A NOVEL, COMBINED APPROACH TO SEMITIC WORD-FORMATION

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To the memory of Gideon Goldenberg

Abstract

This paper examines the way in which constraints on root and template size in Semitic have been formalized in the literature since McCarthy (1979). It identifies three approaches: McCarthy’s double-tier approach, where the sizes of both template and root are arbitrary; Ussishkin’s (1999) and Bat El’s (2003) strictly-vocalic approach, where the template is reduced to its vowels; and the less known root-first approach of Goldenberg (1994), where vocalization is determined by the number of root consonants. The paper points to the problems of each approach and proposes a new, combined approach which solves these problems, by assuming that the template applies to the root, not to the verb. This approach is shown to be successful in the analysis of three test cases from Modern Hebrew: 1) reduplicative verbs; 2) the range of forms based on biradicals; and 3) the exceptionality of the Qal participle.

1. Introduction

This paper examines the three main approaches to Semitic morphology that have emerged in the course of the recent decades, each focusing on a different aspect of the data:

(1) The double-tier approach (originating in McCarthy 1979, 1981): root segments are mapped to pre-existing skeletal positions, interdigitated with a vocalic pattern.

(2) The strictly-vocalic approach (Bat El 2001, 2003; Ussishkin 1999): templates are (possibly discontinuous) vocalic morphemes, whose positioning within the root is determined by phonological principles.¹ There are no skeletal positions.

¹ Proponents of this approach tend to deny the existence of the root as a distinct morpheme, although the approach itself does not force one to do so. This discussion is tangential to this paper.
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2. The Three Approaches: Strong and Weak Points

2.1. Data and the Double-tier Approach

In this section, the three approaches sketched out in the introduction are illustrated and discussed using the relatively simple verbal system of the Neo-Aramaic of Barwar (Khan 2008). This system is presented in (1):

\[ (3) \text{ The root-first approach} \ (\text{Goldenberg} \ 1994): \text{ roots are formed prior to their attribution to syllabic and vocalic patterns. The attribution replicates the number of elements in the root: each root-element is matched with a syllabic position. There is no mapping process.} \]

Each of these approaches has advantages and disadvantages. I propose a fourth, combined approach, which attempts to preserve the advantages of each approach while getting rid of the disadvantages. As its name suggests, it is essentially a combination of the first and third approaches:

\[ (4) \text{ The double-tier, root-first approach}: \text{ roots are formed prior to their attribution to syllabic and vocalic patterns. The attribution is constrained by the number of elements in the root: the syllabic pattern may not have fewer positions than there are root elements. If it has more, then the root is copied to fill the template.}^2 \]

The paper proceeds as follows. In §2, the three existing approaches are presented and their strong and weak points are discussed briefly. The need for a combined approach is made apparent. The proposed combined approach is presented in §3, with a brief discussion on how it may solve some of the problems of the other approaches. In §4, the combined approach is shown to provide an elegant account of two morphological problems in Modern Hebrew: (1) reduplicative verbs, and (2) the range of forms based on biradicals. This analysis leads to a better understanding of yet another problem of Modern Hebrew, the form of the participle QoTel, which is discussed in §5. §6 concludes.

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\[ ^2 \text{ This approach is new in the sense that it has never been explicitly stated and/or argued for. That said, Rose’s 2003 analysis of frequentative verbs in Ethiopic probably involves a view similar to this.} \]
As illustrated in (1), there are at least three verbal types in Barwar. Type I is distinguished by the existence of distinct stem syllabifications in the past and non-past and by the lack of m-. Types II and III both have a prefix m- and the same vocalic patterns, but differ from one another in their syllabification. Quadriradicals can be analysed as a fourth type; regardless of that analytic choice, they behave like type II verbs, rather than type III ones, in that the first consonant of the stem is adjacent to the prefixal element m-.

In the double-tier approach, there are two morphemes: roots and templates. Templates consist of C and V positions, the latter occupied by the vocalic pattern. The stems in (1) are the result of the positioning of the root in the template. For instance, (2) presents how the root √pθx is placed in the past and non-past templates of type I:

(2) The mapping of √pθx to the templates of type I in the double tier approach

<table>
<thead>
<tr>
<th>Root tier</th>
<th>skeletal tier</th>
<th>template</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. non-past [pθαx]</td>
<td>C V C V C</td>
<td>a o i</td>
</tr>
<tr>
<td>b. past [pθιx]</td>
<td>C V C C V</td>
<td></td>
</tr>
</tbody>
</table>

For the non-past base of types II and III, two different templates have to be assumed, one which juxtaposes the prefixal m- and the first radical3 (3a), and one which places the first vowel of the vocalic pattern between the two (3b). For the quadriradical root, a fourth template has to be proposed, with positions for four radicals (3c) and the same juxtaposition as in Type II.

3 This is the term that will be used henceforth for ‘root-element’.
The non-past bases of types II and III

a. Type II [mšaləx]  b. Type III [mapləx]  c. 4R [mkankeš]

\[
\begin{array}{cccccccc}
\hat{s} & l & x & p & l & x & k & n & k & \hat{s} \\
m & a & ə & m & a & ə & m & a & ə
\end{array}
\]

The view in (3) misses at least two important generalizations. First, the vocalic pattern of all three stems is identical. Representing the vocalic pattern as part of each template gives the opposite impression.

The second generalization missed concerns the mapping of quadriradicals. As mentioned above, there seems to be an affinity between Type II and quadriradicals: no quadriradical is ever mapped to the template without juxtaposition, i.e. type III. Moreover, the only difference between the quadriradical template and that of type II is the presence of the extra-position in the former. Both facts can be explained phonologically. Assuming a ban against three adjacent consonants VCCC, the mapping of √knkš to type III *[maknkəš] is ruled out. The extra-position in the template in (3c) can be got rid of by assuming that quadriradicals are ‘squeezed’ inside the type II template. However, that more than one radical can be squeezed into one C position undermines the use of C as notation. Such considerations have led researchers to propose that templates are not to be formalized with C and V positions, but rather with syllable nodes. This led to the approach presented in the next subsection.

2.2. The Strictly-vocalic Approach

Instead of C and V positions, it was initially suggested that templates should be defined in terms of number of syllables (McCarthy and Prince 1994). Thus regarded, the templates of type II and quadriradicals are really one and the same disyllabic template (that of type I is monosyllabic in the past). The fact that in one verb the first syllable is open (ša.ləx), while in another it is closed (kan.kəš) — does not call for two different templates.

Syllabification is a strictly phonological process: the presence of a vowel implies the formation of a syllable. Once templates were defined in terms of syllables, it was only logical to reduce them further into vowels. This became the stance of what I dubbed the strictly
vocalic approach. According to this approach, the template of Type I, for instance, is the discontinuous set \(<a,\ddot{a}>\) in the non-past and \(<i>\) in the past (4a,b); that of type II is \(<a,\ddot{a}>\) in the non-past and \(<u,\ddot{a}>\) in the past (4c,d). This view is complemented by purely phonological principles of syllabification, usually in the form of violable constraints. In the illustration in (4), these are: *CCC (‘no sequences or more than two consonants’), *[syll,V (‘no vowel-initial syllables’), *CC] (‘no word-final clusters’) and *C] (‘no non-final closed syllables’). Once such constraints are accepted, the attested form is the only one possible.

(4) Types I and II derived by the vowels only, with the help of phonological principles

<table>
<thead>
<tr>
<th>Type I</th>
<th>Type II</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. (\sqrt{p\theta x+a,\ddot{a}})</td>
<td>b. (\sqrt{p\theta x+i})</td>
</tr>
<tr>
<td>*CCC</td>
<td>*[ap\theta x]</td>
</tr>
<tr>
<td>*[syll,V</td>
<td>*[ap\theta x]</td>
</tr>
<tr>
<td>*CC]</td>
<td>*[ap\theta x]</td>
</tr>
<tr>
<td>*C]</td>
<td>*[pa\theta x]</td>
</tr>
</tbody>
</table>

The mapping of quadriradicals to type II rather than type I or III is also predicted. Given four radicals \(\sqrt{vnk\ddot{s}}\), mapping to type I would result in impermissible clusters in the past \(*[knk\ddot{i}s]\); as would mapping to type III \(*[maknk\ddot{a}s]\). The only possibility is \([mkank\ddot{a}s]\); this form does violate the fourth principle in (4), but since this principle is a violable constraint, the form is still valid.

