The Fate of Hebrew Gutturals

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Abstract

Modern Hebrew exhibits a mixture of the morphological paradigms of Tiberian Hebrew and the phonology of its revivers, who were speakers of Russian, Yiddish and/or German. In particular, Modern Hebrew adopted from Tiberian Hebrew the morpho-phonological effects of the gutturals, but, under the influence of the non-Semitic languages, it did not adopt the guttural consonants. The research question of this thesis is how Hebrew speakers managed to arrange their linguistic knowledge to include the effects of gutturals, although gutturals are not part of this knowledge.

The Hebrew phonemic inventory of today does not contain ? and f, while guttural h is pronounced as a velar fricative x. In addition, the glottal fricative h, which did exist in Yiddish and German (though not in Russian), also did not enter the spoken language, maybe because it too is guttural. I define guttural sounds as "non-recovered", since speakers do not pronounce them in the stabilized spoken Hebrew of today.

Two phonological phenomena characterized Biblical Hebrew Gutturals: lowering and epenthesis. These two phenomena were partially recovered in today's Hebrew, albeit the non-recovery of their cause, i.e. guttural sounds.

The analysis is couched within the frame of Optimality Theory (Prince and Smolensky 1993), which is built out of constraint interaction. I propose that the grammar of Hebrew speakers consists of paradigmatic constraints on verbs that had historical gutturals in initial or final position, combined with faithfulness constraints (input-output relations) and markedness constraints (output markedness).

In addition, because guttural verbs were not recovered as such, they now contrast minimally with other verb groups, such as the V-final or medial group. I present these contrasts and explain how they are structured in speakers' linguistic knowledge.

Alongside the presentation of constraints and their effects, I show why an account that assumes the recovery of underlying guttural(s) is less probable than my own account, which includes an underlying vowel a instead.
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1. Introduction

In this thesis I study the effect of Tiberian Hebrew gutturals in Modern Hebrew (hereafter Hebrew, or MH when contrasted to Tiberian Hebrew). These gutturals, as I argue, did not survive as phonemes, but their morpho-phonological effects are surface true. This thesis explores how Hebrew was restructured to allow for this apparently opaque state.

The empirical basis of the study is the paradigm of Modern Hebrew verbs corresponding to Tiberian Hebrew verbs with an initial or final guttural (\(\text{?}, h, \text{ʕ} \) and \( h \)). The goal is to provide an Optimality Theoretic analysis that reflects the grammar of today’s Hebrew speakers with respect to these paradigms.

One of the historical changes a language can undergo is a loss of one or more segments. In the case of Hebrew, however, it is inaccurate to say that the gutturals have been lost. As Hebrew was not a spoken language for hundreds of years, a chronological line between, say, Tiberian Hebrew of the first two centuries A.D. and MH does not exist (Horvath and Wexler 1997). Instead, I refer to the gutturals as "non-recovered segments". At the stage of Hebrew's return to being a spoken language, these segments were not adopted by the first native speakers and the ones that followed them.

Whereas in Hebrew historical \( ? \), \( h \) and \( \text{ʕ} \) are simply non-existent (\( ? \), I claim, may sometimes surface to fill an onset position, just like in English), \( h \) was partially recovered as the uvular \( \chi \) (which I transcribe as \( x \)). I refer to stems with historical \( ?, h \) and \( \text{ʕ} \) as \( A \)-stems and stems with a historical \( h \) as \( X \)-stems. This is in order to distinguish, \( A \)-final stems from \( V \)-final stems and \( X \)-final stems from \( x \)-final stems (see §4.5 below). This notation does not imply phonemic or phonetic distinctions between \( A \) and \( a \), or between \( X \) and \( x \). In addition, I name all guttural stems \( G \)-stems.
In the recovered Hebrew there are neither surface gutturals nor (as my argument will be) phonemic, underlying ones. However, the guttural effects of lowering and epenthesis were recovered. Historically, lowering was an effect of a prohibition on the co-occurrence of gutturals and high vowels (McCarthy 1989, 1994); epenthesis repaired illicit sequences of VGC (where G stands for guttural; e.g. /yaʔโม�/ → [yaʔาโม�] ‘he will stand’, cf. regular stem [yiʔโมร] ‘he will guard’). But, as I said, since the gutturals were not recovered, these constraints have become irrelevant in Hebrew, and thus such lowering and epenthesis have become opaque.

In this paper I propose to analyze these seemingly opaque phenomena from a surface perspective, i.e. assuming as little abstractness as possible. For example, some occurrences of the vowel a in a sequence VGC (where G is a historical guttural) are known to be the epenthetic result of the abovementioned constraint against coda gutturals. One way to approach such data is to claim an underlying guttural; since gutturals only very seldom surface in everyday speech, I prefer a less-abstract analysis - mostly with this same a just being there underlyingly.

My efforts focus on accounting for the phenomena without having to posit underlying gutturals at all. This orientation stems from the assumption that a child, when acquiring a language, deduces the language’s input from its output forms. Indeed, it is not impossible that this child should arrive at underlying phonemes that never surface, but I claim that this is the case only if there is no explanation possible through using only forms that do appear in the child’s input, i.e. the language’s output. Moreover, guttural sounds are very marked universally; why then should a child arrive at such underlying representations if s/he can account for the same phenomena in a less marked, more surface-true fashion? I think that an account with no gutturals at all is preferable - as far as learnability goes - to other, more abstract ones.
A possible way of judging between these two approaches is if some phenomenon is found in MH, for which one of the analyses fails to account. When such crucial data are analyzed here, I mention how they support my analysis and not the underlying guttural analysis, or vice versa.

The paper is organised as follows. Chapter 2 introduces the Modern Hebrew verbal system. Chapter 3 provides theoretical background about OT and about related studies. Chapter 4 deals with stem-final cases, where $A$ occurs overtly in all input forms (as the argument goes), although sometimes indistinguishable from stem vowels. Chapter 5 shows how the same $A$ is present, at least underlyingly, in all stem-initial cases. Throughout the paper, the paradigms of verbs with historical gutturals are shown to contrast minimally with other Hebrew verbal paradigms, as a result of the loss of this guttural. Chapter 6 concludes.

For reasons of scope, this paper does not investigate a third, more problematic paradigm, namely that in which historical gutturals occupy a stem-medial position.

2. The Modern Hebrew verbal system

Modern Hebrew has five verbal paradigms, called "binyanim" (sg. “binyan”), referred to as B1, B2, etc. (see (1) below). These are recognized through distinctive vocalic patterns, prosodic structures, prefixes and the combination of these properties. This means that, for example, the form $yi$-*fakel* 'be weighed (3sg.m.fut.)' is understood as a B2 form because: (a) its vocalic pattern is $\{a,e\}$, (b) its stem's prosody is CVCVC, (c) its prefix is $yi$-, and (d) its past form is $ni$-*kal*. 
One binyan may be analyzed as derived from another, but for the present purpose, their derivational relations are not considered. Following is a list of the five binyanim, with their basic vocalic pattern (in bold) and prefix, if any\(^1\). Regular Past and Future forms are provided for each binyan in the basic 3sg.m. The present participle form of the verb has adjectival morphology and morpho-phonology (see Bat-El to appear), and is thus not considered here.

(1) Modern Hebrew binyanim

<table>
<thead>
<tr>
<th>Binyan</th>
<th>Past</th>
<th>Future</th>
<th>gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>C_{1}aC_{2}\check{a}C_{3}</td>
<td>jakal</td>
<td>yi-C_{1}C_{2}\check{a}/\check{a}C_{3} yi-jkól/ yi-gdál</td>
</tr>
<tr>
<td>B2</td>
<td>ni-C_{1}C_{2}\check{a}C_{3}</td>
<td>ni-jkál</td>
<td>yi-C_{1}aC_{2}eC_{3} yi-jakél</td>
</tr>
<tr>
<td>B3</td>
<td>C_{1}iC_{2}eC_{3}</td>
<td>kirévé</td>
<td>ye-C_{1}aC_{2}eC_{3} ye-karévé</td>
</tr>
<tr>
<td>B4</td>
<td>i-C_{1}C_{2}iC_{3}</td>
<td>i-kirív</td>
<td>ya-C_{1}C_{2}iC_{3} ya-kirív</td>
</tr>
<tr>
<td>B5</td>
<td>i-T-C_{1}aC_{2}eC_{3}</td>
<td>it-karévé</td>
<td>yit-C_{1}aC_{2}eC_{3} yit-karévé</td>
</tr>
</tbody>
</table>

The prototypical verb has three consonants, arranged in a disyllabic stem. The verb stem is the size of a binary foot, arguably iambic (Graf & Ussishkin 2002; but see also Becker 2003, for a trochaic analysis). The vocalic pattern of a stem (henceforth VP) changes through inflection, as can be seen in the difference between past and future stems. This process is known as apophony or ablaut, recently analyzed in terms of stem modification (Bat-El 1994, McCarthy and Prince 1990, Steriade 1988). The specific consonants of a stem may appear in more than one binyan, yielding different meanings, as can be seen above in B3, B4 and B5, for the stem consonants \(/k,r,v/\). The regular triconsonantal, disyllabic verbs are traditionally referred to as the "whole" verbs, because all consonants are always surface true. Throughout the analysis, whole verbs serve for comparison in the presentation and analysis of G-verb paradigms, i.e. those involving the historical gutturals.

\(^1\) In the traditional analysis there are two more binyanim, namely the two passives CuCaC and u-CaCaC. These are often used to create adjectives, participles, or passive forms of the verb. I assume that these are not fully-fledged binyanim because no passive verb exists in them that does not have an active counterpart.
In addition, note that B3, B4 and B5 do not alternate prosodically: their prosodic structures are preserved throughout the past and future paradigms. B1 and B2 do alternate prosodically; for example, B1's past form's prosody is CVCVC, while its future form's is CV-CCVC (Bolozky 1978, Bat-El 1989, Adam 2002).

Throughout the paper, I take a surface-oriented view, which maintains that (more often than not) the past 3ms.sg. forms are the bases for the rest of the forms. For example, a form like B3 kirev 'bring close 3ms.sg. Past' constitutes the base for all past forms and for all future forms, whose 3ms.sg. is ye-karev 'weigh 3ms.sg. Future'. Most crucially, I claim that the past 3sg.m. forms are lexical, and all other verbal forms are surface forms, based on the 3sg.m. forms. These relations will be graphically described in the analysis, after the specific OT constraints are defined.

3. Theoretical background

3.1 Linear vs. non-linear representations

Semitic stems are traditionally considered to be made out of two units: a root (i.e. the consonants occupying the C-slots in (1) above) and a binyan (the vowels and prosodic structure in (1)). McCarthy (1981) proposed a non-linear representation, with each unit appearing on a distinct tier. Thus, the binyan is further dissected into a prosodic structure and a vocalic pattern. However, Bat-El (1994) argued that Hebrew stems can be accounted for in a manner much closer to the surface, without having to assume the abstract notion of a root. This brought the non-concatenative nature of Hebrew - and Semitic at that - closer to other world languages, rendering it not so different (Bat-El 2003). That is, following Aronoff’s (1976) word-based approach, the base of a derived form is a fully specified linear representation.
Linguists today provide evidence for both linear and non-linear representations. I will not go into this long and winding debate here, but rather only state that my analysis assumes Bat El’s 1994 linear representation as the input to all forms in Hebrew.

3.2 Introducing Optimality Theory and its relevant aspects

This paper uses the analytic tools provided by Optimality Theory (OT; Prince and Smolensky 1993). OT assumes (a) an input sequence of sounds, and (b) a generating mechanism GEN that provides an infinite number of candidates for this input. Candidates are evaluated through EVAL, which is a set of ranked constraints on output forms. All constraints are present in the grammars of all languages, and the difference between languages is the ranking of these constraints. If so, universality is expressed through the constraint arsenal, and language specific tendencies are expressed through the ranking of these constraints in the specific language.

Selection of the optimal candidate is represented in tableau form. (2) exemplifies:

(2) OT exemplification

<table>
<thead>
<tr>
<th>Input: /X/</th>
<th>Constraint 1</th>
<th>Constraint 2</th>
<th>Constraint 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Candidate a</td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>Candidate b</td>
<td></td>
<td>*!</td>
<td></td>
</tr>
<tr>
<td>Candidate c</td>
<td>*!</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Candidates b and c violate constraints 2 and 1 respectively. Violations are marked with a star. These are fatal violations, marked with an exclamation mark. Once a candidate has fatally violated a constraint, it has no chance to be the optimal candidate. Violations are fatal for a candidate when another relevant candidate does not violate the same constraint. Take, for example, Constraint 2. Candidate c is not a relevant one because it fatally violates the higher ranked constraint 1. Of the two candidates a and b, only b violates constraint 2. This fact renders b’s violation fatal.
Note that all constraints are violable. Candidate 1 violates constraint 3, but this violation is not fatal, because candidate 1 is the only candidate left to evaluate. This fact is expressed by the shading: the shaded part of a tableau is of no consequence to the linguistic output.

