ggan	‘sleep’	rg	rrag	‘grind, stone’
d ^ʃ r	tt ^ʃ ar	‘fall down’	ʋz	qqaz	‘dig’
gl	ggal	‘dry up’	sʋ	ssaʋ	‘buy’

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