The strictly melodic approach also makes a prediction: anything that is syllabically possible in the language — even if it is not attested in native verbs because of historic facts — will be acceptable as a verb. The prediction is correct: Modern Hebrew has denominal verbs such as \(\sqrt{?ibstrekt}\) ‘to abstract’, derived by replacing the original vowels by the morpheme \(<i,e>\) (cf. *diber* ‘speak’) (Bat El 1994). This is a possible surface form for a verb in Modern Hebrew because the language tolerates such clusters phonologically, even though no such verb exists in the native vocabulary. At least in the most straightforward

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4 Contrast this with the impossibility of deriving a verb from the loan *supermarket*: \(*[siprmrket]\) involves two violation of the Sonority Sequencing Principle, which Modern Hebrew adheres to inviolably (see Bat El 1994 for entire discussion).
interpretation of the double-tier approach, such verbs should not exist, because the medial C would have to harbour four different consonants.

If so, the strictly-vocalic approach can account for not only the behaviour of quadriradicals, but also for the range of denominal verbs in Modern Hebrew. However, this was not the only shortcoming of the double-tier approach: the other generalization missed was the shared vocalization of type II [mšaləx] and type III [маšлəx]. In all appearances, this phenomenon argues strongly against the strictly-vocalic approach: if the two templates are reduced to their vocalization <a,ə>, leaving the task of interdigitation to the phonology, then no difference is predicted between the two types. Both /m+√šlx+<a,ə>/ and /m+√plx+<a,ə>/ should result in CVCCVC prosody.

The root-first approach may in fact present a solution to this problem.

### 2.3. The Root-first Approach

The root-first approach, advocated by Goldenberg (1994, 1995, 2005), is less well-known than the other two approaches discussed. As far as I know, no in-depth studies of specific phenomena have been conducted according to this approach: it has only been used by its main proponent to describe the general architecture of Semitic morphology.5

The starting point of the approach is the similarity between non-derived quadriradicals. To see the full extent of this generalization, consider the verbal system of Tigre, a Semitic language spoken in Eritrea (personal field notes):

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5 In his paper from 1994, Goldenberg does not present his view explicitly, nor does he argue for its validity at any length: no derivations are presented in any falsifiable format, and the author’s view is only occasionally asserted to be superior to that of prior authors. For all these reasons, my presentation of Goldenberg’s approach is my interpretation of it, rather than anything that is explicitly stated or thoroughly argued for in the original paper. This interpretation owes much to my conversations with Goldenberg’s student Yaar Hever, whom I sincerely thank; all errors are my own.
In Tigre, the only type to distinguish the imperfective from the subjunctive is type A. The two stems differ in both the number of consonants (the imperfective involves the gemination of the second radical, henceforth R2) and the vocalic pattern (the imperfective has [ə] where the subjunctive has [a]). One may ask what accounts for these asymmetries within type A and between it and other types. More concretely, why don’t types B, C, 4R distinguish imperative and subjunctive forms by means of vocalization (e.g. *[dəngas]), as does type A? The answer is apparent when comparing the type A imperfective to all other imperfectives: like all other imperfectives, it has four radicals (assuming length in type C can be regarded as the addition of a radical). The correct generalization for Tigre is thus the following:

(6) All forms which have, or come to have by a morphological process four radicals, are vocalized identically in the non-perfective aspects.

In other words, the number of radicals determines the vocalization.

No other principle is needed in order to account for the two stems of type A, or for the identity of all quadriradical stems, regardless of their derivational history (i.e. whether they are lexical quadriradicals or reduplicated ones). Under this view, all a speaker needs to remember for each type is the root—√lkf, √lk:b, √d:gm, √dngs, √qrč’č’, √bč’bč’ (’:’ symbolizing length and counting as a radical) — plus the fact that triradical roots are augmented by length in the imperfective. In other words, there are only two types: the triradical type and the quadriradical type.

In the root list of the previous paragraph, [ʔakkəb] and [da:gəm] are represented by roots with a lengthening element. Assuming that each radical claims a position, the length element may be viewed as zero, yielding the roots √d0gm, √ʔk0b. Having admitted /0/ as a possible underlying root element, we may return to the Barwar system, repeated in (7) for convenience:
Verbal types and two of their bases in Neo-Aramaic (Barwar Dialect)

<table>
<thead>
<tr>
<th>Type</th>
<th>non-past</th>
<th>past</th>
<th>glosses</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>paššx-</td>
<td>pššx-</td>
<td>‘to open’</td>
</tr>
<tr>
<td>II</td>
<td>m-šalšx-</td>
<td>m-šulšx-</td>
<td>‘to strip’</td>
</tr>
<tr>
<td>III</td>
<td>m-aplšx-</td>
<td>m-uplšx-</td>
<td>‘to use’</td>
</tr>
<tr>
<td>4R</td>
<td>m-kankš-</td>
<td>m-kunkš-</td>
<td>‘to drag’</td>
</tr>
</tbody>
</table>

Recall the shortcoming of the two other approaches: they were unable to account for the identity in the vocalic patterns of types II and III. However, if /0/ is allowed as a root element, a better understanding is achieved: [m-šulšx] can be regarded as based on the quadriradical root √šl0x (as in (8a) — there is no gemination in Barwar), and [maplšx] as based on the quadriradical root √0plx. The prefixation of m-, as well as the ⟨a/u, ə⟩ vocalization is retained as the morphological pattern of all quadriradicals. The prefixation of m- to the /0/-initial root of [maplšx] entails the deletion of the /0/ on the surface (8b), but the positioning of the vocalization indicates its underlying presence:

(8) Derivation of surface forms from roots\(^6\)

<table>
<thead>
<tr>
<th></th>
<th>a. √šl0x</th>
<th>b. √0plx</th>
</tr>
</thead>
<tbody>
<tr>
<td>add ⟨a,ə⟩ to quadriradicals</td>
<td>šal0šx</td>
<td>əaplšx</td>
</tr>
<tr>
<td>prefix m- to quadriradicals</td>
<td>mšal0šx</td>
<td>m0aplšx</td>
</tr>
<tr>
<td>[mšalšx]</td>
<td>[maplšx]</td>
<td></td>
</tr>
</tbody>
</table>

Both the positioning of the vocalic pattern and its identical quality in all non-type I verbs follow from this analysis, because all roots except those of type I are quadriradical.

If so, just like in Tigre, all the speaker needs to know about a verb in Barwar is the number of radicals underlying it. All underlyingly triradical roots are mapped to type I; all the rest are mapped to the quadriradical type. Again: there are only two verbal types. It is in this sense that the vocalization is a result of the number of radicals.

\(^6\) A reviewer notes that the vowels [a] and [u] in Barwar are long in open syllables, and this length can attest to the position of /0/ before, rather than after, the second radical. The choice is not essential to the argument here. Moreover, as can be understood from Khan (2008: 66), this length is not limited to patterns which arguably have an underlying /0/ after /a/ or /u/.
If the vocalization is the result of the number of radicals, this necessarily entails that there is a two-stage process: first a root is formed, and only then the vocalization is selected. Consider the pairs of verbs from Modern Hebrew in (9):

(9) šiQTeL Verbs in Modern Hebrew

a. kātav ‘to write’ šiṣṭeVeV ‘to rewrite’

b. kāṣaf ‘to duplicate by 2’ šiṣxeP ‘to photocopy, reduplicate’

c. diṣēg ‘to rank’ šiṣdēg ‘to rerank upwards, upgrade’

d. kalāl ‘to include’ šiṣxeL ‘to improve’

The pairs of verbs in (9) are based on the same roots, but the ones on the right are all created through the prefixation of š- to that root. Regardless of the original type of the verb, the š- makes the root quadri-radical, and thus all verbs with š- prefixation appear in the quadri-radical template QiTeL (cf. tirgēm ‘translate’). If so, a triradical root like ṣktv is mapped to type I (QaTaL in Modern Hebrew, 10a); but if that root is augmented it becomes quadri-radical, and thus mapped to type II (10b).