Constraints are divided to two major groups: (a) Faithfulness constraints, which require identity between input and output, and (b) Markedness constraints, which impose unmarked surface representation. The term "marked" refers to linguistic phenomena which are relatively rare in world languages for perceptual and/or phonetic reasons. For example, an output \([kte]\) for the input \(/kte/\) in a language L violates no faithfulness constraint (i.e. it is "fully faithful"), but violates the markedness constraint *COMPLEX, which prohibits a complex sub-syllabic constituent (in this case onset).

Because constraints are considered to be universal, the optimal candidate is selected through the language-specific constraint ranking. If the ranking in L is \(\text{FAITH} >> \text{*COMPLEX},\) it means that in this language it is more important to be faithful to the input than to be unmarked, and the output form for the input \(/kte/\) will be \([kte]\). If the ranking is opposite, i.e. the demand for unmarkedness is more important than the demand for faithfulness, the optimal candidate will be one that does not violate *COMPLEX, \([ket]\) (via epenthesis) or less often \([te]\) (via consonant deletion).

As mentioned, faithfulness constraints seek some type of identity between an input and an output in terms of syllable structure, segment quality etc. Along the same lines, a faithfulness constraint may refer to just one aspect of a segment. for example, the segment \(a\) is \([-\text{HIGH}].\) If the constraint is \(\text{FAITH}^{10}[\text{HIGH}],\) then an output \([e],\) which is also \([-\text{HIGH}],\) may correspond to an input \(/a/\). An output segment \([i],\) however, may not, because it is \([+\text{HIGH}].\)

A faithfulness constraint may describe a correspondence relation between an input and an output (\(\text{FAITH}^{10}\), but also between an output and another output (\(\text{FAITH}^{oo}\)). Going back to \(/kte/\), this means that other words in the language, which do not necessarily have the input
/kte/, may influence the selection of an output. For example, if the output of /kte/ has to be faithful to another output [kta], and this need is more important than faithfulness to the input (FAITH\textsuperscript{OO} \gg FAITH\textsuperscript{IO}), then this output will be [kta]. The pioneering OT work in this respect is Benua's 1997 dissertation.

FAITH\textsuperscript{OO} describes a correspondence relation between two outputs only. However, as is a central argument of this paper, sometimes the tendency of a language is to render an output O identical in some respect to a group of other outputs, which somehow share a common characteristic with this output O. Such groups of outputs are called paradigms, and are dealt with through paradigmatic constraints.

Paradigmatic constraints, if so, express correspondences between groups of outputs. Treatment of paradigms is a later development of OT (see papers in Downing, Hall and Raffelsiefen 2005, Steriade 2000), but is central in the study of Semitic languages of late (Adam 2004, McCarthy 200, Bat-El 2005). Through these constraints, OT expresses the idea that linguistic knowledge is sensitive to paradigms. Back again to kte, suppose that this input belongs to a paradigm with the following outputs: \{[kte, kta, kti, kto, ktu]\}. Now, take for example a Paradigm Uniformity constraint PU\textsubscript{STRUCTURE} that states that "all members of the same paradigm must have the same prosodic structure." If the ranking of L places PU\textsubscript{STRUCTURE} above *COMPLEX, then an candidate [ket] for an input /kte/ will be less optimal than a candidate [kte], since the former's CVC structure is different form the CCV shared by the rest of the members of the paradigm.

In the course of the analysis it will be shown how paradigmatic relations are relevant in the restructuring of the morpho-phonology of Modern Hebrew verbs corresponding to Tiberian Hebrew verbs with guttural.
3.3. Related studies

To the best of my knowledge there are no studies concerned with Modern Hebrew paradigms involving the historical guttural.

One exception is Pariente (2005), which studies Modern Hebrew gutturals, but explores the Hebrew "Sephardic" dialect, in which these segments are surface true. Thus, in this dialect, phenomena that have to do with guttural sounds (i.e. epenthesis and lowering) are easily accounted for, given the phonetic realization of the guttural. But no paper - in OT or elsewhere in generative phonology - has ever explained why and how some of these phenomena made their way into general guttural-less Hebrew, or why and how some of these phenomena were not recovered.

Outside OT and Hebrew, Prunet (1996) explores historical changes regarding gutturals in the Semitic Gurage languages, spoken in and around Ethiopia. In this paper, Prunet shows how the historical pharyngeal fricative /h/ is produced nowadays as a low vowel [a]. He calls this vowel, which he also marks as a capital A, "a guttural vowel." He shows that this vowel has some guttural features, and - assuming a non-linear approach - claims that some roots in Gurage have such underlying guttural vowels.

In the chapters that follow, I analyse Hebrew as containing a vowel /a/ in lieu of the historical gutturals. This claim is similar to Prunet's, because it also assumes a historical change from a guttural to a low vowel. I do not call this a guttural vowel, since there is little of the guttural about it; I simply assume an input with the vowel /a/ where there once was some guttural /?;f;h/. Moreover, Tiberian Hebrew stems that had /h/, are shown to have /ax/ in MH stem-final cases; neither /a/ nor /x/ are guttural in my view, and they are simply there underlingly.

There are many differences between Hebrew and Gurage: most importantly, Gurage changed through history in a natural manner, whereas the Hebrew of today was recovered
from older stages of Hebrew (with many other influences, see Zuckermann forthcoming). Furthermore, Gurage has a stable consonant ꙃ. Prunet also claims that Gurage has an underlying distinction ꙃ≠ꙃ, both surfacing as ꙃ, although with different effects. Hebrew has no guttural sounds whatsoever.

Still, I owe Prunet's paper the basic notion in my analysis, namely the idea that some a's of Modern Hebrew, although underlying, are the recovered residue of historical gutturals.

4. G-Final verbs

4.1 Phenomena

Modern Hebrew G-final verbs, i.e. verbs corresponding to Tiberian Hebrew verbs with an underlying final guttural, differ from the whole verbs both prosodically and segmentally. In this section I present all the phenomena characterizing G-final verbs.

Prosodic word (stress and number of syllables): While whole verb stems do not exceed a disyllabic maximum (Bat-El 1994), G-final verbs, where G represents the historical gutturals ꙃ, ꙃ and ꙃ, are trisyllabic (יִגְדֶּה ‘drive crazy’, cf. יִגֶר ‘launch’) \(^2\). Moreover, while whole verb stems bear ultimate stress, which I assume is assigned by an iambic foot, these G-final verbs have penultimate stress.

Stem final syllable: While the final stem segment in whole verbs is a consonant, the final segment in A-final verbs (where A corresponds to the historical gutturals ꙃ and ꙃ) is the vowel a, which appears after the second VP vowel in Hebrew (יִגֶּה ‘drive crazy’, cf. יִגֶר ‘launch’). Historically, these two gutturals could not be preceded by a non-low vowel, and an

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\(^2\) The historical guttural ꙃ had no lowering effects when in stem-final position, and so is not considered in this section. It is worthwhile to mention that as a result, the Modern Hebrew correspondents of ꙃ-final stems are popularly confused with stems which have either a null or a weak third segment. For example, the historically ꙃ-final verb mile ‘to fill’ is pronounced [mila], like the y/Ø-final nika ‘to clean’.
epenthetic low vowel was inserted between the non-low VP vowel and the guttural (McCarthy 1989, 1994):

(3) A-final verbs: deviation from disyllabic ultimate stress pattern

<table>
<thead>
<tr>
<th>Binyan</th>
<th>Whole Stems</th>
<th>A-final Stems</th>
</tr>
</thead>
<tbody>
<tr>
<td>B3</td>
<td>/i.gér/ 'he launched'</td>
<td>/jigé.a/ 'he drove crazy'</td>
</tr>
<tr>
<td>B4</td>
<td>/i-g.bi.l/ 'he limited'</td>
<td>/i-g.bi.a/ 'he elevated'</td>
</tr>
<tr>
<td>B5</td>
<td>/it-pa.kéd/ 'he enrolled'</td>
<td>/it-pa.ké.a/ 'he burst'</td>
</tr>
</tbody>
</table>

The examples in (3) have the vowel a, which seems to take the position of the final consonant of the whole verbs. In spite of the fact that this a is a vowel, it is not part of the vocalic pattern, which stays intact. In addition, this a does not affect the position of stress, in the sense that stress stays on the second stem syllable, which is the final syllable in the whole verbs but penultimate in the G-final verbs. However, it does affect word size, rendering the unsuffixed verb trisyllabic.

The same deviation is found in verbs that contain the historical guttural h:

(4) X-final verbs: deviation from disyllabic pattern

<table>
<thead>
<tr>
<th>Binyan</th>
<th>Whole Stems</th>
<th>X-Final Stems</th>
</tr>
</thead>
<tbody>
<tr>
<td>B3</td>
<td>/jipér/ 'he recounted'</td>
<td>/sipé.ax/ 'he annexed'</td>
</tr>
<tr>
<td>B4</td>
<td>/i-kjiv/ 'he listened'</td>
<td>/i-kjí.ax/ 'he hardened'</td>
</tr>
<tr>
<td>B5</td>
<td>/it-pakéd/ 'he enrolled'</td>
<td>/it-paké.ax/ 'he sobered up'</td>
</tr>
</tbody>
</table>

*Verbs with a vowel initial suffix:* The examples in (3) and (4) are in the 3ms.sg. Past form, which does not have any suffix. Vowel-initial suffixes draw stress (except in B4 i-kjíax ‘he hardened’, which is not crucial here). When a vowel-initial suffix is added to the G-final verbs in (3) and (4), the non morphological a disappears, and so does the second vowel of the vocalic pattern. The latter also occurs in the whole verbs, and thus, the G-final verbs look like the whole verbs, though A-final verbs do not have a stem final (i.e. the third) consonant (for a discussion on the whole stem see Ussishkin 2000).
In addition, the *a* marked above in bold does not surface next to an *a* of the vocalic pattern. This is manifested in B1 and B2 past forms in (6) below. Furthermore, in the future forms of these binyanim, the final *a* affects the VP. In B1, whole stems may take either the vowel *o* or the vowel *a*. G-final stems never appear with the *o*, always with the vowel *a*. In B2, the whole stem's future vowel is *e*; G-final stems always have *a*:

(6) A/X-final stems in B1 & B2

<table>
<thead>
<tr>
<th>Past</th>
<th>Future</th>
</tr>
</thead>
<tbody>
<tr>
<td>A/X-final stems</td>
<td>Whole stems</td>
</tr>
<tr>
<td>B1</td>
<td>ſamá (*šámá.a) 'hear'</td>
</tr>
<tr>
<td>B2</td>
<td>ni-šmá (*nischmá.a) 'be heard'</td>
</tr>
<tr>
<td>B1</td>
<td>šaláx (*sama.ax) 'send'</td>
</tr>
<tr>
<td>B2</td>
<td>nišláx (*nislá.ax) 'to be sent'</td>
</tr>
</tbody>
</table>

(Note that the stems in (6) are G-final, as attested in their B1 participial form, *šoméa* 'to hear', *šoléax* 'to send')

**Verbs with a consonant initial suffix**: Unlike vowel initial suffixes, consonant-initial suffixes do not draw stress (e.g. šigú 'drive crazy 3pl.Past' vs. šigá-ti '1sg'). The behavior of
G-final stems before consonant-initial suffixes follow the pattern of the whole verbs, which display the vowel $a$ as the second vowel in their vocalic pattern in closed syllables. In these cases as well, the potential sequence of two $a$’s is eliminated.

