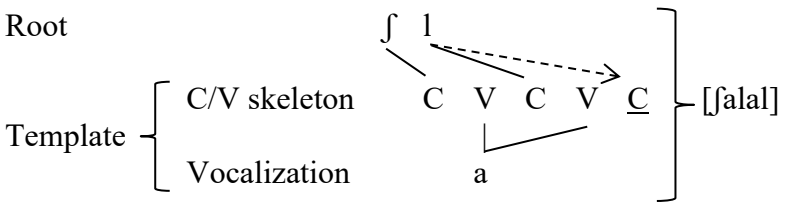
Root reduplication and alignment overcome three challenges to the biradical, OCP-based analysis of Semitic QaTaT stems

Noam Faust
Université Paris 8, CNRS SFL
noam.faust@univ-paris8.fr

1. Introduction

Greenberg (1950) reported on a major asymmetry in Semitic verbs: stems with identical final and penultimate consonants – henceforth QaTaT – are ubiquitous, whereas stems with identical initial and peninitial consonants – henceforth QaQaT – are almost non-existent. In order to explain this asymmetry, McCarthy (1981) famously proposed that the Obligatory Contour Principle (OCP), banning adjacent identical units, holds at the level of the Semitic root. Both √QTT and √QQT roots are illicit. Instead, QaTaT verbs are based on biradical roots √QT matched with a tri-positional template. As illustrated in (1) for the Modern Hebrew verb [ʃalal] 'he invalidated', the root is mapped to the template from left to right. When the final C-slot of the template (underlined) is left empty, the closest root consonant spreads to occupy it, in what McCarthy termed "template satisfaction". Given these premises, a biradical root can never derive a QaQaT verb.

(1) Bipartite root meets tripartite template => "Template Satisfaction" (McCarthy 1981)



McCarthy's analysis undeniably constitutes one of the most important events in autosegmental phonology. In the years that passed since its publication, it faced off many challenges.[1] I will concentrate here on three challenges: **(i)** full reduplication of biradicals, **(ii)** the unsatisfied template of vowel-final stems (the QaTaT-QaTa problem from the title), and **(iii)** Amharic templatic intrusion and the purported violation of the OCP in this language (Broselow 1984). The latter two have not been taken up to the best of my knowledge.

Below I propose a solution to challenge (**i**) which follows Marantz (1982), and necessitates the specific alignment principle in (2).

[1] Especially interesting in my opinion is the debate around the existence of QaQaT verbs in Ethiosemitic, for which see Lowenstamm (2010, 2022) (the former also summarizes other arguments for biradical roots). Also interesting are the adaptations of the original analysis into Optimality Theory (Ussishkin 2000, Bat-El 2006), as well as those using representations without a skeletal tier (McCarthy & Prince 1996); but these are irrelevant for the present purpose.

(2) *Misalignment
A non-final root element must not be template-final.

The principle in (2) is shown to underlie the problems posed by challenges **(ii)** and **(iii)**, such that they are no longer challenges.

In section 2, the three challenges are presented in further details. Section 3 shows how (2) resolves the problems raised by the three challenges.

I end this introduction with a disclaimer. Under the influence of McCarthy & Prince (1996) and Optimality Theory, mainstream work on Semitic templates has seemingly moved away from the skeletal tier, and indeed autosegmental representations. Instead, efforts were concentrated on deriving the form of templates from universal constraints (e.g. Bat-El 2002, 2003; Ussishkin 2005). Nevertheless, as argued in Faust (2015) and Faust & Lampitelli (to appear), templates with arbitrary, lexical shapes have not been argued against convincingly.[2] In this paper, I maintain a definition of templates using C and V slots; consequently, and for reasons of brevity, work in Optimality Theory is not engaged with directly.

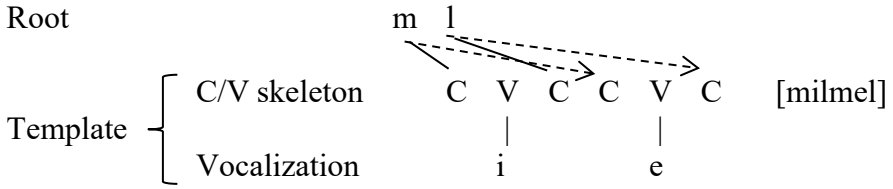
2. Three challenges

2.1. First challenge: fully reduplicated biradicals QaTQaT

The logic behind the mapping in (1) is that spreading is local. C is empty, and therefore the closest segment spreads to fill it. The first segment cannot spread to fill C, because that can only be achieved through line-crossing, which is disallowed.