(10) Roots are mapped according to number of radicals

a. ṣktb => [kātav]

b. ṣktb + š- => šikṭb => [šiṣṭeVeV]

In both cases, the root exists prior to the attribution of the vocalic pattern or type. This is why I called this approach ‘root-first’.

As it is presented by Goldenberg (1994), the root-first approach does have its version of templates, responsible for the prosodic arrangement of radicals. However, once surface triradical roots are allowed to be underlyingly quadri-radical, this arrangement follows from general phonological principles and need not be made to seem arbitrary, as convincingly argued by the strictly-vocalic approach. Thus, although this has not been attempted at any length, it is possible to combine the strictly-vocalic and the root-first approaches.

However, both views run into difficulties when reduplication and biradical effects are encountered, as we shall see in the next subsection.

7 Roots with š- are thus augmented roots, just like roots with /0/.
2.4. Biradicals, Reduplication and the Three Approaches

In a scrutiny of the (naturally incomplete) list of verbal roots in Barwar in Khan (2008), 15 roots of the type QTT have been found (regardless of type). Only one root of the form QQT, used in only one idiomatic expression, was found. This asymmetry was first brought to the attention of the linguistic community by Greenberg (1950), who described it for Arabic and Hebrew. Its theoretical importance was emphasized in its analysis within the double-tier approach. McCarthy (1979, 1981) analyses such roots as underlyingly biradical. Assuming a biradical root QT and a template with three C-slots, and assuming that the root is mapped to the template from left to right, the rightmost C-slot is left empty (11a). McCarthy proposed a principle of ‘Template Satisfaction’, according to which all the slots of a template must be filled. This is achieved by spreading of the second radical rightward (11b). It thus follows naturally that QQT roots cannot be derived from biradical ones by template satisfaction.

(11) QQT roots are impossible to derive from biradicals if mapping is left-to-right

<table>
<thead>
<tr>
<th>Q</th>
<th>T</th>
<th>Q</th>
<th>T</th>
<th>Q</th>
<th>T</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>V</td>
<td>C</td>
<td>V</td>
<td>C</td>
<td>V</td>
</tr>
</tbody>
</table>

However, this does not account for the rareness of QQT roots, which could in principle be derived from underlyingly QQT roots, rather than from more primitive biradicals. McCarthy therefore proposed that any two identical surface segments are preferably conceived of as two instantiations of the same underlying autosegment.8 This generalization became famous as the Obligatory Contour Principle (OCP): ‘A grammar is less highly valued to the extent that it contains representations in which there are adjacent identical elements on any autosegmental tier’ (McCarthy 1981, p. 384).9 Ever since McCarthy

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8 In Semitic, this would be true even if a vowel intervenes, because vowels and consonants occupy different ‘tiers’.

9 Notice that the OCP is not proven by the absence of QQT verbs; it is only one possible explanation for it. The logic is: if the OCP were true, then assuming left to right mapping would derive the lack of QQT. In other words, the OCP is the abstraction made in order to explain the absence of QQT, and thus cannot be
(1981, 1983) the OCP has been used to explain many other phenomena in both Semitic and non-Semitic languages.

Such templatic effects are undoubtedly the strongest point of the double-tier approach. Template satisfaction has been used to account for reduplications of the QTLL and QTQT types, as represented in (12) by the Hebrew verbs *kivnen* ‘fine tune’ (related to *kiven* ‘aim’) and *kivkev* ‘draw a hyphenated line’ (related to *kav* ‘line’).

(12) Reduplicated verbs

<table>
<thead>
<tr>
<th>a. originally triradical</th>
<th>a. originally biradical</th>
</tr>
</thead>
<tbody>
<tr>
<td>k</td>
<td>v</td>
</tr>
<tr>
<td>C</td>
<td>i</td>
</tr>
<tr>
<td>[k v]</td>
<td>[k v]</td>
</tr>
<tr>
<td>C</td>
<td>i</td>
</tr>
</tbody>
</table>

Such templatic effects are a complete impossibility in the root-first approach: in that approach, the template cannot be taken to trigger reduplication, because it is attributed to the root after its derivation. Indeed, Goldenberg dismisses the autosegmental line of research as little more than a ‘modest contribution to the graphic arts’ (Goldenberg 1994: 34). That said, verbs like *kivnen* and *kivkev* are described in this approach as based on ‘1233 and 1212 arrangements’: it is unclear how the association of the reduplicated radicals to an original single segment is represented. Biradical roots are also synchronically irrelevant in Goldenberg’s opinion: roots, it is claimed, are minimally tripartite, and moreover, it is not true that QQT types are uncommon, as such roots are attested in Ethio-Semitic. It is nevertheless precisely on the basis of the Ethio-Semitic language Chaha that Lowenstamm (2010) has convincingly proved the synchronic existence of biradicals. If so, the root-first approach suffers from a serious disadvantage: it cannot deal with biradicals, which are clearly real.

The strictly-vocalic approach also lacks the skeletal positions of the double-tier approach, and thus shares with the root-first approach the impossibility of deriving the templatic effects in (11) and (12). Given a biradical root QT and a vocalic pattern <i,e>, it seems that the most straightforward result is QiTe, not QiTeT or QiTQeT.

proved by it. Independent support is required for the existence of the OCP. Fortunately, such independent support is available elsewhere (McCarthy 1983; Bohas 1990).
Moreover, since there are no skeletal positions, no process of mapping can be assumed which would rule out *QiQeT. Recent accounts of *QQT, such as Gafos 1998, Bat El 2003 and Coetzee 2009, assume without discussion that the phonological calculatory process can somehow distinguish between QiQiT and QiQjT sequences. Constraints are provided that will rule out the former; but these constraints either reproduce through ‘alignment’ requirements or simply state (Bat El 2003) the impossibility of having two identical segments at the left edge of a word. Moreover, in order to rule out QiTe, additional machinery is required, such as an alignment constraint requiring that the root and stem be aligned, or a constraint demanding that stems end in a consonant (despite much contrasting evidence). The resulting accounts are, in my opinion, considerably less elegant and convincing.

To summarize this section, each of the approaches has strong and weak points. Let me repeat their characterization:

1. *The double-tier approach* (originating in McCarthy 1979): root segments are mapped to pre-existing skeletal positions, interdigitated with a vocalic pattern.
2. *The strictly-vocalic approach* (Bat El 2001, 2003; Ussishkin 1999): templates are (possibly discontinuous) vocalic morphemes, whose positioning within the root is determined by phonological principles. There are no skeletal positions.
3. *The root-first approach* (Goldenberg 1994): roots are formed prior to their attribution to syllabic and vocalic patterns. The attribution replicates the number of elements in the root: each root-element is matched with a syllabic position. There is no mapping process.

The double tier-approach accounts elegantly for the rareness of QQT and for other templatic effects. But since it is defined in terms of C and V slots, which in addition must be filled, it fails to explain cases where there are either too many radicals (Hebrew [ʔibstrekt]) or too few (verbs such as Barwar [šaləx] behave like quadriradicals but have only three surface radicals). The strictly-vocalic approach, which relies on phonology to do the mapping of roots to their vocalic templates, correctly predicts [ʔibstrekt], but loses the elegant account of *QQT and reduplication. The root-first approach, which completely divorces the vocalic pattern from the type, is ideal in accounting for the similarities in vocalic patterns. But since this approach first builds roots

10 Where QiQi indicates that both consonants are identical and QiQj indicates that they are not identical.
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and only then attributes them to syllabic and vocalic patterns, it cannot use the template to account for reduplication or for *QQT and ends up denying their existence.