(7) G-final verbs with a C-initial suffix

<table>
<thead>
<tr>
<th>Suffix</th>
<th>Whole stems</th>
<th>$A$-final stems</th>
<th>$X$-final stems</th>
</tr>
</thead>
<tbody>
<tr>
<td>-ti</td>
<td>$\text{jigér-ti} \Rightarrow \text{jigárti}$</td>
<td>$\text{jigéa-ti} \Rightarrow \text{jigáti}$</td>
<td>$\text{sipéax-ti} \Rightarrow \text{sipaxti}$</td>
</tr>
<tr>
<td>Past 1sg.</td>
<td>'launch'</td>
<td>'drive crazy'</td>
<td>'annex'</td>
</tr>
<tr>
<td>-ta</td>
<td>$\text{i-fkid-ta} \Rightarrow \text{ifkádta}$</td>
<td>$\text{i-fkia-ta} \Rightarrow \text{ifkáta}$</td>
<td>$\text{i-kjiax-ta} \Rightarrow \text{ikfáxta}$</td>
</tr>
<tr>
<td>Past 2sg.m.</td>
<td>'deposit'</td>
<td>'confiscate'</td>
<td>'harden'</td>
</tr>
<tr>
<td>-nu</td>
<td>$\text{it-pakéd-nu} \Rightarrow \text{itpakádnu}$</td>
<td>$\text{it-pakéa-nu} \Rightarrow \text{itpakánu}$</td>
<td>$\text{it-pakéax-nu} \Rightarrow \text{itpakáxnu}$</td>
</tr>
<tr>
<td>Past 1pl.</td>
<td>'enroll'</td>
<td>'burst'</td>
<td>'sober up'</td>
</tr>
</tbody>
</table>

It should be noted that the $a$ surfaces in all suffixless B3, B4, and B5 verbs, regardless of the existence or type of the prefix.

4.2 G-final verbs - Analysis

4.2.1 Past stems

As noted in §4.1, the $a$ appearing in G-final stems is historically - but not synchronically - motivated, given that today’s Hebrew does not have gutturals. I thus propose that what had been in the earlier stages of the language an epenthetic $\lbrack a\rbrack$ is now restructured as an underlying /a/.

Three important generalizations can be made to characterize all the forms in the previous section:

i. $A$ surfaces in unsuffixed forms; the VP stays intact (recall that $A$ does not surface in cases with historical $?$) ($\text{jigé.A} \text{‘drive crazy’}$, cf. $\text{jigé} \text{‘launch’}$).

ii. In forms with a V-initial suffix, $A$ is deleted. ($\text{jigá-ti} \text{‘drive crazy’}$, cf. $\text{jigár-ti} \text{‘launch’}$)
iii. When the *A of an input is next to a VP a, only one a surfaces. (*\textit{sama}, \textit{sama.a} ‘hear’, cf. \textit{amar} ‘guard’)

Two notions are central to my analysis. The first notion is the distinction between IO-correspondence and OO-correspondence. To express these relations, I use two types of faithfulness constraints, \textsc{maximality} (\textsc{max}) and \textsc{identity} (\textsc{id}). \textsc{max} constraints demand that each segment in the input (whether an underlying or surface form) have a correspondent in the output candidate (though not necessarily an identical correspondent). Given two corresponding segments, \textsc{id} constraints demand them to be identical. Either of these two constraint types may be specified for an OO or IO correspondence.

Using the same notions of Benua (1997), I claim that 3ms.sg. Past forms are subject to \textsc{max}^\textsc{io}, since these inputs are the bases for inflection; the rest of the forms, i.e. all conjugations in both future and past tenses, are subject to \textsc{id}^\textsc{oo}, which demands that they be identical to the 3sg.m past form. (8) shows this graphically:

(8) \begin{figure} 
\text{IO vs. OO correspondence} 
\end{figure}

The second central notion is the abovementioned Paradigm Uniformity (PU). A paradigm is a network of words related on two axes, a vertical one for the shared grammatical category and a horizontal one for the shared lexeme (Van Marle 2000). McCarthy (2005), in his analysis of Arabic verb paradigm, proposes PU constraints on the horizontal axis, i.e. that the correspondence relation is among forms which share a lexeme. In addition, his PU constraints are bi-directional, so that given a pair of paradigmatically related forms, either form may be the base of the other.
In my analysis I assume PU constraints on the vertical axis, i.e. among forms sharing the same grammatical category (but not the same lexeme). In Hebrew, this grammatical category is the inflectional category within each binyan. In addition, I assume a uni-directional relation, i.e. that a form from the paradigm of the whole verbs serves as the base for a G-verb in the same binyan, but not vice versa. In more simple terms, I am expressing the notion that speakers want G-stems to resemble whole stems, but not vice versa. There is no quantitative claim here: I am not saying that whole stems are bases because they are a majority in the language, but rather because speakers are aware of the fact that whole stems constitute the less problematic, most easily-accountable verb group in Hebrew. They are the most surface-true (all consonants surface in every form) and the most regular in terms of size (disyllabic) and stress (they are iambic, as most other Hebrew categories are).

As noted above, the main problematicity found in G-verbs is their deviation from patterns identified in the whole stems, like in the case of stem-size. Nevertheless, it was also mentioned that other aspects of the whole verbs are preserved in the G-verbs; for example, the VP \{i,e\} of the whole verb gidél 'grow' and its stressed vowel é are also present in the A-final stem figéa 'drive crazy'. Not only VP vowels and their stress pattern remain intact, but also the inflectional suffix. G-stems with V-initial suffixes, such as figú, are also identical to whole verbs in their vowel quality and in how these vowels are placed in feet. This is so despite the fact that -u is a suffix, not a VP vowel. That is, G-final verbs tend to retain the morphological vowels (of the VP and the suffix). I express all the notions above through two PU constraints, PUIMV (identical morphological vowels) and PUIMV-F (identical morphological-vowels-foot):
(9) PU constraint and their effects

a. **PUIMV** (identical morphological vowels)

Given an *G*-final verb and a whole verb sharing a binyan and an inflectional category, the *G*-final verb has the same morphological vowels as the whole stem.

b. **PUIMV-F**

Given an *G*-final verb and a whole verb sharing a binyan and an inflectional category, the morphological vowels of these two verbs have identical footing.

c. Relations and the PU effect

```
/ʃîgea/ (3sg.m.past)

[ʃîgea] IO [ʃîg-u],[ye-[ʃag-u], …

[ʃîgea] OO [ʃîg-u],[ye-[ʃag-u], …

[giːdl] [giːdl-u],[ye-[gadl-u], …
```

The diagram in (c) makes an important claim, namely that there is no correspondence between the inflected forms and an input. In other words, the inflected forms do not have an input, but rather are inflected forms of the 3sg.m output. This claim will hold throughout the analysis.

The PU constraints above mean that a G-verb must contain the same morphological vowels as the corresponding whole verb, and that these vowels must be arranged in feet in the same way that they are in the equivalent whole stem (feet are marked with `{}`). For example, The guttural verb /ʃibɛ]/a 'fixate 3ms.sg.' does not violate either of these constraints, because it has the same morphological vowels (in this case the VP vowels *i,e*) as the whole stem /giːdɛl/ 'grow (3ms.sg.)' (PUIMV), and these are contained within the same binary iambic foot, just like in the whole verb (PUIMV-F).
Now let us put these constraints to the test. In the case of the 3ms.sg. Past form, $\text{MAX}^{10}$ and the PU constraints rule out any other possibility than the fully faithful one. (10) demonstrates this for both B3 and B4 verbs (in the top left corner of each tableau, $I$ stands for 'input' and $P$ for 'paradigm', providing the parallel whole verb):

(10) Stem-final A- unsuffixed forms: B3 /jigè/ 'drive crazy', B4 [i-kfìa] 'harden'

<table>
<thead>
<tr>
<th></th>
<th>$\text{PUIMV-F}$</th>
<th>$\text{PUIMV}$</th>
<th>$\text{MAX}^{10}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>/jigè/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>/jigèá</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>/jigå</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>/jigè</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>$\text{PUIMV-F}$</th>
<th>$\text{PUIMV}$</th>
<th>$\text{MAX}^{10}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>/i-kfìax/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>/i-kfìa</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>/i-kfìax</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>/i-kfìx</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If so, in the 3sg.m. form, the optimal footing leaves an extrametrical final /a/: [{jigè}Fa]PrWd.

Note that only those candidates that are identical in both footing and quality of the morphological vowels survive the PU constraints. In addition, note that candidates (c) do not violate $\text{PUIMV-F}$ because the morphological vowel $i$ is the only vowel shared by the $A$-verb and the whole verb, and this $i$ is identically footed in both outputs. These candidates, however, violate $\text{PUIMV}$ because they do not have two vowels $i$ like those in the whole stem.

Recall also that I assumed (iambic) binary feet (i.e. a constraint Foot=Bin is undominated). In addition, the 3ms.sg. form does not provide us with the ranking of the constraints with respect to one another (the dotted line represents this), because all possible rankings provide the same optimal form, which does not violate any of the constraints.
We have also seen that a's are deleted in suffixed forms, when the suffix is V-initial. The ranking in (10) accounts for this phenomenon as well. Recall that MAX\textsuperscript{10} is irrelevant here, because the suffixed output has no 3sg.m. surface form as its base, as shown in (11). A more relevant constraint IDENT\textsuperscript{OO}, demanding that the outputs be identical, is crucially ranked below the PU constraints (the O in the top left corner stands for 'output', and there is no I ('input') form there):

(11) Stem-final A- V-initial suffixes

<table>
<thead>
<tr>
<th>O: [{jigé}a]</th>
<th>P: [{gidl-ú}]</th>
<th>PUIMV-F</th>
<th>PUIMV</th>
<th>IDENT\textsuperscript{OO}</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. {jigú}</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>b. {jigé}u</td>
<td></td>
<td>*!</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>c. {jigá}u</td>
<td></td>
<td>*!</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>d. {jí{gaú}}</td>
<td></td>
<td>*!</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>e. {jí{geú}}</td>
<td></td>
<td>*!</td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

Candidates b-e all violate PUIMV-F: in all of them, the shared morphological vowels i and u are not arranged in feet in the output candidates in the same manner that they are in {gidlú}. Note, however, that none of these candidates violates PUIMV, because they all have the vowels i and u. Candidate (a) does violate IDENT\textsuperscript{OO}, but by then it is already the optimal candidate.

The grammar maps X-verbs like the B3 form nicéAx-u 'to win 3pl. Past' to nicxú. The fact that of the two stem-segments a and x it is a that is deleted follows from the low vowel’s effect on the prosody, as can be seen in (12):

(12) Stem-final X- suffixed cases

<table>
<thead>
<tr>
<th>O: [nicéax]</th>
<th>P: [{gidl-ú}]</th>
<th>PUIMV-F</th>
<th>PUIMV</th>
<th>IDENT\textsuperscript{OO}</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. {nicxú}</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>b. ni{ca.ú}</td>
<td></td>
<td>*!</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>c. {nicá}u</td>
<td></td>
<td>*!</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>d. {nicá}xu</td>
<td></td>
<td>*!</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>e. ni{caxú}</td>
<td></td>
<td>*!</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>f. {nicé}axu</td>
<td></td>
<td>*!</td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>
As mentioned above, there are cases where A appears to coalesce with the VP a. One example is when C-Initial suffixes are attached to the A-final stem. I said that the A of-fitA seems to take the position of the last consonant in the whole verbs; why then is [figáti] 'drive crazy 1ms.sg. Past)’ not *[figaati] (cf. the whole verb figarti 'launch 1ms.sg. Past')? The tableau in (13) shows how, with the current set of constraints, both are optimal:

(13) Stem-final A: C-initial suffixes

<table>
<thead>
<tr>
<th></th>
<th>PUIMV-F</th>
<th>PUIMV</th>
<th>IDENTOO</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What is responsible for the emergence of only one [a]? I suggest that a lower-ranked markedness constraint judges in favor of the actual output, fitA. This constraint may be either Stem=Foot (i.e. the stem without the suffix must be the size of a foot) or an alignment constraint (Alignment constraints demand alignment of edges, in this case those of the stem and the foot); which constraint it is is not crucial to the point here. It is crucial that a long vowel is banned: the markedness constraint *LONGLONGVOWEL is almost never violated in Hebrew. It is also important to mention that the 2fm.sg. form fitA (cf. gidált) is reached through the same ranking.

This coalescence phenomenon may help in falsifying an underlying guttural. Consider, for example the surface form [fitA]. Historically, the input form was /fige/ with a final guttural / that could not be preceded by a non-low vowel. This yielded historical fitA. If we suppose that the same is true for Modern Hebrew, only that the guttural does not surface, we would...
have to explain other forms in which the sequence \[e]/\[l]/ does surface, as would be presented in the \(A\)-initial section. One such example is B4 \textit{e-elim} ‘disappear (caus.)’, which in MH surfaces as \[e\text{-elim}\]. Furthermore, if we wanted to say that Modern Hebrew has \[figea\] because \(\text{fige}/\) violates some \(\text{Gutt}/\) markedness constraint (i.e. no coda gutturals), we would have to explain why \[figati\], with an underlying form \(\text{figa}/\text{ti}/\), does not yield \[figa\text{-ati}\].