All Semitic languages exhibit quadriradical stems, e.g. Modern Hebrew [tiʁgem] 'he translated'. Many of these involve fully reduplicated biradicals, like [milmel] 'mutter' from the same language, related to [mila] 'word'. However, assuming a quadri-positional template, left-to-right association and a biradical root √ml, [milmel] can only be derived through line crossing:

(3) Line crossing in left-to-right + spreading account of fully reduplicated biradicals



Within autosegmental phonology, Broselow & McCarthy (1983) propose a solution to this challenge, which I will show below runs into a principled difficulty. See also Bat-El (2006) for an account without autosegmental representations.

2.2. Second challenge: the QaTaT – QaTa problem

Consider the three Modern Hebrew verbs in (4). They are all of the same type known as "qal" or "paʕal", as attested by the shared vocalization <a,a> in the PST3MSG and the use of the same action noun and passive participle templates QTiLa and QaTuL. (4b) involves identical penultimate and final consonants, and would be derived from a biradical root through template satisfaction. However, (4c) lacks a third consonant. If one wants to argue that the three verbs

[2] But see the interesting proposal in Golston (1996), where templates are defined by the markedness constraints they *violate*.

share a template, one must explain why the template is not satisfied in (4c) or, in other words, why the third C-slot of (4c) may remain empty.

(4) Three Modern Hebrew verbs

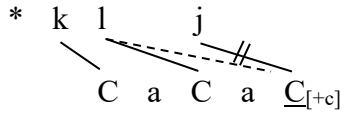
	PST.3MSG	ACTION N	PASS.PRTC.3MSG	
a.	kalat	klita	kalut	'receive'
b.	kalal	klila	kalul	'include'
c.	kala	klija	kaluj	'roast'

Triplets like the one in (4) are found in most, if not all Semitic language. Any Semiticist knows the beginning of the solution to the challenge posed by them: the root of (4c) is not biradical √kl, but triradical √klj. The final /j/ is even apparent in the action noun and passive participle.

However, this view does not immediately answer the question. In the verbal form, the final /j/ is clearly absent from the final position; let us assume that the final C-slot of the verbal template is specified [+c(onsonantal)]. [3] Why then is the template allowed to remain unsatisfied?

The question is posed in graphic form in (5). Assuming that the root-final /j/ cannot be associated to C, the situation is identical to that in (2) above. Why is the position allowed to remain empty, instead of the second radical /l/ satisfying the template as in (2) above, to derive [kalal]?

(5) Template satisfaction wrongly predicts [kalal] for √klj+CaCaC$_{[+C]}$



The existence of QaTaT forms with a satisfied template alongside QaTa forms with an unsatisfied template is what I call the QaTaT – QaTa problem. I am unaware of this challenge having been raised in the past.

2.3. Third challenge: Amharic (Broselow 1984)

Broselow (1984) claims that the analysis of QaTaT verbs as derived from √QT does not hold for the Ethiosemitic language Amharic. In this language, QaTaT verbs are based on OCP-violating √QTT roots.

The argument begins with the comparison of the paradigms in (6) (the data are slightly altered, based on Leslau 1995's reference grammar). (6a) shows the basic stems of a type A verb with an unremarkable root (three different consonants, always surface-true). (6b) shows that stems with identical final and penultimate consonants adhere to the same templates. (6c) shows a third paradigm, also of type A, which differs from the other two in several respects. Two are crucial: **i.** the PFV, IPFV and JUSS involve one less consonant than (6a,b); and **ii.** the GRD and the INF in (6c) feature the same number of consonants as (6a,b) because an additional [t] (in bold) occurs in the final consonantal position (the L position in the TEMPLATE column).

[3] Indeed, no verbal form in Hebrew ever features [j] in this position. But the reason for the non-realization of /j/ cannot be phonological, as [aj] is a legitimate sequence in Modern Hebrew, e.g. [banaj] 'builder'. See Aïm (2004) for more cases of featural specification for templatic positions.

(6) Three verbal paradigms in Amharic

	TEMPLATE	a. 'break'	b. 'like'	*but*	c. 'scorch'
PFV3MSG	QäTTäL-ä	säbbär-ä	wäddäd-ä		fädʒdʒ-ä
IPFV3MSG	jɨQäTL-all	jɨsäbr-all	jɨwädd-all		jɨfädʒ-all
JUSS3MSG	jɨQTäL	jɨsbär	jɨwdäd		jɨfɨdʒ
GRND3MSG	QäTL-o	säbr-o	wäddo		fädʒto
INF	mäQTäL	mäsbär	mäwdäd		mäfdʒät

Broselow argues that verbs like (6c) are based on biradical roots (√fdʒ for 6c). The [t] in the GRND and INF of (6c) is then a "default consonant inserted in order to satisfy the tri-positional template." But if this is so, why is this strategy not used for the seemingly biradical (6b)? Broselow concludes that the verb in (6b) cannot be based on a biradical root √wd. Instead, such verbs are based on OCP-violating √QTT roots (√wdd for 6b). Thus, for Broselow, Amharic roots may violate the OCP.