What is needed is a theory that incorporates the advantages of each approach but does away with their shortcomings; in other words, an approach which admits templatic effects, derives the vocalic pattern from the number of radicals and does not rule out having a multi-consonantal root like [ʔibstrek]. In the next subsection, I present an attempt to forge such an approach: the double-tier, root-first approach.

3. The Double-tier, Root-first Approach

In this section, I will present my attempt at combining the three approaches presented above. The double-tier, root-first approach, as its name suggests, consists of the introduction of templates into Goldenberg’s approach, thus allowing it to account for templatic effects. A relaxation of what C stands for will allow the combined theory to avoid the shortcomings of McCarthy’s original proposal.

According to Goldenberg, there are two types of roots, simplex and complex. Simplex roots are minimally tripartite, but may also be quadripartite. Complex roots are those that are formed through the augmentation of a simplex triradical, as in ŝ+√ktv in (10) above. Whether a root is simplex or complex is irrelevant for the selection of the type it appears in: roots with three radicals will be mapped to the triradical template, roots with four radical to the quadriradical template.

We have seen three ways of rendering a triradical root quadriradical: prefixation of ŝ- in Hebrew and prefixation or infixation of /0/ in Barwar. In order to integrate the relevant aspect of McCarthy’s template into the root-first approach, we can say that before vocalization is considered, the appropriate number of C-position is associated to the radicals:

(13) Integrating templates into the root-first approach

<table>
<thead>
<tr>
<th>root</th>
<th>C-template</th>
<th>vocalic pattern</th>
<th>surface forms</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Modern Hebrew √ktb</td>
<td>CCC</td>
<td>&lt;a,a&gt;, &lt;o&gt;</td>
<td>katav, -ktov</td>
</tr>
<tr>
<td>ŝ+ √ktb</td>
<td>CCC</td>
<td>&lt;i,e&gt;, &lt;a,e&gt;</td>
<td>šixtev, -šixtev</td>
</tr>
<tr>
<td>b. Barwar √pθx</td>
<td>CCC</td>
<td>&lt;a,ə&gt;, &lt;i&gt;</td>
<td>pəθəx, pθix-</td>
</tr>
<tr>
<td>√šlx+0₁</td>
<td>CCC</td>
<td>&lt;a,ə&gt;, &lt;u,ə&gt;</td>
<td>-šaləx, -šuləx-</td>
</tr>
<tr>
<td>0+√plx</td>
<td>CCC</td>
<td>&lt;a,ə&gt;, &lt;u,ə&gt;</td>
<td>-apləx, -apləx-</td>
</tr>
</tbody>
</table>
In (13), not only root formation, but also template attribution precedes the vocalic pattern. As Goldenberg claims, there are two templates, represented here CCC and CCCC. But when described as in (13), a certain redundancy is apparent: both templates and roots state triradical minimality. As a result, one of the two morphemes — roots or templates — can be discharged of this obligation. This is exactly what we require: if the triradical minimality is stated by the template, then the possibility of biradical roots is not ruled out by the theory. Indeed, it is almost inherent to it. Unlike triradical and quadriradical roots, biradical ones are expected to be able to link to either template. (14) shows cases of reduplicated biradicals from Modern Hebrew appearing in both the triradical and the quadriradical template.

(14) Reduplicated biradicals in both triradical and quadriradical templates

<table>
<thead>
<tr>
<th>a. triradical template</th>
<th>b. quadriradical template</th>
</tr>
</thead>
<tbody>
<tr>
<td>(cf. <em>katav</em> ‘write’)</td>
<td>(cf. <em>pirsem</em> ‘publish’)</td>
</tr>
<tr>
<td>šalal ‘to negate’</td>
<td>milmel ‘to mumble’</td>
</tr>
<tr>
<td>šadad ‘to rob’</td>
<td>nidned ‘to swing back and forth (trns.)’</td>
</tr>
<tr>
<td>kafaf ‘to bend (trns.)’</td>
<td>sfšef ‘to rub’</td>
</tr>
<tr>
<td>xanana ‘to pardon’</td>
<td>gimgem ‘to stutter’</td>
</tr>
</tbody>
</table>

The combined view in (13) adopts Goldenberg’s root-first view, but assumes *contra* Goldenberg, that the number of radicals and the number of positions in the template is not always identical. Thus, without losing Goldenberg’s analysis of the distribution of vocalic patterns, the proposed view is able to incorporate biradicals and templatic effects into the system.

Finally, one asks how roots with more than four radicals can be accounted for if each position in the template is represented as a single consonantal slot C, and there are only four positions. The simple answer is that such C positions should not be regarded as representing a single consonant, but rather a single consonantal slot. The difference becomes important when stress is considered. It has long been noted that there is an asymmetry between onsets and codas with respect to their interaction with stress. Whereas the existence of codas may affect stress, onsets never interact with stress: they behave as simplex onsets. Such facts, among others, have led Lowenstamm (2003) to propose that for templatic purposes, there are no complex onsets: what seems like a complex onset is represented as one skeletal slot (15a). Scheer (1998) represented
branching onsets as closed domains, over which inter-nuclear government can hold (15b):¹¹

(15) Representations of the branching onset in [brɛd] as non-branching

<table>
<thead>
<tr>
<th>a. b r ɛ d</th>
<th>b. b r ɛ d</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>C V C V</td>
<td>[C V C] V C V</td>
</tr>
<tr>
<td>government</td>
<td></td>
</tr>
</tbody>
</table>

In both representations, complex onsets are, for all purposes, single domains. Thus, more than one consonant can be mapped to the positions of the template that end up as onsets without yielding an illicit verb. A specific prediction with respect to verbs with more than four radicals is made: only if the medial cluster required (such as [bstr] in [ʔibstrekt]) can be syllabified as [([C]_{coda}([CC]_{onset})], can the verb be derived. I have found no counter-example to this scenario.¹²

To summarize, the double-tier, root-first assumes that templates are used as filters on roots, rather than replicating their number of radicals, thus allowing for templating effects and biradicals. At the same time, the architecture proposed can accommodate the creation of augmented roots before any template is considered — thus sharing the advantages of the root-first approach. Finally, adopting a more abstract interpretation of the notation ‘C’, the approach comes to share the advantage of the strictly-vocalic view in its account for derived roots with more than four radicals such as Modern Hebrew [ʔibstrekt]. Thus, the double-tier, root-first approach can incorporate...

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¹¹ Both Lowenstamm and Scheer’s works were conducted within the framework of Government phonology (Kaye et al. 1990) in its CVCV option (Lowenstamm 1996), in which the skeletal level consists of strictly alternating C and V slots. In order to remain unrealized, an empty V-slot has to be governed by a following full V slot.

¹² In order to derive one, one must pick a base noun which, if squeezed into a quadriradical template, will result in a medial CCC cluster, wherein [([C]_{coda}([CC]_{onset})], but not [([CC]_{coda}([CC]_{onset})], is ruled out by the Sonority. Such a derivation is predicted to crash. That such scenarios have to be invented can serve as confirmation for the correctness of the proposal. Nevertheless, consider the loanword [ʔintegral], used in Mathematics. According to Bat El’s proposal, there should be no problem to derive verb *[ʔintgrel], because [nt] is a legitimate coda cluster in Hebrew, and [gr] is a legitimate onset cluster. The verb is, however, illicit. This fact can be explained in the present account, where the coda position cannot be split. This leaves [tgr] for the onset, and this is an impossible cluster.
the advantages of all three preceding approaches without sharing their shortcomings.

The next two sections bring forth three case studies that prove the superiority of the present proposal over its predecessors.