Alternatively, assuming two underlying gutturals - as was the historical case - i.e. an \(i\) that does not cause lowering and an \(l\) that does, is in my opinion far too abstract a goal for the learner of Hebrew. Moreover, such an account suggests two different underlying segments in order to avoid assuming a non-morphological vowel in the underlying representations (as my proposal does). With this objective, \(X\)-cases would also have to be accounted for in the same way: Hebrew learners would also have to assume an underlying \(h\) that causes lowering \[niceax\] but never surfaces, contrasted to an underlying \(x\), which always surfaces but never requires lowering.

This, too, is improbable. As §5 will show, the distiction \(x\) vs. historical \(h\) no longer exists in stem-initial cases. This points to its non-existence in Hebrew in general, and renders the claim for an underlying difference between the two fricatives even more poorly-supported than the claim for an underlying glottal.

### 4.2.2 Past-Future correspondence

I had mentioned earlier that future forms are derived from past forms. Apophony is crucial here. Consider for example the B3 \(X\)-final pair \textit{simeax} \(\rightarrow\) \textit{ye-sameax} 'make happy (3sg.m. Past-Future)'. This is one case of the most common apophony in the Hebrew verbal system,
namely $i \Rightarrow a$. Apophony is performed on the base past form, yielding the future form. However, as (14) shows, the ranking established above does not account for preference of the deviant (in terms of size) yesameax over yesamex, which does not have the base verb's $[a]$.

IDENT$^{oo}$ judges in favour of yesameax. This constraint must be ranked above the size constraint mentioned above, as (14) shows. It also has to be a graded constraint, i.e. a constraint that is sensitive to quantity of violations: all candidates are starred for the $i \Rightarrow a$ apophony; but besides that, the most faithful candidate (a) is optimal:

(14) A-final stems: Future 3sg.m.

<table>
<thead>
<tr>
<th></th>
<th>O: [{simé}ax]</th>
<th>P: [ye-{samén}]</th>
<th>PU$_{IMV-F}$</th>
<th>PU$_{IMV}$</th>
<th>IDENT$^{oo}$</th>
<th>ALIGN (STEM,FOOT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>ye{samé}ax</td>
<td></td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>ye{saméx}</td>
<td></td>
<td>*</td>
<td>**!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td>ye{samáx}</td>
<td></td>
<td>*!</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d.</td>
<td>yesa{meáx}</td>
<td></td>
<td>*!</td>
<td>*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note that candidates with no apophony will be ruled out by PU$_{IMV}$ for not having the same morphological vowels as the whole stem.

All future forms that have only a prefix (and no suffix) are explained in this way. But what about those with suffixes? In fact, the situation is similar to that in the suffixed past tense form, as (15) demonstrates:

(15) A-final verbs: Future 3sg.m.

<table>
<thead>
<tr>
<th></th>
<th>O: [siméáx]</th>
<th>P: [ye-{samn-ú}]</th>
<th>PU$_{IMV}$</th>
<th>IDENT$^{oo}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>ye{samxú}</td>
<td></td>
<td>***</td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>ye{samé}xu</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td>ye{samé}xu</td>
<td></td>
<td>*!</td>
<td>*</td>
</tr>
<tr>
<td>d.</td>
<td>yesa{mxú}</td>
<td></td>
<td>*!</td>
<td>*</td>
</tr>
<tr>
<td>e.</td>
<td>yesa{mxú}</td>
<td></td>
<td>*!</td>
<td>*</td>
</tr>
<tr>
<td>f.</td>
<td>ye{same}xu</td>
<td></td>
<td>*!</td>
<td>*</td>
</tr>
</tbody>
</table>

In (15), too, any candidate whose morphological vowels are shared by the whole verb and are not metrically arranged as those of the whole verb, is ruled out. Note that candidates (e) and (f) have feet with the same structure and vowel quality, but these are not made up of the specific
vowels that correspond to the whole stem's vowel. Even though (a) violates IDENT\textsuperscript{OO}, the latter is too low-ranked to matter.

Another apparent coalescence case is found in B1 and B2. The next subsection is dedicated to it.

4.2.3. Underlying coalescence cases- B1, B2

The account given up to this point is well-fitted for B3, B4 and B5. These three binyanim have been recognized as a group before (Adam 2002, to name one), as the prosodically non-alternating ones, because their prosodic structure does not alternate throughout the inflectional paradigm. This subsection deals mainly with one other important issue that arises from B1 and B2, the prosodically-alternating ones.

In the previous section, I claimed that G-verbs are subject to paradigmatic relations with regular verbs. \textit{A}-final forms in the non-alternating binyanim were shown to deviate from the disyllabic pattern of whole stems. In (16), it is shown that the VP of the (3m.sg.) future form in B1 and B2 changes in \textit{A}-final stems, but does not deviate from the whole stems' disyllabicity, as happens in the other three binyanim. In B1 and B2, the second VP vowel seems to either disappear or coalesce with \textit{A} (\textit{X}-cases behave in the same way):

\begin{tabular}{|c|c|c|c|c|}
\hline
 & Past & & Future & \\
 & A-Final & cf. & A-Final & cf. \\
\hline
B1 & \textperthousand jama (*jama.a) & \textperthousand jamar & yi-\textperthousand fma (*yi\textperthousand fmo.a) or *yi\textperthousand fma.a) & yi-\textperthousand fmor/yi-gdal \\
 & \textquoteleft hear\textquoteright & \textquoteleft guard\textquoteright & & \\
\hline
B2 & ni-\textperthousand fma (*ni\textperthousand fma.a) & ni-\textperthousand fmar & yi-\textperthousand fma (*yi\textperthousand fame.a) & yi-\textperthousand famer \\
 & \textquoteleft heard\textquoteright & \textquoteleft guarded\textquoteright & & \\
\hline
B3 & \textperthousand gig\textperthousand e.a & \textperthousand jiger & ye-\textperthousand jag\textperthousand e.a & ye-\textperthousand jag\textperthousand e \\
 & \textquoteleft drive crazy\textquoteright & \textquoteleft launch\textquoteright & & \\
\hline
B4 & i-\textperthousand fim\textperthousand i.a & i-\textperthousand fim\textperthousand in & ya-\textperthousand fim\textperthousand i.a & ya-\textperthousand fim \\
 & \textquoteleft hear (causative)\textquoteright & \textquoteleft fatten\textquoteright & & \\
\hline
B5 & it-kab\textperthousand e.a & it-kabel & yit-kab\textperthousand e.a & yit-kabel \\
 & \textquoteleft fixate (intrans.)\textquoteright & \textquoteleft be received\textquoteright & & \\
\hline
\end{tabular}
First, note that whereas in the guttural verbs the past 3sg.m may be considered as the base for the future 3sg.m (where there is always an [a]), the whole verbs undergo apophony "on the way" from the past to the future.

Secondly, note that it is not possible to claim that these B1 and B2 forms do not have a third segment, since such a segment surfaces elsewhere (in the present participle form āomeA ‘hear’, and in other binyanim with related meaning such as in the pair āama (B1) 'be heard' and hifmīA 'hear (caus.)')

Let us start then with B1 Past forms. Why does the A not surface at the edge of the stem, to yield, for example, āama. I claim here that in B1 the second [a] of āama corresponds just to the non-morphological A, and not to a VP a.

To prove this point, consider the following data: B1 has a group of monosyllabic verbs, which may be analysed to contain only two segments. This group is presented in (17):

(17) Monosyllabic verb of B1 vs. whole verbs

<table>
<thead>
<tr>
<th>MonoSyll.</th>
<th>Reg.</th>
</tr>
</thead>
<tbody>
<tr>
<td>āav</td>
<td>āaxav</td>
</tr>
<tr>
<td>āam</td>
<td>āam</td>
</tr>
<tr>
<td>āav</td>
<td>āaxav</td>
</tr>
</tbody>
</table>

The point here is that these stems, even though they have only one a, do not violate Paradigm Uniformity as to the vocalic pattern. The learner, I claim understands the VP of B1 as containing one vowel, {a}. When the VP {a} is applied to a regular stem, it must be copied to prevent illicit clusters such as āaxv. But when the VP is applied to the biconsonantal stems in (17), the number of consonants leaves no reason for copying it to create āava, for example. Likewise, when the underlying segments of a stem are {f,m,A} there is no reason for copying the VP vowel. PUIMV-F is satisfied because the foot structure is {a,ā}, just like in āamār, and the underlying form is simply āamA ‘hear’. The same low ranked size-constraint
mentioned in (13) above, now specified as ALIGN(FOOT, STEM), rules out a candidate *jamaa* (I mark the input with a capital A because it does surface as distinct from the vocalic pattern elsewhere):

(18) \textit{A}-final B1 Past form

<table>
<thead>
<tr>
<th>I: /j'amA/</th>
<th>PUIMV-F</th>
<th>PUIMV</th>
<th>MAX\textsuperscript{IO}</th>
<th>ALIGN(F,S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. {j'amá}</td>
<td></td>
<td></td>
<td></td>
<td>!</td>
</tr>
<tr>
<td>b. {j'amá}a</td>
<td></td>
<td></td>
<td></td>
<td>!</td>
</tr>
<tr>
<td>c. {j'am}</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Moving on to Future B1 forms, it was shown in the beginning of this subsection that the VP of the whole stems' future forms is either \{o\} (cf. *yifmór 'guard') or \{a\} (cf. *yigdál 'grow (intrans.)'). Although the former is the productive one, many verbs take the latter as their VP, some of them completely unmotivatedly. I conclude from this that B1 3sg.m. future forms, as opposed to those of other binyanim, are lexical. It also follows from this fact that a PU constraint should not rule out \textit{A}-final forms if they include a VP \{a\} rather than \{o\}. If so, B1's future 3sg.m also has an input, unlike the future 3sg.m. forms in the non-alternating binyanim. All other things being equal, the most faithful candidate wins through lower ranked IDENT\textsuperscript{IO}, which demands that all segments in input forms have identical correspondents in output forms:

(19) \textit{A}-final B1 Future form *yifma 'hear (3sg.m.)'

<table>
<thead>
<tr>
<th>I: /yifmA/</th>
<th>PU</th>
<th>PUIMV</th>
<th>MAX\textsuperscript{IO}</th>
<th>IDENT\textsuperscript{IO}</th>
<th>ALIGN(F,S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. {yifmá}</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. {yifmó}a</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>!</td>
</tr>
<tr>
<td>c. {yifmó}</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>!</td>
</tr>
<tr>
<td>d. {yifmé}</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>!</td>
</tr>
</tbody>
</table>
Note that this is not problematic for whole stems, whose input now is specified with an \{o\} (Thes PU constraints are not relevant for whole stems since there cannot be a correspondence relation between a stem's output and itself):

(20) Whole verb B1 Future form yi翻身 ‘guard (3sg.m.)’

<table>
<thead>
<tr>
<th>I: /yi翻身/</th>
<th>MAX$^{Io}$</th>
<th>IDENT$^{OO}$</th>
<th>IDENT$^{Io}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. {yi翻身már}</td>
<td>_ _ _ _ _ _ _ _ _</td>
<td>_ _ _ _ _ _ _ _ _</td>
<td>*!</td>
</tr>
<tr>
<td>$^x$b. {yi翻身mór}</td>
<td>_ _ _ _ _ _ _ _ _</td>
<td>_ _ _ _ _ _ _ _ _</td>
<td>_ _ _ _ _ _ _ _ _</td>
</tr>
</tbody>
</table>

It is worthwhile to point out that another account is possible, wherein it is only $A$-stems that do not have a future input. Under this account, the output correspondent for the future 3sg.m yi翻身 is the past 3sg.m. [sama], and IDENT$^{OO}$ rules out any candidate that does not have the a (*yi翻身mo). *yi翻身moa is ruled out in the same way as in (19). But this would obligate us to claim that the more productive system (i.e. whole verbs) has a double input, whereas special cases (i.e. $G$-verbs) are simpler; in my opinion, this is less probable.