Three aspects of the data in (6) nevertheless remain unexplained. First, what brings about the difference in the JUSS templates between (6a,b) on the one hand and (6c) on the other? Second, Leslau reports that all verbs of the type in (6c) – of which there are quite a few – involve a second palatalized consonant (with two exceptions, only one of which involves a second palatali*zable* consonant). Finally, if the non-radical [t] is inserted to fill a templatic position, why is it only used in the GRND and INF?

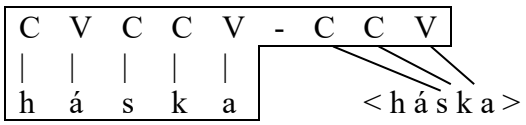
I am unaware of any published (or unpublished) response to the challenge posed by Broselow.

3. Analysis

In a classic paper about reduplication, Marantz (1982) proposed the following analysis. Reduplicants are specified only at the skeletal level, not at the segmental one. In order to satisfy the template of the reduplicant, the segmental material of the base is reduplicated. Depending on the template of the reduplicant, all or only part of the base can reappear in the reduplicant.

This is illustrated by the Dakota example [háska] 'be tall', whose reduplicated form is [háska-ska]. The inner frame represents the first step, wherein a skeletally-specified reduplicant /-CCV/ is added to the base. In the second stage (outer frame), the segmental material is reduplicated in its entirety and then used to satisfy the template of the reduplicant. Importantly for the present purpose, the satisfaction of the reduplicant proceeds from right to left.

(7) Suffixed reduplicant and its template satisfaction (Marantz 1982)



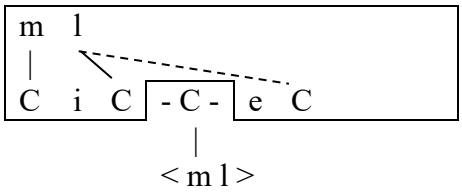
In the overwhelming majority of the cases Marantz surveyed, right-to-left association correlated with the reduplicant appearing to the right of the base. This follows from the generalization proposed in the introduction:

(8) *Misalignment (repeated from 2) [4]
A non-final root element must not be template-final.

In order to make sure that the final root element is also final in the derived form, association proceeds from right to left.

Using Marantz's approach, Broselow & McCarthy (1983) account for QaTQaT cases like [milmel] with the notion of "infixed reduplicants". The first stage (framed) is identical to the left-to-right template satisfaction in (1) above. The second stage (unframed) inserts an infixed skeletal slot C. As in (9), the root is reduplicated. It is associated from left-to-right again, and [milmel] is yielded.[5]

(9) [milmel] is a case of an infixed reduplicant C (Broselow & McCarthy 1983)



The authors argue for the validity of this analysis by showing that, in Levantine Arabic, some triradical roots exhibit a surprising reduplication pattern 123 => 1213, e.g. [barad] 'he shaved' [barbad] 'he shaved unevenly'. Such a pattern would work exactly as in (9); the only difference would be the number of radicals.

A crucial point that Broselow & McCarthy seem to miss is that, across Semitic, the 1213 pattern is extremely rare, whereas the biradical 1212 pattern is ubiquitous. Modern Hebrew, for instance, lacks the former altogether, but exhibits many verbs of the latter. It cannot be the case that C infixation applies only for biradicals.

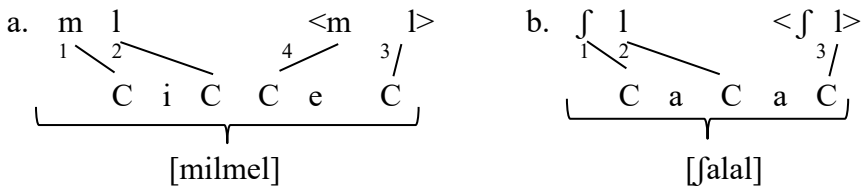
An alternative to this account appears in (10a). The root √ml is matched with the template CiCCeC. Association proceeds from left-to-right. The mismatch between root and template triggers root reduplication as in Marantz's account. Accordingly, the reduplicated root is associated from right to left (the order of operations is referred to by numbering). Crucially, this approach also applies to biradical roots with tripositional templates, as shown in (10b): the root is reduplicated and associated edge-in. The only difference between (10a) and (10b) is that in the latter, just like in the Dakota case in (7) above, one of the segments of the reduplicated root remains unassociated for lack of a C-slot.[6]