4. Reduplication in Modern Hebrew

In the previous two sections, I claimed that the templates proposed by the double-tier approach cannot be reduced to their vowels, and must be incorporated in any theory of Semitic word-formation. In this section, I will treat two additional problems that bolster this claim, and show how the proposed combined approach can account for them. Both of these problems have to do with reduplication.

4.1. Reduplication of Radicals in the Quadriradical Template

Consider the following data from Modern Hebrew:

(16) Modern Hebrew Types I and II and the reduplication of triradicals

<table>
<thead>
<tr>
<th>Type I</th>
<th>Type II</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. šamar ‘to keep’</td>
<td>šimer ‘to preserve’</td>
</tr>
<tr>
<td>gadal ‘to grow’</td>
<td>gidel ‘to cultivate’</td>
</tr>
<tr>
<td>xašav ‘to think’</td>
<td>xišev ‘to calculate’</td>
</tr>
<tr>
<td>b. laxaš ‘to whisper’</td>
<td>lxšeš ‘to whisper repeatedly’</td>
</tr>
<tr>
<td>caxak ‘to laugh’</td>
<td>cixkek ‘to giggle’</td>
</tr>
<tr>
<td>(ʕ)akac ‘to sting’</td>
<td>(ʕ)ikece ‘to sting lightly in many places’</td>
</tr>
</tbody>
</table>

In (16a), the well-known fact that the same root can appear in more than one verbal type is recalled. The root √šmr appears in the triradical template (i.e. type II, in which quadriradicals never appear), and in the quadriradical one (type I, in which all quadriradicals appear). The analysis of this fact within the present approach is identical to the one proposed for Barwar type II in (8) and (13) above: the root of [šimer] is in fact quadriradical √šm0r, yielded by the augmentation of √šmr by /0 3 /. The same root can appear as augmented and unaugmented.

The data in (16b) show that sometimes the realization of a triradical root in type II entails the reduplication of the last radical. The
result is, much more often than not, a pluractional verb (for pluractionality, see Greenberg 2010).\footnote{Bat El (2006) does not agree that the QiTLeL pattern has pluractional meaning (but see (18) below).}

Reduplication of radicals was one of the two reasons to integrate templates in the root-first approach. Here we see the fruit of that integration. Recall that we have hypothesized, in the analysis of biradicals, that roots may be made to satisfy templates that contain more positions than these roots have radicals. There is no reason why that should not hold of the triradical root and the quadriradical template. The prediction is thus made that there are two ways — not one, as in the root-first approach — by which a triradical root may end up in the quadriradical type II:

1) By internal augmentation of the root.
2) By the mere association of the root to that template.

In the first case, the second radical roots will occupy both medial slots, but (in a language with no gemination such as Modern Hebrew) the root will seem unaltered on the surface (17a); in the second case, the last radical will be reduplicated to fit the template (17b):

(17) Two ways in which a triradical may end up in a quadriradical template

<table>
<thead>
<tr>
<th>Root creation</th>
<th>Template satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. $\sqrt{\text{šmr}}+0_3 = \sqrt{\text{šm0r}}$</td>
<td>$\text{š m r}$</td>
</tr>
</tbody>
</table>
|               | \[
|               | C C C C |
|               | [šimer] |
| b. $\sqrt{\text{lxš}}$ | $\text{l x š}$ |
|               | \[
|               | C C C C |
|               | [lixšeš] |

The second strategy, as we saw in (16b), has a morpho-semantic function, i.e. that of conveying pluractionality.

The examples in (18) show two further aspects of the mapping in (17b). (18a) proves that this mapping has a lexical meaning: the nouns are mapped directly to type II, rather than through internal augmentation, in order to convey the pluractional meaning. (18b) shows that one and the same root can be mapped to type II directly or through augmentation.
(18) More reduplication of triradicals

a. *kadur* ‘ball, n.’
   *kidrer* ‘to dribble’

   *(ʔ)*avir ‘air, n.’
   *(ʔ)*ivrer ‘to air’

   *kveč* ‘a crumple’
   *kivčeč* ‘to crumple’

b. *kipec* ‘to jump several times’
   *kifcec* ‘to jump around many times’

   *kiven* ‘to aim, direct’
   *kivnen* ‘to fine-tune’

   *(ʔ)*išer ‘to confirm’
   *(ʔ)*išrer ‘to confirm bureaucratically’

Because of the dual route in (17), the data in (18b) are predicted and unproblematic for the root-first, double-tier approach. In contrast, they are problematic for all three preceding approaches. As we saw, the root-first approach, with its rejection of template satisfaction, leaves reduplication unexplained. In McCarthy’s double-tier approach, the marriage of root and template cannot yield more than one result, or the theory will be considerably weakened. The same is true in the strictly-vocalic approach: √QTL + <i,e> cannot have two results. Both theories need to assume a reduplicatory morpheme (Ussishkin 2000) or constraint (Bat El 2006). These approaches thus require further machinery for what is a direct consequence of the architecture of the approach advocated here.

The same phenomenon of reduplication is encountered in biradicals, as shown in (19):

(19) Biradicals in the quadripartite template: first list

a. *mila* ‘word, n.’
   *milmel* ‘to mumble’

   *daf* ‘sheet of paper, n.’
   *difdef* ‘to leaf through (a book)’

   *zapıng* ‘switching channels repeatedly’
   *zipzep* ‘to switch channels repeatedly’

b. *likek* ‘to lick’
   *likek* ‘to lick repeatedly’

   *mišel* ‘to feel, grope’
   *mišmel* ‘to feel, grope repeatedly’

   *dilel* ‘to dilute (trns.)’
   *dildel* ‘to thin down over a period’

The data in (19a) show that the placement of biradicals in the quadripartite template is used for the same purpose as in triradicals: the creation of verbs with puractional denotation.14 The data in (19b) are the biradical equivalent of (18b): the same biradical root exhibits two possible mappings into the quadripartite template. As in the triradical

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14 Like for QiTLeL, Bat El (2006) does not accept that pluractionality is a function of QiTQeT. But the robustness of this generalization is bolstered by the lists in Greenberg (2010)
case, this is not predicted by the previous approaches: given a biradical root \(\sqrt{QT}\) and a template CiCCeC or \(<i,e>\), either QiTeT or QiTQeT must result.

The double-tier, root-first approach predicts there to be three mappings for biradicals: since there are two radicals, \(\sqrt{QT}\) may be mapped to CCC, i.e. to type I. This is certainly the case in verbs such as kalal 'to include' (related to kol ‘all’) and xacac ‘to separate’ (related to xayic ‘concrete partition’) etc. The two other mappings are parallel to those of triradicals: 1) by the addition of underlying length /03/; and 2) by pure imposition of CCCC. Let us consider what results of the addition of /03/. This augment adds underlying length to the second radical. Such length can only be maintained if that radical and /03/ are always adjacent. This is only possible in the quadripartite template. As shown in (20a), the augmented root \(\sqrt{QTO_3}\) is mapped to the quadripartite template, and the last position is filled by the second radical through spreading. The second path to type II is through imposition of its template. In biradicals, the process of the satisfaction of a quadripartite template is as in section 2, example (12): full reduplication of the biradical to fill all positions in the template (20b).