Finally, V-initial suffixed future forms behave exactly like whole stems, only without the third consonant:

(21) A-final Future forms with V-initial suffix

<table>
<thead>
<tr>
<th>Whole stems</th>
<th>A/Ax-final stems</th>
</tr>
</thead>
<tbody>
<tr>
<td>3sg.m.</td>
<td>3pl.</td>
</tr>
<tr>
<td>yi翻身</td>
<td>‘guard’</td>
</tr>
<tr>
<td>yikroc</td>
<td>‘wink’</td>
</tr>
<tr>
<td>yi翻身kon</td>
<td>‘dwell’</td>
</tr>
<tr>
<td>yinvol</td>
<td>‘wilt’</td>
</tr>
</tbody>
</table>

The vowel $e$ in all the plural forms above is traditionally considered to be epenthetic and the result of the illicit cluster in, for example, *yi翻身knu. This is a case of opacity - if we consider the plural form to be based on the singular one - since there is no apparent reason as to why this vowel should not be the $o$ of the yi翻身kon. Still, this is beside the point; regardless of the status
of this vowel, it is there in the plural whole verb *yiʃkenu*, and the previous ranking predicts correctly that it will also be there in G-verbs *yiʃmeu*:

(22) A-final B1 Future form: plural

<table>
<thead>
<tr>
<th></th>
<th>O: [yiʃ{ma}]</th>
<th>PU IMV-F</th>
<th>PUIMV</th>
<th>IDENT oo</th>
<th>ALIGN(F,S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>yiʃ{me}u</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>yif{m}u</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td>yiʃ{ma}u</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>

Two other problems are posed by B2: first, just like in B1, the 3sg.m. Past form *nisma* 'be heard' displays no apparent *A*, even though a non-morphological *A* is present elsewhere with this lexeme, as I have shown. Now, assuming – as I did for B1 Future forms - that underlying *A*-final forms in B2 Past include both a VP *a* and the the non-morphological *A*, my ranking predicts correctly, with the crucial addition of ALIGN(F,S) >> IDENT10:

(23) B2 lexical form

<table>
<thead>
<tr>
<th></th>
<th>I: /niʃmaA/</th>
<th>PU IMV-F</th>
<th>PUIMV</th>
<th>MAX10</th>
<th>IDENT oo</th>
<th>ALIGN (F,S)</th>
<th>IDENT 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>niʃ{ma}</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>niʃ{ma}a</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td>niʃ{amê}a</td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d.</td>
<td>niʃ{mê}</td>
<td></td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The same ranking will also predict correctly if for some reason the underlying form contained only one *a*. I do not wish to follow this path because it renders inexplicable the deviation in B2 future forms. *X*-final stems, though not shown here, follow the same principle and may be accounted for in the same way.

B2's future form is more problematic, because its VP vowel is *e* and not *a*, and yet it coalesces with the *A* of *A*-final stems just like the VP *a*’s above: the surface form is *yi-fama* 'be heard' and not *yiʃamêa*. Further discussion on this problem is postponed to an appendix,
for two reasons: (1) its account is lengthy and not complete; (2) B2 in general is showing
signs of gradual disappearance in Hebrew. One of these signs is that very few of its forms are
used in everyday speech in verb form, a fact that can ease systematic anomalies for the
learner: there are simply very few B2 $A$-final forms to memorize.

### 4.3 A note on minimal pairs

The $A$-final paradigm contrasts minimally with another vowel-final paradigm, in which the
final vowel is either that of the vocalic pattern (in the future) or a different vowel altogether
(in the past). (24) demonstrates this in the 3sg.m. form:

(24) $A$-final stems vs. $V$-final stems (Past-Future pairs)

<table>
<thead>
<tr>
<th>Binyan</th>
<th>$V$-final stems</th>
<th>$A$-final stems</th>
<th>Whole stems</th>
</tr>
</thead>
<tbody>
<tr>
<td>B3</td>
<td>a. ñinâ - yeñané 'change'</td>
<td>ñinéa - yeñanéa 'move'</td>
<td>ñinén - yeñanén 'learn by heart'</td>
</tr>
<tr>
<td>B4</td>
<td>b. isi - yasi 'marry'</td>
<td>isía - yasia 'drive'</td>
<td>isir - yasir 'remove'</td>
</tr>
<tr>
<td>B1</td>
<td>c. kará - yikré 'happen'</td>
<td>kará - yikrá 'ear'</td>
<td>ñamár - yîjmor 'guard'</td>
</tr>
</tbody>
</table>

In addition, because $X$ is a residue of the historical change $h \rightarrow x$, it now contrasts
minimally with regular $x$-final stems:

(25) $X$-final stems vs. regular $x$-final stems (Past-Future pairs)

<table>
<thead>
<tr>
<th>Binyan</th>
<th>$x$-final stems</th>
<th>$X$-final stems</th>
<th>Whole stems</th>
</tr>
</thead>
<tbody>
<tr>
<td>B3</td>
<td>a. siméx - yesaméx 'rely'</td>
<td>siméax - yesaméax 'make happy'</td>
<td>simén -yesamén 'mark'</td>
</tr>
<tr>
<td>B4</td>
<td>b. ifríx - yafrix 'falsified'</td>
<td>ifríax - yafríax 'blow in the air'</td>
<td>ifríd - yafríd 'separate'</td>
</tr>
<tr>
<td>B2</td>
<td>c. jafâx - yîjpox 'spill'</td>
<td>saláx - yislax 'forgive'</td>
<td>ñamár - yîjmor 'guard'</td>
</tr>
</tbody>
</table>

In both (24) and (25), the first two examples are from the non-alternating binyanim. In
these, there is no danger of mapping a form that does not contain $/A/$ to one that does (e.g.
$simex \rightarrow *simeax$ or $isi \rightarrow *isía$), because the input form, i.e. the past 3sg.m, is different.
However, in B1 (the (c) examples) the past form is identical. How can a speaker know that the
future form of one kara is yikre and of another kara is yikra? A complete account for the V-final stems is easily a matter for another paper (or a dissertation- see Sumner 2003)\(^3\), and I will not go into it; recall, however, that I said that B1 future 3sg.m. also has an input, and does not rely on the past 3sg.m. output. This way, there is no problematicity in the two distinct future forms (yikra, yikre) of a single past form (kara).

The distinction \(X\)-\(x\) is identical. In the non alternating binyanim, the whole stem input simex 'rely' and the \(X\)-stem input simex\(^x\) 'make happy' differ only in the non-morphological vowel \(a\) that the latter has. IDENT\(^10\) will rule out any candidate for \(/\text{simeax}/\) that does not have this \(\lbrack a\rbrack\), and ALIGN(F,S) will rule out a candidate \(/\text{siméax}/\), since this will result in misalignment of stem and binary foot. In the alternating binyanim, as I said, there is no problem, because these also have future inputs.

### 4.4 A note on historical final \(h\)

Historically, most of the examples shown in this section had either \(\breve{a}\) or \(h\) as the third consonant. Indeed, very few \(h\)-final verbs existed in earlier stages of the language. Five still exist in Modern Hebrew, of which only two belong to the common register: \(i\)-tmia 'puzzle' and \(i\)-gbia 'elevate' (historically \(hi\)-tmia\([h]\) and \(hi\)-gbia\([h]\)). These exist only in B1, B4 and in some adjectives, and behave exactly like the other A-final stems in this section.\(^4\)

The (minimally-contrasting) vowel-final forms described in §4.5 have been referred to traditionally as \(h\)-final, but this was a result of Hebrew script, in which final open syllables were represented with the same letter \(<\pi>\) that stood also for the phoneme \(h\).

---

\(^3\) Note Past forms of the V-final paradigm do not straightforwardly act as \(C_2\)-less verbs. For example yefane-fina 'change' (cf. yefager-figer 'launch'). But this is not the topic of this paper.

\(^4\) The other three forms, in B1: nagá 'illuminate', kamá 'yearn', maa 'fade (trans.)' All these had a final \(h\) in Biblical Hebrew.
4.5 Negating a diphthong account

As has been noted to me by Charles Kisseberth, the two final vowels of *figéa* could be regarded as a diphthong. A few arguments stand against this view:

First, *éa* diphthongs are very marked in the languages of the world, because none of the vowels glide. When they do appear, it is either the case that one of the vowels glides (Rumanian) and/or that they are accompanied by a diphthong system much more developed than that of Hebrew. Furthermore, diphthongs are much more commonly stressed on the more sonorous segment than on the less sonorant one, such as the *e* in *éa*.

Thirdly, a diphthong account is very hard to falsify. More specifically, nothing can prove that *éa* is not a diphthong. It has been proposed to me to look into poetry, but I think that Hebrew poetry, which is strongly influenced by comme-il-faut language, does not constitute hard evidence in synchronic investigation,

We may profit from a diphthong account in two ways. First, previous studies on the Hebrew verbal system made use of the constraint ONSET, demanding that all syllables have onsets, in order to explain the alignment of consonants and VP. Assuming *ea* is not disyllabic, but rather a diphthong, entails no ONSET violations. However, identical onset violations abound in Hebrew, with stress on the *a*. Consider the following minimal pairs:

\[
\begin{array}{llll}
(26) & \text{éa vs. éá - minimal pairs} \\
 & \text{a. méa} & \text{'a hundred'} & \text{meát} & \text{'a little'} \\
 & \text{b. léa} & \text{(proper noun)} & \text{léá} & \text{'tired(f.)'} \\
 & \text{c. géa} & \text{(proper noun)} & \text{geá} & \text{'proud (f.)'}
\end{array}
\]

Considering the data above, I would now have to assume both a diphthong *éa* and an ONSET-violating *eá*. If I wished to claim that both are diphthongs, I would now have to explain the difference in stress. I believe that a disyllabic account is more surface-true and less expensive
to the whole system. In addition, computerized recording I have conducted proved that éa and eá are identical in length and quality, disregarding stress effects.

Another profit that can be made through a diphthong approach has to do with word size. Hebrew verbs do seem to follow a disyllabic pattern, commonly expressed in OT through Word/Stem=Foot. If éa is a diphthong, then figéa 'drive crazy' does not deviate from the acknowledged disyllabic pattern. The more acceptable approach today is to express the notion of disyllabicity through numerous alignment and markedness constraints (see, for example, Ussishkin and Graf 2002). This is what I did in my account, making no reference to a general word-size constraint; the PU and alignment constraints on their own succeeded in accounting for the word-size deviations with little problematicity.

All the above does not serve to say that a diphthong account is not possible (I have mentioned that I cannot prove that); I claimed here only that such an account is neither probable nor profitable.

4.6 G-final verbs - Summary

In this chapter, stems with historical gutturals were shown to contain an underlying /A/ in the case of ṣ and h, and the same underlying /A/ along with a regular Hebrew x in the case of historical h. Output forms were shown to be the result of constraints on paradigmatic relations. An underlying guttural account was claimed to be not only complex, but also opaque.
It is important to mention that whereas A-final verbs are quite stable in Hebrew, X-final ones are often confused with regular x-final whole verbs and vice versa. This is mostly apparent in the present participle form, not presented in this paper. Why is it that speakers seek to unify the X-paradigm but not (or by far much less so) the A-paradigm? The X-initial account in §5 may provide an answer.

5. G-initial verbs

Up to this point, I have discussed cases which resulted from the historical recovery patterns \( ?, ?, h \rightarrow \emptyset \) and \( h \rightarrow x \). (Note, again, that historical \( ? \)-final stems were not included chapter 4, because historically they resulted in deletion of \( ? \) and not lowering). In Tiberian Hebrew, \( ?, ?, h \) and \( h \) appeared also stem initially. Owing to the recovery patterns, \( ?, ?, h \) are not pronounced in MH when in onset position. However, they are retained in some form when in coda position, not necessarily as \( [a] \). This section presents the data and explores the options for their analysis.

---

5 Consider the following:

(+)

<table>
<thead>
<tr>
<th>Paradigm</th>
<th>sg.m.</th>
<th>sg.f.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-final</td>
<td>[jomea] ‘hear’</td>
<td>[joma-at] (<em>[jomeet]</em>)</td>
</tr>
<tr>
<td>X-final</td>
<td>[foxeax] ‘forget’</td>
<td>[foxax-at] ( \sim /[foxex-et]/ )</td>
</tr>
<tr>
<td>x-final</td>
<td>[corex] ‘necessitate’</td>
<td>[corex-et] ( \sim /[corax-at]/ )</td>
</tr>
<tr>
<td>cf. whole stem</td>
<td>[codek] ‘be right’</td>
<td>[codek-et]</td>
</tr>
</tbody>
</table>

Note that the italicized forms are highly colloquial and deemed uneducated. They surface very seldom, and speakers usually correct themselves. Still, no such variation exists in A-final forms.
5.1 Phenomena

In verb-initial position, the historical gutturals do not display idiosyncratic behavior, since they are always followed by a vowel. Verbs with initial historical gutturals may either have a glottal stop ?axal 'eat' (in careful speech) or be onsetless, e.g. axal. The question that arises in this respect is whether a verb-initial glottal is phonemic or inserted (in careful speech) to rescue an onsetless syllable. However, when such stems are preceded by a prefix (i.e. they are stem-initial but not verb-initial), a vowel is inserted. This epenthesis is reminiscent of Tiberian Hebrew’s restriction on gutturals in coda position (McCarthy 1989, 1994). (27) presents the MH phenomena:

(27) A-initial stems- 3sg.m forms

<table>
<thead>
<tr>
<th>Past</th>
<th>Future</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-stems</td>
<td>Whole stems</td>
</tr>
<tr>
<td>B1 amád</td>
<td>'stand'</td>
</tr>
<tr>
<td>B2 ne-emád</td>
<td>'stand still'</td>
</tr>
<tr>
<td>B3 iméd</td>
<td>'paginate'</td>
</tr>
<tr>
<td>B4 e-emíd</td>
<td>'stand(trans.)'</td>
</tr>
</tbody>
</table>

Two phenomena are important to note here: firstly, from a synchronic perspective, like the G-final cases, the bolded forms also deviate from the well-attested regular disyllabic stem-size. Secondly, prefix vowels display lowering when compared to the whole verbs.