[4] Alignment considerations do feature prominently in the aforementioned accounts in Optimality Theory; *Misalignment is certainly not an innovation of the present proposal. Having said that, Bat-El (2006) argues, along with Nelson (2003) and in contrast to the present proposal, that right-anchoring is not part of Universal Grammar.

[5] Henceforth, for graphic reasons, vowels are represented instead of V-slots with associated segments; the tier labels "root, skeleton, vocalization" are also absent.

[6] Edge-in association has been argued for by Yip (1988) and Buckley (1990). However, the application of the principle in those papers is different from the one proposed here. Verbs like [ʃalal] (10b) are not treated as reduplicated; instead, first the final radical associates to the final C-slot and then it spreads leftwards. This approach and the one championed here encounter difficulties in accounting for different forms ([milmel] in (10a) poses a challenge to Yip 1988, too), and this is not the place to compare them. Both approaches adhere to *Misalignment.

(10) Reduplication followed by edge-in association

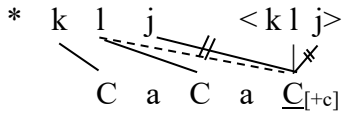


This way of regarding reduplication and template satisfaction avoids the line-crossing mentioned in (3) above, does not claim internal infixation only for biradical roots and is in conformity with the typological generalizations in Marantz (1982).

We may consider this challenge overcome. But crucially, overcoming it involved admitting the alignment principle above. In (10b), why is /l/ and not /ʃ/ associated to the final slot? The answer is that such an association would violate the principle of *Misalignment by deriving [ʃalaʃ] from √ʃl. Both (10a) and (10b) abide by *Misalignment.

The ban on misalignment also sheds light on the QaTaT – QaTa problem. Recall that QaTa verbs involved an unsatisfied template, which is expected to be satisfied and yield QaTaT. The configuration is given again in (11), with the reduplication and right-to-left association I now claim is general: /j/ cannot attach to $C_{[+c]}$, the root is reduplicated, but even the reduplicant's /j/ can't associate to $C_{[+c]}$. Why doesn't the next consonant of the reduplicant associate to $C_{[+c]}$?

(11) Template satisfaction wrongly predicts [kalal] for √klj+CaCa$C_{[+C]}$



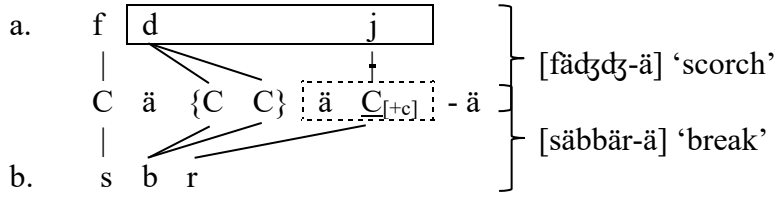
The impossibility of (11) can now be attributed to the violation of *Misalignment which would result from positioning the penultimate radical at the right edge of the template. Since the correct alignment is impossible in this case (because of the specification $_{[+c]}$), the template may remain unsatisfied.

Returning to the Amharic cases, we may now better understand some of facts, on the basis of a comparison to Modern Hebrew. What if the set in (6) above represented the Amharic instantiation of the QaTaT-QaTa problem? That is, what if seemingly biradical verbs like [fädʒdʒ-ä] were based on *tri*radical roots whose final consonant cannot associate to the final templatic slot?

The identity of the missing final radical is already hinted at by the palatal nature of all of the second surface consonants of these verbs. Like in Modern Hebrew, the missing final radical is the palatal /j/. The palatality of this missing consonant ends up on the preceding consonant. In other words, what surfaces as two consonants [f,dʒ], originates in a triconsonantal set /f,d,j/.