(20) Two ways in which a biradical may end up in a quadriradical template

<table>
<thead>
<tr>
<th>Root creation</th>
<th>Template satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. (\sqrt{lk+0_3} = \sqrt{lk0_3})</td>
<td>(\hat{s}k)</td>
</tr>
<tr>
<td></td>
<td>(\backslash/)</td>
</tr>
<tr>
<td></td>
<td>C C C C</td>
</tr>
<tr>
<td></td>
<td>[likek]</td>
</tr>
<tr>
<td>b. (\sqrt{lk})</td>
<td>(lklk)</td>
</tr>
<tr>
<td></td>
<td>(\backslash/)</td>
</tr>
<tr>
<td></td>
<td>C C C C</td>
</tr>
<tr>
<td></td>
<td>[liklek]</td>
</tr>
</tbody>
</table>

Crucially, it is in the fully reduplicated QiTQeT verbs, and not in the QiTeT ones that we expect to find pluractionality, because these are derived in the same way as QiTLeL: quadripartite template imposition. This is indeed exactly where pluractionality is commonly found, whereas QiTeT (or QaTaT) verbs do not carry this special function. Whether this parallelism between QiTQeT and QiTLeL (to the exclusion of QiTeT and QaTaT) can be achieved in any of the other three approaches remains unknown.\(^{15}\)

\(^{15}\) That said, as far as I can tell, a similar prediction can be made — but isn’t — in Bat El’s (2006) system. As explained in ft. 14, Bat El does not agree that there is a semantic aspect to reduplication.
To summarize this subsection, by making a distinction between root-augmentation and template satisfaction, the root-first, double-tier approach predicts that both triradicals and biradicals will have two paths to the quadripartite template. This prediction, which is borne out, is unavailable to the other approaches without additional machinery.

4.2. Other Biradicals in Type II?

Besides QiTeT and QiTQeT, two other arrangements in the quadripartite template can be related to biradical words with only two surface consonants, Qi(Y)eT and QoTeT: 16

(21) Two other ways to treat biradicals in the quadripartite template

a. šat ‘to sail, float’ šiyet ‘to navigate’
   (ʔ)ot ‘letter’ ʔiyet ‘to spell’
   dak ‘fine, thin’ diyek ‘to be specific’
   xuga ‘dial, n.’ xiyeg ‘to dial, v.’
   buša ‘shame, n.’ biyeš ‘to shame, n.’
   min ‘species, type’ miyen ‘to classify according to type’
   kef ‘fun’ kiyef ‘to have fun’
   —  —  siyer ‘to tour, patrol’
   —  —  ciyet ‘to smile’

b. šat ‘to sail’ šotet ‘to wander’
   (ʕ)af ‘to fly’ (ʕ)ofef ‘to fly here and there’
   (ʔ)ot ‘signal’ ʔotet ‘to signal’
   henif ‘to raise’ nofeš ‘to wave sth’
   kam ‘to rise’ komem ‘to arise sth’
  .dmama ‘silence’ domem ‘to turn off (engine)’

The recent literature on these verbs derives their differences from the original quality and quantity of a base (Bat-El 1994, Ussishkin 2000, Faust and Hever 2010). For example, miyen ‘to classify according to type’ is arguably derived from to min ‘type, species’, in order to preserve the [i] of the base. However, there are several problems with such accounts. First, not all such verbs have bases. Second, such

16 QoTeT is a sub-type of quadripartite QiTeL, as evidenced for example in the form of the prefixal participle me-QoTeT.
general principles do not always yield the right result: for instance, minen would do a better job for min, because it preserves not only the [i] but also the contiguity of the base. Third, such analyses tend to be circular, in that they prove the denominal nature of the verb almost solely on the basis of the preservation of these traits, and then explain the preservation of the traits by saying that the verb is denominal. And finally, as (21) illustrates, this type of explanation is far from covering all the cases at hand.

The deviant forms in (21) may be explained by assuming that the verbs are not denominal, but rather deradical. They are derived from the root, in this case what seems like a biradical root. If so, with the addition of these two new possibilities, four mappings present themselves for biradicals: QiTeT, QiTQeT, QoTeT, QiYeT. But why only four? And more importantly, why specifically these four? And if the <o,e> vocalization is a possible vocalization with biradicals, then why not QoYeT or QoTQeT?17

Two additional pieces of information help solve the puzzle. Interestingly, the vocalization <o,e> is only possible with reduplicated roots: there is only one verb in the entire language that has this vocalization and does not involve reduplication: roken ‘to empty’. All other verbs with this vocalization — and there are quite a few — involve reduplication.18

To my knowledge, no attempt — explicit or implicit — has been made to account for these distributional lacunae in either of the

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17 The only other synchronic account of QoTeT verbs that I know of is mentioned rather briefly in Izre’el (2009). The roots of QoTeT verbs are said to be quadriradicals with an augment /o/, so that QoTeT is in fact /QiQTeT/ and morphophonological processes are responsible for the surface form. This analysis is quite similar in essence to the one proposed in the body of the present paper; but it does not answer the different questions raised.

18 Outi Bat El (p.c.) reports that the QoTeT group seems to be losing ground. Indeed, several QoTeT verbs — though not all — alternate with QiTeT: koded~/kided ‘to encode’, poce~picec ‘to explode’, tof~tiff ‘to tap, drum’. This does not happen the other way around: words that belong to the QiTeT group do not switch to QoTeT. As a result, Bat El claims, this group should be treated as exceptional. Regardless of how such exceptionality may be expressed, it is worth noting that several well-defined sub-groups of QoTeT do not alternate. Those are: 1) roots with initial gutturals (foded ‘to encourage’, *fided); 2) roots for which there is an independent form QiTeT with an independent meaning (ginen ‘to garden’, gone, *ginen ‘to defend’); 3) roots in the reflexive type hitQaTeL, which also has this alternation (hitmaded ‘to confront, cope with’, *hitmaded). Most importantly, even where variation is attested, my feeling is that it is only in the past form: poce~picec, *yefacec. In all these cases, QoTeT verbs certainly stand their ground; they are thus not expected to disappear from the language in the foreseeable future.
approaches described here. It is safe to say, however, that such lacunae are the most worrisome for the strictly-vocalic approach, which in its simplest form is obliged to assume a vocalic pattern \(<o,e>\). There is no reason that such a vocalic pattern should be applied only to biradicals.

The beginning of the answer to the questions above is known to any Semiticist. Analysing the forms in (21) as biradical is wrong. These roots are glide-medial. I will now show that under this assumption, and adopting the double-tier, root-first approach, the distributional lacunae above can be accounted for.

Assume that the root of šiyet ‘to navigate’, šotet ‘to wander’ is indeed \(\sqrt{\text{šyt}}\). The root is thus triradical. We know that any triradical root can be mapped to the quadripartite template in either of two ways: 1) internal augmentation; 2) template imposition. In the first option, the triradical root is expected to emerge in its entirety. We thus correctly predict [šiyet], with the underlying /y/ on the surface. Notice that in the present analysis, this /y/ is underlyingly long (the root is \(\sqrt{\text{šy}0\text{t}}\), which is underlyingly /šiyyet/); this may explain why it does not appear in the type I šat ‘sail’, where it is not underlyingly long. In the second of the two ways, quadripartite template imposition, we have seen the third radical get reduplicated (lixšeš ‘to whisper repeatedly’, 17b). We thus wrongly predict *[šiytet].