One historical fact is worth mentioning here: the past forms of B2 and B4 had, in Biblical Hebrew, a [V,GV,C] sequence (e.g. neʃema:d), that resulted from an illicit /VjGC/ (e.g. /niʃma:d/), possibly because the epenthetic vowel after a guttural could not be i. In the future form of B2, however, the guttural was not in coda position, and the input was /yi-ʃame:d/.

6The B4 cases are a little more complicated than presented here: in the regular paradigm, there is alternation between i and e (ʃfim~ʃemin) because of other influences. However, in the A-initial paradigm the vowel is always e.
Still, the guttural could not be geminated, as was required of this position (cf. yippare:c, *yifare:c 'be broken'), and thus the short [i] was lengthened into long e:, and the form was ye:ame:d (Gesenius 1910). In Modern Hebrew there are no length distinctions and no gutturals, but B2 prefix vowels in A-stems were recovered as e in both future and past.

Back to (27), note that the four forms in the table stand in strong semantic relation and display an irrefutable segmental similarity; it is not likely that they are not of the same lexeme. However, there is much variation: the initial stem segment is a in B1 amad, i in B3 imed, and e in B2 -emad and B4 -emid. Moreover, the stem - whatever it be - has different effects on the prefix vowel: B1's future vowel [i] surfaces as [a], and all B2's prefix vowels surfaces as [e], as does B4's past vowel /i/.

In my following analysis, I propose that the common stem is AmVd, where the A is a non-affix segment. I so propose because if the first segment were, say, an unspecified vowel V, it would be difficult to predict the lowering effects on this paradigm's prefixes. Albeit the abstractness of this claim, it is shown to predict correctly in the next two sections.

5.2 G-initial verbs - Analysis

In this subsection, I show how those verbs which had a stem-initial guttural ? , h in Tiberian Hebrew can be analysed as A-initial. ? , h. All cases in which the stem-initial is not a are explained through independent vowel interaction constraint. Verbs with initial historical h are shown to have merged with whole verbs.

5.2.1 Prosody

Let us start with B1. Along the lines of the solution to B1 A-Final stems, I again suggest that the A of A-initial stems is indistinguishable from the VP a, which is simply not copied in
guttural stems as it is in whole stem. (28) shows that there is no need to copy it, and a candidate that does is less optimal than one that doesn’t:

(28) Stem initial A- B1

<table>
<thead>
<tr>
<th>I: /Amad/ P: [{gadál}]</th>
<th>PU IMV-F</th>
<th>PUIMV</th>
<th>MAX 10</th>
<th>ALIGN (STEM,FOOT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. {amád}</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. a{amád}</td>
<td></td>
<td></td>
<td></td>
<td>*!</td>
</tr>
<tr>
<td>c. {mád}</td>
<td></td>
<td>*!</td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

Like in the A-final cases, it is the alignment constraint that prohibits the surfacing of two a’s.

However, prefixed forms create a problem. PUIMV demands that the morphological vowels of A-stems be identical to those of the whole stems. This demand is violated as a result of the stem being vowel-initial: B2 ne-emád ‘stand still (3sg.m.Past)’ has a VP different from the whole stem’s /i,a/ (in nimár ‘be guarded’, for example). This, as (29) shows, yields the wrong output:

(29) Stem initial A- B2

<table>
<thead>
<tr>
<th>I: /ni-Amad/ P: [{ni[bár]}]</th>
<th>PU IMV-F</th>
<th>PUIMV</th>
<th>MAX 10</th>
<th>ALIGN (STEM,FOOT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ne-{emád}</td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. ni-{imád}</td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. {ni-mád}</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

However, note that in the whole verb nifbar, the prefix ni- and the stem are well aligned. Now, following the assumption that the stem is AmVd, The prefix ni- in *ni-mad is simply not aligned with its stem. Ranking a prefix-stem alignment constraint above the PU constraints accounts for the phenomenon (with no bearing on regular, well-aligned stems such as ni-fbar):
This ranking expresses the idea that even though it is more costly to lose the metrical structure than to keep an input segment (PU >> MAX^lo), it is even more costly (also in terms of stem-recognition, if you will) to lose this segment through prefixation, because then the prefix is not aligned with the stem (ALIGN_{(Prefix,R, Stem,L)} >> PU). In terms of perception, whereas in the stem-final cases an omitted /A/ leaves a syllable boundary (or ONSET violation, in /fige]{a, for example), in a non-aligned A-initial candidate (*ni-mad) such a syllable boundary will not be perceived as resulting from the stem, because it does not cause an onset violation. All that aside, this ranking holds for B1, B2 and B4; B3, where there is no prefix and an initial a does not surface, will be returned to later.

Minimal pairs that result from the non-recovery of ?f, h support the alignment argument. Like A-final verbs, A-initial verbs now also contrast minimally with another common verbal paradigm, again the monosyllabic one. A-initial stems have an initial vowel, whereas the monosyllabic paradigm does not. This contrast is most apparent in B4 forms (the prefix vowel is e- in these forms, rather than i-):

(31) A-initial stems vs. monosyllabic stem (B4)

<table>
<thead>
<tr>
<th>Monosyllabic stems</th>
<th>A-initial stems</th>
<th>Whole stems</th>
</tr>
</thead>
<tbody>
<tr>
<td>e-ric ‘run (caus.)’</td>
<td>e-eric ‘admire’</td>
<td>i-fric ‘spawn’</td>
</tr>
<tr>
<td>e-pil ‘drop’</td>
<td>e-epil ‘scale’</td>
<td>i-fpil ‘humiliate’</td>
</tr>
<tr>
<td>e-sik ‘conclude’</td>
<td>e-esik ‘employ’</td>
<td>i-fsik ‘tease’</td>
</tr>
</tbody>
</table>

7 In some dialects, all B4 prefixes in the monosyllabic cases surface as i-. This is besides the point of this paper.
Because the first segment of the monosyllabic stem is a consonant, the prefix is well-aligned; however, in the A-initial stems, the prefix must be aligned with this /A/.

Note that an account with an underlying glottal may solve these problems with less difficulty, by simply stating a *Gutt* constraint. Such an account will have to explain, however, why in stem-final position, with a suffix, this glottal disappears entirely (as mentioned above in *figa*-ti, *figaa*-ti), whereas in stem-initial position its deletion leaves an epenthetic vowel. This problem would be added to the general problematicity of the underlying glottal account: its opacity. Such an account assumes a guttural which first causes epenthesis because it cannot stand in a VGC sequence, and then disappears altogether. This is an opaque, two-stage account, problematic for the non derivational approach of Optimality Theory.

5.2.2 Vowel quality

This subsection shows how, under a glottal-less analysis, the quality of the prefix vowels and the actual segment that corresponds to /A/ is the result of vowel interaction and hiatus constraints. Consider the independent data of the bound morpheme /mi-/ 'from/than':

(32) Distribution of mi-

i. mi-london  'from London'  v. m{ɪ~e}-oren  'from Oren'
ii.mi-yugoslavia  'from Yugoslavia'  vi. me-erkules  'from Hercules'
iii. mi-carfat  'from France'  vii. me-argentina  'from Argentina'
iv. m{ɪ~e}-ima  'from mother'

The underlying vowel i may lower to e before another vowel, but must lower before a and e. I suggest the ad-hoc constraint *[ia] for the latter and *V_iV_j for the former. The reason that (vii) isn't *ma-argentina, with /i/ becoming [a], I take to be a faithfulness-to-hight constraint: i can turn into e, because they are both [-low], but it cannot turn into a since it does not share any height feature with a (i is [+high, -low] and a is [-high, +low]). I express this through
because of FAITH, demanding that corresponding segments share a height feature value. The a of argentina does not change because of some faithfulness to stem vowels.

An account with an underlying glottal would have to either assume the same constraints along with vowel harmony across glottals, or assume i → e lowering before glottals, in which case it would be hard to account for the variation in (iv) and (v). Once again, I find it better to rely on surface segments than on abstractly constructed ad-hoc ones.

Back to the A-initial cases, we see that the constraints mentioned for mi- are active in the prefixes i- (B4) and ni- (B2). The two prefixes, which mark their respective binyanim, lower to e before a stem beginning with a (/i-Amin/ → [e-emin]). However, in e-emin 'believe' it is not only the prefix vowel that changes, but also the stem's A. The reason that *eamin is not the output is that it contains both PUIMV and *VjVj violations; the stem's vowel a cannot raise to i because of FAITH, and neither can the prefix vowel lower to a, for the same reason. And so /iamin/ has to map to [eemin], as (33) exemplifies (irrelevant constraints omitted).

(33) A-initial stems- B2 Past e-emin 'believe' i/min 'fatten'

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a. e{emin}</td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. e{amin}</td>
<td></td>
<td>*</td>
<td>*</td>
<td></td>
<td>!</td>
</tr>
<tr>
<td>c. {imin}</td>
<td></td>
<td>*!</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. i{amin}</td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. a{amin}</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. i{imin}</td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>g. e{imin}</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td>!</td>
</tr>
</tbody>
</table>

*[ia] eliminates the most faithful candidate (d). Either of the two input vowels i,a may change to e, but none may fully harmonize with the other, because of FAITH[HEIGHT]. As shown in (33), *[ia] and FAITH[HEIGHT] should both be ranked above PUIMV, which would have eliminated the actual optimal candidate. Note that B2's past form does not provide us with the ranking of PUIMV and *VjVj with respect to one another. Note also, in candidates (f) and (g),
that whereas PUIMV would rule out any candidate that does not have the morphological vowels /i, i/, present in the regular forms as well (e.g. *fmin 'fatten'), it cannot distinguish if an output's i corresponds to the prefix i or the VP i. (a) and (b) both violate PUIMV, but only (b) violates *V_iV_j, which renders (a) optimal.

But *V_iV_j creates a problem: In the A-final stems it was MAX to that ruled out a candidate [fjigé] for the input /fjigé/. Ranking *V_iV_j above MAX will rule out the heterophonemic hiatus. So, assuming that stress is relevant, I modify *V_iV_j to *UNSTRESSEDV_iV_j. In addition, the *[i] violation of A-final stems such as ifría 'he disturbed' I now assume to be the result of a higher-ranked FAITHStressedVowel, if only in B4.

The only form that violates *UNSTRESSV_iV_j is the problematic future form of B2. If we assume a future input for B2, like in B1, then this is predictable from the same ranking, only here it is made crucial that *[i], FAITH[HEIGHT] and PUIMV be ranked above *UNSTRESSV_iV_j, as (34) shows:

(34) A-Initial Stems- B2 Future ye-amed 'stand still' yiaver 'break'

<table>
<thead>
<tr>
<th>I: /yi-Aamed/</th>
<th>ALIGN (R, Prefix, L, Stem)</th>
<th>*[i]</th>
<th>FAITH [HEIGHT]</th>
<th>PUIMV</th>
<th>*UNSTRESSV_iV_j</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ye{améd}</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>b. {yeméd}</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. yi{améd}</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. ya{améd}</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. ye{eméd}</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. yi{iméd}</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Candidates (e) and (f) violate PUIMV because they do not have the same morphological vowels as the whole verb. Candidate (a) is optimal because it does have the same VP vowels as the whole stem. Note that the prefix's vowel is not considered by PUIMV; otherwise (a) too would be ruled out, because it has a prefix vowel that is not like the whole stem's prefix vowel. This is so because whereas prefixes and suffixes that are stem-external in whole stems
(like the vowels of the 1st.sg. suffixes -tî) are not counted as the stem's morphological vowels, stem internal ones (like the suffix -u or the prefix i- of B4) are considered as such.