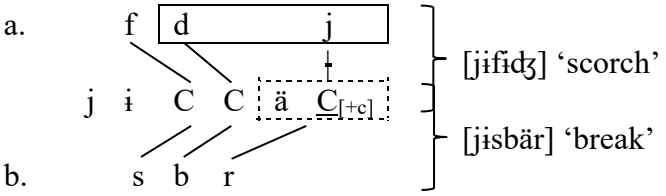
The analysis is made explicit in (12), showing both the similarity to and the difference from Modern Hebrew. The first template examined is that of the perfective, with the prespecified gemination of the second consonant (signaled by {CC}). As in Modern Hebrew, the final C-slot of the template is specified [+c], and so in (12a), the final radical cannot access it (cf. 12b). Unlike in Hebrew, the radical is joined to the preceding consonant and palatalizes it. Also unlike in Hebrew, the non-satisfaction of the template leads to its truncation: both the second /ä/ vowel of the template and the final C-slot are deleted (the sequence deleted is framed in a broken contour). At no point is *Misalignment violated.

(12) /j/-final vs. regular verbs in Amharic – PFV



The possibility for templates to truncate explains a second issue I raised with respect to Broselow’s (1984) analysis, namely the reason that different templates seem to be used in triconsonantal JUSS [jɨsbär] and its allegedly biconsonantal parallel [jɨfɨdʒ]. As shown in (13), the two forms in fact do share a template; but since the root √fdj cannot satisfy the template fully, its template is truncated. This leads to epenthesis appearing between the last two Cs (Amharic does not tolerate [fdʒ] as a final cluster; in verbs of the same class that result in a licit cluster, no epenthesis occurs):

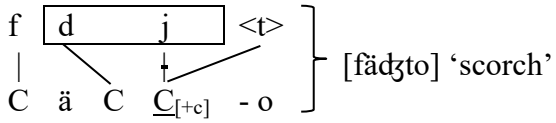
(13) /j/-final vs. regular verbs in Amharic – JUSS



More importantly than the specifics of the analysis of verbs such as ‘scorch’, once their roots are identified as triradical, there is no longer reason to regard verbs like [wäddäd-ä] ‘he liked’ as based on OCP-violating roots. The Semitic-wide analysis of such verbs as based on biradicals can be maintained for Amharic, too. The second consonant of the root is [+c] and therefore can associate to the final slot through reduplication and right to left association, as in the Hebrew case in (4) above.

What of the main issue of Broselow’s paper, namely the insertion of default [t] in the GRND and INF? I argue, with Broselow, that [t] is inserted in order to satisfy the template. Importantly for the present purpose, this template satisfaction strategy *does not violate *Misalignment*: [t] is a non-root consonant, and so the root is not misaligned – all non-final root consonants are also not template-final.

(14) / j/-final verbs in Amharic – GRND



Of course, one no longer expects [t] insertion in paradigms based on true biradical roots, since, in these, reduplication and right-to-left association can satisfy the template. To summarize, [t]-insertion emerges as a template satisfaction strategy which allows the grammar to adhere to the *Misalignment priniciple.

One question remains: why does [t]-insertion occur in the GRND and INF of /j/-final verbs, but not in the PFV, IMPF and JUSS forms? This question is answered in detail in Faust (to appear, b), based on Faust (to appear,a). In the latter, a parallel case of [t]-intrusion from Modern Hebrew is shown to employ not a default consonant, but the feminine suffix /-t/. Faust (to

appear, b) then argues for the same analysis in Amharic. Following Leslau (1995), it is claimed that the Amharic GRND and INF are morphologically nominal; they are therefore the only bases in the verbal paradigm that can employ an external feminine suffix in order to satisfy the template (since only nouns can carry non-agreement gender suffixes). In other words, the intrusive [t] in Amharic is not a "default consonant" but a feminine suffix. I leave the issue at that, as it is elaborated upon elsewhere.

4. Conclusion

This short paper discussed three challenges to the OCP-based account of QaTaT verbs in Semitic. I argued that these challenges can be overcome using *Misalignment and template satisfaction through reduplication. QaTa and QaTQaT verbs no longer require specific mechanisms, and Amharic does not have OCP-violating √QTT roots. In some cases, an intrusive [t] can be employed in order to satisfy the template without violating *Misalignment.

In the last decades, there has been a debate around the cognitive reality of the Semitic root (see survey in Faust & Hever 2010). It has been repeatedly suggested (e.g. Bat-el 2002, 2003; Laks 2018, 2022; Ussishkin 2000, 2005) that this notion is unnecessary: there is no sense in which [säbbära] is "derived from" or "based on" a unit √sbr. The analysis in this paper adds another argument in favor of the necessity of admitting the root as a morph. The proposed constraint *Misalignment refers directly to this level, and cannot be reformulated without it; specifically, [t]-insertion is a possible solution to misalignment precisely *because* /t/ is not a root element. Time will tell if surface-oriented approaches which do not recognize roots can cover the phenomena discussed in this paper.

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