The prediction is wrong, but it leaves hope: the second path to the quadripartite template always involves reduplication of the third radical, and this is exactly what we always get after [o]. Now consider the following well-known set of pairs:

(22) QaTaL - HiQTiL pairs

<table>
<thead>
<tr>
<th>a.</th>
<th>kafac</th>
<th>‘to jump’</th>
<th>bikpic</th>
<th>‘to make jump’</th>
</tr>
</thead>
<tbody>
<tr>
<td>gadal</td>
<td>‘to grow’</td>
<td>bigdil</td>
<td>‘to enlarge’</td>
<td></td>
</tr>
<tr>
<td>rakad</td>
<td>‘to dance’</td>
<td>birkid</td>
<td>‘to make dance’</td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>yarad</td>
<td>‘to descend’</td>
<td>horid</td>
<td>‘to bring down’</td>
</tr>
<tr>
<td>yalav</td>
<td>‘to sit’</td>
<td>bošiv</td>
<td>‘to make sit’</td>
<td></td>
</tr>
<tr>
<td>yaca(ʔ)</td>
<td>‘to exit’</td>
<td>boći(ʔ)</td>
<td>‘to extract’</td>
<td></td>
</tr>
<tr>
<td>yada(ʔ)</td>
<td>‘to know’</td>
<td>bodia(ʔ)</td>
<td>‘to announce’</td>
<td></td>
</tr>
</tbody>
</table>

The data in (22) introduce the causative formation hiQTiL, which constitutes a special sub-group of the quadripartite template, differing somewhat in its vocalic pattern from other quadriradicals. But it is not the differences, but rather the similarities that concern us. By the addition of the causative prefixal augment \(h\)- to the root, the original
first radical is pushed to the second position. By analogy to the verbs in (22a), those in (22b) have the underlying form /hiyrid/, /hiyšiv/ etc. Their surface form is nevertheless [hořid], [hošiv] etc. In other words, the form of the radical /y/, when in pre-consonantal (or ‘coda’) position, is such that it coalesces with the preceding vowel to yield the vowel [o], which expresses both the vocalization and the radical. According to the traditional analysis, which I will adopt in full, /y/ becomes /w/ in this position; there being no w-final diphthongs in Modern Hebrew, the sequences /iw/ or /aw/ are realized as [o]. This is represented in a derivational scheme in (23a) for the HiQTiL verbs. Back to the predicted, though unattested *[QiYTET] verbs, we now know why they are unattested. The underlying sequence /QiYTET/, predicted to exist, is in fact exactly the attested [QoTeT], as (23b) shows.

(23) Deriving surface [o]¹⁹

<table>
<thead>
<tr>
<th></th>
<th>a. /hiyrid/ ‘to bring down’</th>
<th>b. /šiytet/ ‘to wander’</th>
</tr>
</thead>
<tbody>
<tr>
<td>y=&gt;w</td>
<td>/hiwrid/</td>
<td>/šiwtet/</td>
</tr>
<tr>
<td>iw=&gt;[o]</td>
<td>[hořid]</td>
<td>[šotet]</td>
</tr>
</tbody>
</table>

In other words, [šotet] is exactly the form predicted for a triradical root √šyt placed in a quadripartite template. Moreover, this view explains all and only the attested forms: if <ο,ε> is simply a vocalic pattern, other logical possibilities are as QoyeT and QoTQeT; in the present view these are impossible, because they do not involve a pre-consonantal /y/. The reason that verbs with <ο,ε> always involve reduplication is also revealed. For /y/ to be placed in a preconsonantal position, the quadripartite template must be imposed on a triradical root √QYT; and we have seen that this scenario deterministically leads to reduplication of the third radical. All of these correct predictions are unavailable to either the double-tier or the strictly-vocalic approaches, at least not without a significant modification of how these approaches were applied in the literature. The root-first

¹⁹ A reviewer remarks that this confounds ‘historical radicals’, such as the /lwl/ in horid, and the proposed /wl/ of šotet. S/he adds that synchronic initial /l/ is retained in hiQTiL, and brings the example yanak ‘suckle’ — heynik ‘to breast-feed’. But this example is very exceptional in present day Hebrew: most speakers associate the HiQTiL verb to a regular paradigm with no /l/, and say henik, menik—manik. Other such verbs (e.g. heytv ‘to be good at’) belong to too high a register, unlike verbs like horid. For clarity, I reiterate: the claim here is not historical; I claim that on the synchronic level, there is a morphophonological rule that has /yl/ alternate with /wl/ in coda position. This rule is active in both horid and šotet.
A novel, combined approach to Semitic word-formation

approach, with its rejection of template-driven reduplication, does not share the success of the present analysis. Only the combined double-tier, root-first approach limits the system exactly where limitations are called for.

To summarize, this section illustrated the advantages of the proposed combined view over its predecessors. On the basis of a strictly quadripartite analysis of all roots in type II, inspired by the root-first approach, and with the incorporation of templates into that view, the proposed approach predicts only two mappings possible for biradical and triradical verbs in this template. It thus neither over-generalizes (like the double-tier or the strictly vocalic approaches) nor undergeneralizes (like the root-first approach); all and only the attested forms are predicted to exist.

To close this section, a remark is due regarding the verb roken ‘to empty’, the only verb that carries the specific vocalization <o,e> but does not involve reduplication. This root has three surface radicals. Recall that the analysis predicted either the <i,e> vocalic pattern or reduplication for all triradical roots in the quadripartite template. The architecture of the account thus rules out the possibility that this is a triradical root. But it does not rule out a quadriradical analysis of roken. If roken is regarded as based on quadriradical √rykn, the surface for [roken] is exactly what one expects. That /y/ is part of the root is suggested by the adjectives [rek] (~[reyk]) ‘empty’ and [reykani] ‘void (pej.)’. In Hebrew, /y/ is extremely rare in quadriradical roots — probably because the bulk of them are word-based — and quadriradicals with a second radical /y/ are thus all the rarer. That said, in the next section, we will encounter a morphological domain where quadriradicals with /y/ are ubiquitous.

5. A Third Case Study: Hebrew Type I Participles

In this section, I show another advantage of the proposed approach: it can account for the exceptionality of type I participles in Hebrew. This advantage is shared by the root-first approach; but it is a consequence of the analysis of /y/-medial roots, and thus is best appreciated in the context of the analyses of the previous sections, which were only possible in the combined approach.

In Modern Hebrew, as the data in (24) show, most verbs have two stems: a past and a non-past stem. Participles, which are used for the expression of the present (among other constructions), share a stem
with other non-past forms. In type I, however, participles have two particularities. First, they have a unique vocalic pattern. Second, they do not carry a prefix m-, which the participles of other active type do.

(24) Active types of Hebrew

<table>
<thead>
<tr>
<th>Type</th>
<th>Past</th>
<th>Non-past</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td>I</td>
<td>našam</td>
<td>nošem</td>
</tr>
<tr>
<td></td>
<td>xipes</td>
<td>m-xapes</td>
</tr>
<tr>
<td>III</td>
<td>hišṭnis</td>
<td>m-axnis</td>
</tr>
<tr>
<td>II(4R)</td>
<td>šidreg</td>
<td>m-šadreg</td>
</tr>
</tbody>
</table>

The object of this section is to find the logic behind the distribution of both m- and the vocalic pattern of type I participles. First, the reader will have noticed by now a parallelism between the three Semitic systems encountered in this paper, repeated in (25). In all three systems, the non-past stem of type I has two distinct vowels, unlike the other stems of the type, which either have two identical vowels or a single one. In Tigre and Barwar, the vocalization of the non-past stem is identical to that of quadriradicals. In Tigre, the reason for the identity in vocalization is surface true: the stem is derived by the internal lengthening augment, thus rendering the stem quadriradical. Hebrew stands out in that the two-vowel vocalization of the type I participle is not identical to that of the type II participle.

(25) Synthesis of three Semitic systems: first attempt

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<tbody>
<tr>
<td></td>
<td>past</td>
<td>present</td>
<td>futur</td>
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<tr>
<td>I</td>
<td>našam</td>
<td>nošem</td>
<td>-nšom</td>
</tr>
<tr>
<td>II</td>
<td>xipes</td>
<td>m-xapes</td>
<td>-xapes</td>
</tr>
<tr>
<td>(4R)</td>
<td>šidreg</td>
<td>m-šadreg</td>
<td>-šadreg</td>
</tr>
</tbody>
</table>

<sup>20</sup> In the non-active verb NiQTaL, the participle shares a stem with the past rather than the non-past. Other verbal types (the non-active HiTQaTeL and the passive types) have the same stem throughout their paradigm.