Another prefix-vowel problem is that B1's prefix vowel i, unlike the i in B2 and B4's prefixes, lowers to a. This is so, I suggest, because B1's prefix vowel is not specified for quality. In this it is different from ni- (B2 Past), i- (B4 Past) and yi- (B2 future) which are specified as /i/, and lower to [e] owing to interaction with A-initial stems. If so, B1's future prefix is /yV-/., and the prior ranking predicts correctly (here it is the low-ranked IDENT IO that judges in favor of the candidate with /a/):

(35) A-initial stems- B1 Future

<table>
<thead>
<tr>
<th>I: /yV+Amod/</th>
<th>P: [yi{bóór}]</th>
<th>[*ia]</th>
<th>FAITH [high]</th>
<th>PUIMV</th>
<th>*UNSTRESS V1Vj</th>
<th>IDENT IO</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ya{amód}</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. ye{emód}</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. ye{amód}</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. yi{amód}</td>
<td></td>
<td>!</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. yi{imód}</td>
<td></td>
<td>!</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Since in (35) the prefix's vowel is stem-internal in the whole stems, all three output candidates (a)-(c) violate PUIMV. Selection rests now on lower-ranked constraints. Candidate (c) violates the hiatus constraint and candidate (b) violates IDENT IO, which demands identity to the input. Because the input vowel is unspecified, it may be any vowel, and candidate (a) wins because (b) has a different stem vowel than the input's /A/.

The prefix vowel that surfaces in B1's whole verbs is the result of the prefix's y glide, which is stable throughout the future prefix paradigm of all binyanim.

As mentioned before, I consider all B1 3m.sg. forms to be lexical. In this last tableau, deviation of the vowel a of the prefix from the pattern yi- is shown not to be lexical; it follows from vowel interaction. Nevertheless, as the next subsection shows, lexicality of the future 3sg.m. stem is apparent in the X-cases.

\(^8\) Historically, it is presumed that at an early stage of language, pre-Biblical Hebrew, the prefix's vowel was always a. Later on, along with many other closed syllable vowels, it turned into i in all cases save for the guttural cases, where it was retained owing to ease of pronunciation (Gesenius 1910).
5.2.3 X-Initial Stems

In Tiberian Hebrew, $h$ too could not stand in a non-final coda position, and yielded epenthesis. In MH, stems with the historical $h$ do not act differently from regular forms (including whole stems with historical /k/, which had a spirantised alophone [x]). The sole exception to this generalization is the vowel of B1’s future prefix.

(36) X-initial stems

<table>
<thead>
<tr>
<th></th>
<th>Past</th>
<th>Future</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>/X/</td>
<td>/k~x/</td>
</tr>
<tr>
<td>B1</td>
<td>xaʃáv 'think'</td>
<td>katáv 'write'</td>
</tr>
<tr>
<td>B2</td>
<td>ni-xʃáv 'be considered'</td>
<td>ni-xtáv 'be written'</td>
</tr>
<tr>
<td>B3</td>
<td>xiʃɛv 'calculate'</td>
<td>kijɛr 'connect'</td>
</tr>
<tr>
<td>B4</td>
<td>i-ʃfv 'consider'</td>
<td>i-xtiv 'dictate'</td>
</tr>
</tbody>
</table>

(36) shows that $X$ causes lowering in the B1 prefix, which I have established to be $yV$-, to [ya]. There is no apparent reason why there should be [a] and not the [i] of /k~x/ cases (cf. yixtov). I suggest that this is simply a lexicalized form. This is not unreasonable, since B1 has another phonologically unmotivated $ya$-, namely the subminimal monosyllabic stems, already mentioned above (for other purposes):

(37) Subminimal B1 stems

<table>
<thead>
<tr>
<th>Gloss</th>
<th>Past</th>
<th>Future</th>
<th>cf.</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. 'run'</td>
<td>rac</td>
<td>ya+ruc (*yiruc)</td>
<td>yiʃmor 'guard'</td>
</tr>
<tr>
<td>ii. 'sing'</td>
<td>jɛr</td>
<td>ya+jir (*yiʃir)</td>
<td></td>
</tr>
<tr>
<td>iii. 'put'</td>
<td>sam</td>
<td>ya+sim (*yisim)</td>
<td></td>
</tr>
</tbody>
</table>

---

9 In B2 forms, the prefix vowel varies, e.g. niʃfav~nexfav 'be considered'. The varying {i~e} forms seem to act similarly for both /X/ and /k~x/ (it is important to note here that while B4 displays this variation with all consonants, B2 does it only for these two, probably a result of its lesser frequency). This is once again the result of an interaction independently observed in mi- 'from/than', in forms like m[i~e]-xułaarec 'from abroad' and m[i~e]-xayfa 'from Haifa', as opposed to mi-karov 'from close-up'. The phoneme $x$ (transcribed throughout as [r]), which has the same place of articulation as $x$, also causes lowering of a preceding vowel /i/, e.g. m[i~e]-raxok 'from afar' and m[i~e]-rusya 'from Russia'. If so, this lowering is a general property of the language, and has less to do with historical $h$ (although $h$ may have contributed to its emergence). It will thus not be explained here.
Despite the lack of (synchronic) phonological motivation for this deviation from \(i\), the mapping is facilitated for the learner by the fact that only sub-minimal stems surface thusly. The same holds for \(X\) cases: the clue for the learner is that the \(x\) in front of which the prefix vowel is \(a\) is the stable \(x\), i.e. the one that appears in the unprefixed past form \(xafd\) (*kafd) as well.

Finally, note that the fact that there is only one minor deviation from the patterns of whole stems provides an answer to the question posed at the end of chapter 4, as to the lesser stability of \(X\)-final stems when contrasted with \(A\)-final ones. Whereas the latter appear stem-initially as well as stem-finally, the former appear only stem-finally.

### 5.2.4 A-initial B3

As Shown in (27), the stem of B3 does not seem to be \(a\)-initial in any way. As opposed to B1, B2, and B4 there never are any lowering effects in it. B3 stems, such as \(imed\) 'paginate', seem to have no initial segment at all (cf. \(limed\) 'teach'). One way to go is to simply assume that the underlying form is in fact the vowel-initial \(imed\). The question then is how a learner maps an \(A\)-initial form in B1, for example, to an \(i\)-initial one. This mapping could be done through similarity of the other, second and third consonants, but why then not map \(Amad\) 'stand' to \(limed\), on the basis of the two second vowels?

Another possible way of mapping is through the fact that all the \(A\)-initial stems are onsetless. However that can be done, I suggest here that the underlying form may be \(Amad\) - i.e. \(A\)-initial - for this form as well. The relevant form to rule out will be \(*a.i.méd\), with both the VP and the \(A\) surfacing somehow.

Consider the \(a\)-final data from (3), repeated here with their vocalic patterns as (38). Why does a final \(a\) surface here separate from the VP vowel?
A-final verbs: deviation from disyllabic pattern

<table>
<thead>
<tr>
<th>VP</th>
<th>Whole Stems</th>
<th>A-Final Stems</th>
</tr>
</thead>
<tbody>
<tr>
<td>{i,e}</td>
<td>jī.gēr</td>
<td>jīgē.a</td>
</tr>
<tr>
<td></td>
<td>'launch'</td>
<td>'drive crazy'</td>
</tr>
<tr>
<td>{i,i}</td>
<td>i-f.kid</td>
<td>i-f.ki.a</td>
</tr>
<tr>
<td></td>
<td>'deposit'</td>
<td>'confiscate'</td>
</tr>
<tr>
<td>{a,e}</td>
<td>i-t-pa.kēd</td>
<td>i-t-pa.kē.a</td>
</tr>
<tr>
<td></td>
<td>'enroll'</td>
<td>'burst'</td>
</tr>
</tbody>
</table>

The answer is that, besides the PU and MAX requirements, the vowels before a do not assimilate with it because they are stressed, and only an unstressed heterogeneous hiatus is banned. Thus, the ranking established previously accounts for the mapping of /AmVd+/i,e\VocPat to [iméd] and not to the *UNSTRESSV_iV_j violations in *[a.i.méd] or *[ayméd]. This is shown in (39), with the addition of an a-final case, to show the contrast (irrelevant constraints were omitted):  

<table>
<thead>
<tr>
<th>(39) A-initial stems- B3</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) I: /Aimed/</td>
</tr>
<tr>
<td>O: [jīmēɾ]</td>
</tr>
<tr>
<td>PUIMV</td>
</tr>
<tr>
<td>a.  {imēd}</td>
</tr>
<tr>
<td>b. a. {imēd}</td>
</tr>
<tr>
<td>c.  {aymēd}</td>
</tr>
<tr>
<td>d.  {e.mēd}</td>
</tr>
<tr>
<td>e.  {a.mād}</td>
</tr>
<tr>
<td>b) I: /jīgēa/</td>
</tr>
<tr>
<td>O: [jīgēɾ]</td>
</tr>
<tr>
<td>PUIMV</td>
</tr>
<tr>
<td>a.  {jīgē}</td>
</tr>
<tr>
<td>b.   jīgē</td>
</tr>
<tr>
<td>c.   jīga</td>
</tr>
</tbody>
</table>

And so, the present ranking allows the learner to generalize to a-initial stems even when the first VP vowel is not different from that of the regular pattern, given that there is no initial onset. Note that an input /imed/ - and not /Aimed/ - will also yield the correct output in (39). This analysis agrees with the principle of Richness of the Base (Smolensky 1996), since it reflects the fact that either input yields the same output.
5.3 Comparing to an underlying guttural account

An account with an underlying guttural, however it is structured, may appear to be simpler. Let us say this guttural is ? . All stem size violations can be accounted for through a constraint *V?C, under which an underlying B1 future form /yV?-mod/ 'stand' will yield an epenthetic vowel ya-amod, its quality being the expected quality of an epenthesis caused by a guttural. This vowel will in turn determine the prefix vowel a . In contrast, the underlying B2 past form /ni-?mad/ 'stand (reflex.)' would yield neemad for some constraint *[HIGH]? (a synchronic account cannot follow the impossible-geminate explanation above, because there are very few cases of gemination in Hebrew). The epenthetic vowel's quality would be determined by that of the prefix, maybe through the same constraint *U\text{STRESS}Vj proposed in my account.

The underlying glottal account appears simpler especially in the B3 cases, where ? does not affect the stem simply because it stand in onset position. The strong side of this analysis is that all these constraints are attested independently (in older stages of Hebrew or in other languages with gutturals).

I suggest, however, that this account is actually less acceptable. First, why posit an underlying glottal that never surfaces if we can posit an underlying A that does surface systematically? I doubt whether the former, all the above being said, is really less complex than the latter. Furthermore, as mentioned, the fact that this /?/ never surfaces renders the surface forms opaque, because there is an effect (for example ne-emad) without its cause (*ne-?emad).

In addition, any attempt to have the epenthetic vowel ne-emad correspond to the deleted guttural through MAX would run into serious difficulties in explaining the lowering of the prefix vowels: if something must correspond to /?/, why can't it be the vowel i, which would not cause lowering of the prefix and would thus be more optimal? This can be stated as a
FAITH[^HIGH] constraint, considering that ? is [-HIGH]; but then why is MAX not abided when there is a /?/ in onset position, and nothing corresponds to it? And furthermore, wouldn't this assumption be just like assuming a vowel [a] that always corresponds to /?/? Together with the vowel interaction constraints, which were shown to be crucial for both accounts, assuming a ?-correspondent [a] or [-HIGH] would yield the same surface forms.

These facts bring us full circle, back to the underlying /A/ account being better in terms of learnability. Such an account represents a stronger resemblance between surface and underlying forms, because this /A/ does surface at times, and the cases where it doesn't are accountable.

To summarize, a theoretical question raised by these two competing analyses is "what are the parameters for the level of complexity in a given account?". In other words, what is more complex for the learner: to arrive at a theoretical, underlying segment, whose corresponding surface manifestations abide constraints that are known to be universal in the case of this specific segment; or to account for surface phenomena in a manner closest as possible to the surface forms, although constraints and generalizations may not follow from universal principles, but rather rest on language-specific paradigmatic relations. This is a matter of long dispute; I, as can be understood from this thesis, support the second strategy.

5.4 Stem-initial cases - Summary

In this chapter, I showed how the ranking devised for A-final stems accounts for A-initial ones as well. These stems were proved to be A-initial, i.e. to have a low vowel /A/ as their first underlying segment. In addition, when this A did not surface it was shown to be the result of various vowel quality and interaction constraints, which in turn affected the prefix vowels, too.
The minor deviation in X-initial forms was accounted for lexically; otherwise, historical $h$-initial stems were shown to be identical to whole stems.

I have also showed that even though the $/A/$ does not surface in all 3sg.m. stems, it is not hard for speakers to generalise over all $A$-initial stems.