<sup>21</sup> Some Type I infinitives do not share the vocalization of the future, e.g. yišʔal ‘he will ask’ - lûšʔal ‘to ask’. Except for some irregular cases, this is predictable on the basis of the quality of the surrounding radicals. Since this problem does not affect the argument here, it was circumvented in the presentation of the data.
However, we have seen, in the previous section, verbs of type II whose participles have the same vocalic pattern as the type I participle: those derived by the imposition of the quadriradical template on √QYT root, such as šotet ‘wander’. We have also seen the rare example of a quadriradical with this vocalization, roken ‘empty’. If we replace the type II verbs in (25a) by šotet and roken, a coherent picture emerges:

(26) Synthesis of three Semitic systems: first attempt

<table>
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</thead>
<tbody>
<tr>
<td>past</td>
<td>present</td>
<td>futur</td>
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<tr>
<td>našam</td>
<td>nošem</td>
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<tr>
<td>pôix-</td>
<td>pâzôx-</td>
<td>lak(a)š</td>
</tr>
<tr>
<td>šiš-</td>
<td>m-šalâx-</td>
<td>-šadreg</td>
</tr>
<tr>
<td>(4R) roken</td>
<td>m-roken</td>
<td>-roken</td>
</tr>
<tr>
<td></td>
<td>m-kankši-</td>
<td>-kankši</td>
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<tr>
<td></td>
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<td>dangâns</td>
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<td></td>
<td>-dangâs</td>
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<tr>
<td></td>
<td></td>
<td>-dangâs</td>
</tr>
</tbody>
</table>

The theoretical conclusion is clear: type I in Modern Hebrew participles are quadriradical. They are derived by infixation of a morpheme /y/ in the second position of the triradical root, thus yielding quadriradical √QYTL. Such a scenario, as we saw in the rare type II roken ‘empty’ (but also in šotet), results in the vocalization <o,e>. We can thus synchronically relate [nošem] to /naʾYšem/, just as [roken] and [šotet] were underlyingly /raʾYken/ and /šaʾYtet/. The derivation proceeds as in (23) above: /y/ becomes /w/ and coalesces with the stems vowel (in this case /a/). In view of the situation in Tigre (and most Ethio-Semitic languages), where it is possible for only one stem of a verb’s paradigm to be augmented, this internal augmentation is not surprising.

The same conclusion can be reached on principled grounds language-internally. We have established that vocalization is the result of the number of radicals. The type I participle QoTelL has a different vocalization from the other non-past forms, the future and infinitive. It follows that it does not have the same number of radicals. Since it does have three surface radicals, one may assume that there is a quiescent fourth radical involved in the derivation of this form. This radical is, however, not entirely quiescent: its effect is noticeable on the first vowel of the stem which, given that there are four radicals, should have been [a] by comparison to quadriradical -šadreg. The question is raised as to what sound coalesces with /a/ to yield [o]. The answer is /u/, or /w/. The analogy with √QYT roots in type II provides the final clue as to the identity of the internal augment.

To summarize, on either language-internal or cross-linguistic basis, there is nothing surprising about the vocalic pattern of Type I.
participles: this is the pattern one would expect to emerge if the stem were an internally augmented triradical. Internal augmentation is a valid means of stem-derivation; the only peculiarity of Hebrew is that the internal augment here is /y/.\textsuperscript{22}

The analysis above accounts for the first peculiarity of type I participles, their special vocalization. It does not, as it stands, explain the absence of m- from these forms. Why is the stem QoTel not prefixed with m-, like other participles? In fact, this absence can also be explained within Goldenberg’s root-first approach.

The first step is to turn the question on its head: why does internal augmentation with /y/ not appear in type II? Recall that all roots in type II are quadriradical. If /y/ augmentation were applied to a quadriradical $\sqrt{QTL}$, a root with five radicals $\sqrt{QYTLD}$ would result. Such roots are reserved to denominal verbs in Modern Hebrew (and other Semitic languages): a derivational strategy that creates them is unlikely to be adopted. On the phonological side, the underlying diphthongs /iw/ and /aw/ would appear in closed syllables Qi$\mathfrak{w}$T.LeD, a marked syllabification for diphthongs throughout Semitic.

If so, in type II, participles and future forms are doomed to be identical. I submit that the logic of the prefixation of $m$- in Modern Hebrew is thus the following: $m$- is inserted where present and future forms are identical in order to explicitly mark this difference. Described in this way, it is clear why in type I no such insertion is called for. Triradicals can be internally augmented; quadriradicals may not, and thus call for another morphological strategy: this is the function of $m$-.\textsuperscript{23}

To summarize, in order to account for the double exceptionality of the Modern Hebrew type I participle QoTel, this short section has made two parallels: between languages and between types within

\textsuperscript{22} An internal augment /y/ is also assumed in the derivation of some type II verbs in Gurage (e.g. Lowenstamm 1986). Also, one may assume that originally, the Modern Hebrew augment was simply length, as it is in the Arabic participle ka:$\mathfrak{t}$eb ‘writer’. It is well known that /a:/ shifted to /o/ in Northern-Semitic (e.g. Rubin 2008). The diachronic facts therefore do not support an underlying /Y/ in this case. However, I claim that synchronically, the parallel between QoTel and QoTeT cannot be ignored.

\textsuperscript{23} In Faust (2011) it is argued that $m$- fills a similar function in nouns like mig$\mathfrak{d}$al ‘tower’, related to gadal ‘grow’. That function is simply the addition of an animacy-neutral nominalizing prefix. Thus, m-xapes can be glossed ‘he/it (which) searches’. Viewed in this way, the role of the participial $m$- resembles that of the homophonous interrogative pronoun of Hebrew in $m$-i ‘who?’ and $m$-a ‘what’. However, I remain agnostic on whether this is a synchronic relation.
Modern Hebrew. The first parallel indicated that internal augmentation is plausibly the reason behind the form’s special vocalization. The second parallel confirmed that indication. The logic behind the distribution of the prefix m- was also revealed, designating it as an analytic alternative called for when internal augmentation is impossible.

The analysis in this section does not directly necessitate anything more than Goldenberg’s root-first approach. But it does so indirectly: the parallel made with Y-medial roots, which validates the abstraction in the analysis, requires viewing such roots as reduplicated by template satisfaction. This principle, unsupported by the root-first approach, is introduced into it by the proposed combined view. As for the two other approaches discussed, since they do not admit the creation of roots prior to template selection, it is unclear how they can share the success of the present analysis.

In the next section I recapitulate on the present proposal — the double-tier, root-first approach — by way of summary and conclusion.

6. Summary and Conclusion

In this paper I argued for a new approach to Semitic morphology, which I termed the double-tier, root-first approach. This approach, as its name suggests, is little more than a combination of Goldenberg’s root-first approach and McCarthy’s (1979) autosegmental double-tier approach. Like the former, the proposed view has roots created before the attribution of a template, and assumes the existence of only two templates: a tripartite template and a quadripartite one. The vocalization of the stem is a function of the attribution of either template. This generalization — which is a hallmark of the root-first approach — was shown to be advantageous at various points in the paper.

Unlike the root-first approach, the proposed approach admits templates that have independent morphemic status, and do not only replicate the number of radicals in the root. As a consequence, these templates can be imposed on roots, resulting in reduplication. Reduplication, as in the double-tier approach, is thus a templatic process. However, it is not the only reason a triradical root may be mapped to the quadripartite template: another scenario is internal augmentation. The distinction between the two scenarios is unavailable for an approach that does not admit the possibility of root creation before template selection (short of using a reduplicant morpheme).
Templates in the proposed view are formalized with three or four C-slots. However, such C-slots may harbor more than one consonant, if they are syllabified as onsets. Thus, the main advantage of the strictly-vocalic approach is incorporated into the proposed view.

The advantages of the root-first, double-tier approach were exemplified using three related test cases from Modern Hebrew: 1) reduplication in type II (QiTeT, QiTQeT, QiTLeL); 2) biradicals and related forms in type II (QiTeT, QiTQeT, QiYeT, QoTeT); and 3) the type I participle QoTeL. In all three cases I hope to have shown that the system makes correct predictions, unavailable to the other approaches described. I hope that other aspects of Semitic morphology can now be identified which will challenge — and thereby help validate or refute — these claims.

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