Finally, I contrasted my analysis to an analysis that assumes an underlying guttural. I showed that such an account necessitates the same complex assumptions as my account, but is also opaque, unlike mine. This opacity was the main reason for the negation of an underlying guttural, despite the fact that it is advantageous in terms of universality.

6. Conclusion

The goal of this thesis was to provide an Optimality Theoretic analysis that reflects the grammar of today’s Hebrew speakers with respect to the once guttural paradigms. From a more general point of view, the question was how Hebrew speakers accounted for guttural effects even though there were no gutturals recovered.

As chapters 4 and 5 showed, the $A$-final and $A$-initial forms were recovered as containing an underlying $/A/$, in lieu of the guttural sound. X-final stems were also recovered with this $a$, although with the addition of $x$, and X-initial stems were recovered as regular whole stems.

Retention of this $/a/$ in final position followed from the nature of paradigmatic constraints on metricality and vowel quality in comparison to whole verbs. The altered quality of $/A/$ in stem-initial position was predicted through vowel-interaction constraints, most importantly a constraint against unstressed heterogeneous hiati. Thus, the same ranking of constraints could account for both whole verbs and G-verbs.

Because the recovery path was $?,h,\acute{\iota}\rightarrow\emptyset$ but $h\rightarrow x$, $X$-stems were shown to have undergone a merger with regular $/x/$s, and $?,h,\acute{\iota}$ were recovered as a sub-class. In fact, these
deviated significantly only in the G-final paradigm; in the G-initial paradigm, the few differences between $X$ and $x$ are no longer explained systematically.

Throughout the thesis, I contrasted and compared my analysis to an analysis containing an underlying glottal. The main problematicity of such an account was claimed to be that no such sound is ever pronounced stably, a fact which, as I have shown, renders all underlying glottal explanations opaque. This thesis' approach was to avoid such opacity, because of its problematicity to the theory and because of the aspiration of staying as close as possible to the surface form.

True, the G-initial account proposed herein did assume an underlying /A/ that surfaces only when there is no interaction with a prefix or suffix vowel; still, no explanation posed a segment which never surfaces. In terms of learnability, in my opinion, my account is superior to an underlying glottal account, which forces the learner to arrive at inputs without ever hearing a systematic output.

All in all, the case of historical gutturals in Hebrew is an example of how loss of motivation (or in this case the non-recovery thereof) brings about reanalysis of input forms, Input-Output correspondences and paradigmatic relations, with the goal of systematically explaining the phenomena.

7. Topics for further research

This thesis did not touch on three main topics related to historical gutturals. These could constitute material for further research:

1) The stem-medial paradigm was not examined in this thesis. This paradigm presents some problems for the analysis above because its 3sg.m forms deviate only very minimally from the whole stems patterns, and no medial $A$ ever surfaces in them. However, /a/’s do
surface as epenthetic vowels in inflected forms. Moreover, many cases of variation exist in this verb group that a more encompassing account should consider.

2) The present and past participle forms, which deviate from those of the whole stem, were also not included in this paper. In these forms, there is significant variation in X-final stems, much more so than in past and future forms.

3) Every binyan has a special verbal noun (sometimes referred to as the gerund). Historical guttural stems, mainly A-final ones, deviate from whole stem patterns in these verbal nouns. In future accounts, it should be examined whether these verbal nouns follow the patterns described in this paper.

Bibliography


the Hebrew Imperative Paradigm. *PPT* 44-64.


Graf, Dafna & Adam Ussishkin (2001) Emergent Iambs: Stress in Modern Hebrew *Lingua* 113/3 239-270


Zuckermann, Ghilad (2005) Introduction article for the upcoming book *Mosaic or mosaic*

http://www.zuckermann.org/print/mosaic
Appendix: G-final Future forms of B2

As I mentioned at the end of chapter 4, B2's future form is problematic because its A-final stems affect the VP vowel e, and the surface form is *yi-fama 'be heard' and not *yifaméa. This appendix provides two possible approaches to this problem.

The form *yifaméa is a problem for my analysis, because its equivalent whole stem's vocalic pattern, {a,e}, is widely attested in the non-alternating binyanim, where it does surface in its entirety, as (40) shows:

(40)   CaCéA stems (Future 3sg.m.)

<table>
<thead>
<tr>
<th>Reg.</th>
<th>A-final</th>
</tr>
</thead>
<tbody>
<tr>
<td>B3</td>
<td>yeʃajer 'launch'</td>
</tr>
<tr>
<td>B5</td>
<td>yitkabel 'accept (pass.)'</td>
</tr>
<tr>
<td>B2</td>
<td>yiʃamer 'be guarded'</td>
</tr>
</tbody>
</table>

The A in B2's Future form *yifamA in (35) displays assimilation with the VP's vowel e (cf. yifamer). This is so despite the fact that there is no regular form *yi-C₁aC₂aC₃ (*yigadal), like there is in B1, and despite the appearance of éa in other binyanim.

Although I have mentioned (at the end of chapter 4) that B2 is the least common binyan in MH, I believe it is still active to an extent, and its deviation deserves an explanation.

First, (41) shows how the ranking hitherto established fails to account for this phenomenon (recall that B2 also has a Future input):

(41)   A-final B2 Future forms - wrong output

<table>
<thead>
<tr>
<th>I: /yiʃameA/</th>
<th>PU IMV-F</th>
<th>PUIMV</th>
<th>MAXIO</th>
<th>IDENT IO</th>
<th>IDENT IO</th>
<th>ALIGN (F,S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>~ a. yi{ʃamá}</td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>? b. yi{ʃame}</td>
<td></td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>? e. yi{ʃamé}a</td>
<td></td>
<td></td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The correct output candidate (a) violates PUIMV because it does not have the same VP as the whole stem. However, note that if it didn't violate PUIMV, it would be more optimal than the other two candidates. How can we undo PUIMV's effect?
Two possible solutions exist. The first is to assume that this $e$ is epenthetic, i.e. the underlying whole stem /yi-famr/ 'guard(reflex.)' yields the surface form [yifamer] (A similar claim is made in Dor 1995). Following this track, there is no need for this epenthesis in /yi-fama/ and the correct surface form is straightforwardly [yifama]. However, we would have to claim that PUIMV is now sensitive to the epenthesis vs. VP distinction, which is too far-fetched, because all it has for comparison is a whole stem's output.

Another drawback is that there is no independent motivation for assuming that the $e$ in yi-faver is any more epenthetic than, for example, B3's ye-faper 'improve'. These two forms differ only in the historical guttural cases.

Another possible solution for the B2 future problem can be found in comparing the VPs of all the binyanim in the A-final forms. A second scrutiny of all the VP's of A-final stems provides the answer: B2 is the only binyan whose stressed vowel is not shared by both past and future forms. (42) clarifies:

(42) Vocalic patterns of unsuffixed (3sg.m) forms:

<table>
<thead>
<tr>
<th></th>
<th>Past</th>
<th>Future</th>
<th>Apophony</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>{a, á}</td>
<td>{V, á}</td>
<td></td>
</tr>
<tr>
<td>B2</td>
<td>{i, á}</td>
<td>{a, é}</td>
<td>$i \rightarrow a$, $a \rightarrow e$</td>
</tr>
<tr>
<td>B3</td>
<td>{i, é}</td>
<td>{a, é}</td>
<td>$i \rightarrow a$</td>
</tr>
<tr>
<td>B4</td>
<td>{i, i}</td>
<td>{a, i}</td>
<td>$i \rightarrow a$</td>
</tr>
<tr>
<td>B5</td>
<td>{a, é}</td>
<td>{a, é}</td>
<td>$\emptyset$</td>
</tr>
</tbody>
</table>

The more common apophony is the non-alternating binyanim's $i \rightarrow a$. This apophony concerns only the unstressed vowels. B2 apophony $a \rightarrow e$ stands out in that it occurs in a stressed position, and in that it is the only instance of such an apophony.

A PUsv (=stressed vowel) constraint, demanding that all stressed vowels in a single paradigm be identical, is thus irrelevant for all 3sg.m. forms except B2's. Note that this PU constraint is of the "shared lexeme" kind, i.e. it describes a relation on the horizontal axis. The PU constraints hitherto considered described relations on the vertical axis, i.e. the
grammatical category. (43) exemplifies how this yields the correct output for both B3 (43a) and B2 (43b) future forms:

(43) A-final Future B2 - paradigm uniformity with Past output

<table>
<thead>
<tr>
<th></th>
<th>a. ye{jágé}a</th>
<th>b. ye{jágé}</th>
<th>b. ye{jágá}</th>
</tr>
</thead>
<tbody>
<tr>
<td>P: [yi{jamér}]</td>
<td>PIMV =F</td>
<td>PUSV</td>
<td>PIMV</td>
</tr>
<tr>
<td>a. yi{jamá}</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. yi{jamé}</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>c. yi{jamé}a</td>
<td></td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

(X-Stems do not add any problematicity to this problem's solution.)

This solution is at least as problematic as the epentheses solution. First of all, it does not account for inflected forms which surface with different stressed vowels, e.g. {jígáti, jígú}, and holds just for 3sg.m. forms. More importantly, it necessitates assuming a different ranking for whole stems and A-final stems, to avoid the same leveling phenomenon *nifmar-*yif'mar in the whole-stems.

In sum, both solutions require a certain suspension of disbelief: the first in unmotivatedly assuming the vowel e is epenthetic, and the second in assuming constraints that hold only for 3sg.m. forms and a ranking that holds only for A-final forms. I leave it to the reader to weigh the two accounts and do not go further into this phenomenon.

Before I conclude this appendix, it should be noted that this anomaly - the fact that in A-final B2 future forms the second vowel of the VP does not surface - is difficult to account for from an underlying guttural approach as well. Such an analysis, with a final underlying guttural, could equally explain the appearance of a low vowel a, but not why the e is deleted in B2 and not in B3.
To conclude, the account presented in this paper is less fitting for the B2 future $A$-final forms. As I said, this is of little consequence, since this binyan is fading fast from the native knowledge of Hebrew speakers.
תקציר

бурן חומדנית קיםת תועבות של הפרדיגמות המורפולוגיות של העברית וחברית הפונולוגיה של

סינתי השפה, שיפורドレス לה גרנות, העברית המורפולוגית יאשעתי ממ翥 או זולוה, בברס

ה себרכן, ביבוב הקסם פורמלוגית לשון העברית גפתא, הנמצאים של העברית המודרנית.

 fileSize=1041, forgiving: 1241, forgiving: 7010

אימצו את העיצורי הגרוניים מצא בתשובה. אימצו את העיצורי הגרוניים נמל שיעורי העברית

כלולות בחל הידע הלשוני של השפה העיצורי הגרוניים של העברית המודרנית. הזני חלקי

הלשון ע.addWidget

התאמא הפרסומים העבריים בשם אל כל בתולוקת א"י, deix, בוער עיצורי הגרוניים, בין צד

המכח חקיק, בנסף כלח, העיצורים ה"א, להם קיים יבירה בגר닛י, אם כי גברית, אם כי גפס

ל鹳ת המורפולוגית. אלופ פמטים כדי האות לרש משג וניה. ואנ מגדיר את העיצורי

הגרוניים "בלוקת" מושקמתו, יוג núi שדיבור העברית של היום élevé נייט או מפטא אום.

שניה תופעת המורפולוגית יאני את האוניות הגנויות בערבית הת"כ: הננכה תונה החדרת תונה

( wbwt). שת התופעת האלה נותר עניין בְּ Nikki יא גם בשפת העברית המודרנית של היום, על

催化. שיא kapsום של הגרוניים, הזה זמר העיצורי הגרוניים.

העבודה נכתבה במשורר atozיות אוטונומיות (פפיט הקסמים, 1993) היה kapsום פלטיס

ידיון של אוטונומיות עלה, układ העבורה, בין גורס יא kapsים פִּידונומיים שומואלזים לעﻚועת העילין

שכלע עיצורי הגרוניים בוף שביל, בישה פולירוimento ומפרגות/cpuחקת, סוקינו ביד של

הוחזרו שבחיות השדר, הקפזה זה קפזה.

בנוסף, כיוון שמועלים עם עיצורי הגרוניים או שקומוב כאלים, כדי את עליית הקפזה, פעה

אוחוז, קונב הקבצתי לי מיעון. בנח העבורה מי מאי את התבנאיות האלה למפרIndexChanged kommun, ש

בידיע הלשוני של הדובר.

בדבד ען תנג את אילו פסיפיס, אתי מוסבר 클וד-רשבן שמוכן את שיקופים של עיצורי

גרוניים (או יעיק גרני בדד) בקצף, פנה סברין מאורי הניהות אשין מצע, הכלל ואת התנועה 6 חקפים.
נ牢固树立を使用する方法

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