Guttural Ghosts in Modern Hebrew

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Many morphological paradigms in Modern Hebrew exhibit alternations between [a], zero, and a rare [ʔ] in positions where one expects to find a consonant. The letters symbolizing these alternations in the orthography were used to represent the guttural sounds [ʔ, ʕ, h] in stages of the language that had these sounds. Gutturals are largely absent from Modern Hebrew pronunciation, and yet their presence is still felt indirectly, through these alternations. Following Faust (2005), we analyze these "guttural ghosts" as underlying /a/ vowels. The analysis is conducted within the theory of Government Phonology (Kaye, Lowenstamm, and Vergnaud 1990) in its Strict CV offshoot (Lowenstamm 1996, Scheer 2004). Against the conclusions of previous accounts, we show that given standard assumptions in this theory, the phenomenon is strictly phonological. We also discuss a puzzle regarding the interaction of such guttural ghosts with epenthesis and reduplication, and we provide an Obligatory Contour Principle–based account that relies crucially on the vocalic identity of these entities.

Keywords: floating vowels, government, gutturals, Modern Hebrew, Obligatory Contour Principle

1 Introduction

A specter is haunting Modern Hebrew morphophonology: the specter of guttural consonants. In this article, we aim to identify the nature of that specter and bring it closer to the realm of natural phonological phenomena.

1.1 Mysterious Alternations: Is It a Zero? Is It a Glottal Stop? Is It /a/?

As a first acquaintance with this specter, consider the Modern Hebrew (MH) verbs in (1). These verbs are all of the type QiTeL, so called because it is characterized by the vocalic pattern ⟨i,e⟩ in the PST.3MSG (⟨Q,T,L⟩ stand for any nonaffixal material in the stem). (1a) shows that the second vowel of the stem is absent when a vowel-initial suffix is added; the stem has the form QiTL-, with the second consonant in an internal coda position. Most verbs of the type QiTeL have three stable consonants, like (1a). But there are also quite a few verbs with unstable stem material. The framed cells in the verbs in (1b–c) illustrate the type of instability that we will be concerned with here. In (1b), the unsuffixed form usually lacks a consonant altogether in the medial position (rarely, a glottal stop may break the hiatus in this position). Nevertheless, it cannot be concluded that this position is altogether empty, since in the suffixed form, although the position is a coda

in the parallel (1a), a vowel [a] appears in (1b). Since the epenthetic vowel of MH is [e], not [a], the insertion of this vowel must somehow be lexically recorded. A similar alternation between [a] and the absence of a segment is apparent in (1c). The unsuffixed form has an [a] in the stem-final position—again, in what would have been a (word-final) coda position. In such verbs, a third stem consonant is absent in the suffixed form. Much rarer, though important, is again the pronunciation in parentheses, with a glottal stop in stem-final position.[1]

(1) *[a]-Ø~[ʔ] in Modern Hebrew QiTeL*

	PST.3MSG				PST.3PL					
	Q	i	T	e	L	Q	i	T	L	- u
a.	ʃ	i	g	e	ʁ	ʃ	i	g	ʁ	- u	'launch'
b.	ʃ	i	(ʔ)	e	ʁ	ʃ	i	a	ʁ	- u	'estimate'
c.	ʃ	i	g	é	a	ʃ	i	g	(ʔ)	- u	'madden'

(For the remainder of this article, we will transcribe the optional [ʔ] only in the postconsonantal position, where it is unexpected. The reader must keep in mind that any onsetless syllable may optionally begin with a glottal stop.)

The data in (1) point to the existence of an unstable entity in the stem, which is realized as /a/ in coda position, but remains mostly unrealized—or surfaces as [ʔ]—when followed by a vowel. This entity is consonantal in some sense, since it is treated like a stem consonant. Yet the only obligatory clue to its presence is vocalic: it is a vowel [a]. Like a ghost, this entity is thus identifiable only indirectly, by its effect on its environment.

1.2 Mysterious Epenthesis

Such ghostly effects are also apparent in MH in the distribution of epenthesis, as illustrated in (2) by the passive verbal template hu(Q)TaL.[2] The unsuffixed form in (2a) has only two stem consonants and so takes the form huTaL. Its suffixed form lacks the /a/ vowel entirely. Indeed, like the vowel /e/ of the QiTeL base, the vowel /a/ in the same __C$_{stem}$ position alternates with zero when a vowel-initial suffix is attached. In the unsuffixed form in (2b), however, syncope of the stem's /a/ results in a triconsonantal cluster, which is resolved by epenthesis between the last two consonants (in boldface). Now consider the verb in (2c). While its unsuffixed form appears to be vowel-final, the epenthetic vowel appears in the suffixed form, even though there does not seem to be a triconsonantal cluster to save. This epenthesis can be understood if one assumes a final inaudible "consonant" in the stem: when the vowel /a/ of the stem is absent, the underlying triconsonantal cluster forces epenthesis just as in (2b). This analysis is supported by the contrast with (2d), where the base is genuinely vowel-final and no epenthesis occurs.

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[1] Stress is generally final in MH. For this reason, it is marked only when not final.
[2] We refer to the template as **h**uQTaL in order to be consistent with the traditional appellation. Like all historical /h/'s in MH, this sound is very rarely pronounced. It therefore does not appear in the examples in (2).

(2) *[e]-epenthesis without surface motivation in Modern Hebrew passive huQ(T)aL*

	a. 'take off'	b. 'separate'	c. 'disturb'	d. 'fertilize'	Template
PST.3MSG	uʁad	ufʁad	ufʁa	ufʁa	huQTaL
PST.3MPL	uʁd-u	ufʁed-u	ufʁe-u	ufʁ-u	huQTLu

The behavior of the verbs in (1b–c) and (2c) points to the existence of a "ghost" consonant in their representations. Again, the term *ghost* is appropriate because the manifestation of this consonant is indirect, in that such verbs pattern together with verbs that have real consonants in the relevant positions, rather than with verbs that lack any entity there.[3]

For students of Hebrew and Semitic, the diachronic identity of this ghost consonant is not a mystery. In Biblical Hebrew (BH), such verbs hosted the glottal consonants [h, ʔ] or the pharyngeal [ʕ]. But while this fact is represented in the orthography of MH, these sounds are largely absent from the spoken language. It is therefore unlikely that a learner reconstructs a pharyngeal consonant in the relevant position. Still, the phenomena in (1b–c) and (2c) are generalized, widespread, and fully productive in the MH system. The generalizations apply regularly not only to words originating in BH, but also to words with orthographic gutturals that have been introduced into the language only in modern times, be they native words or adapted Arabic loans originally containing gutturals.[4] In none of these cases is a guttural sound ever produced (the rare epenthetic [ʔ] that *is* sometimes pronounced cannot be considered a guttural in MH; see the discussion in section 2.1). For the effect to be derived, the representation of such forms must include something specific. It is unlikely that that something is a guttural consonant; but what *is* it, then?

The first study of the effects of historical gutturals in MH that attempted to go beyond merely showing the facts was presented by Faust (2005). He argued that a vowel /a/ appears in MH where a guttural consonant [h, ʔ, ʕ] appeared in BH. More recently, Pariente (2012) has endorsed roughly the same view. Both of these accounts are couched in Optimality Theory with little attention to representations. Possibly as a result, they have what we consider the weakness of appealing time and again to minute inter- and intraparadigm uniformity effects.

Here, we develop Faust's proposal into a strictly phonological account framed in the Strict CV version of Government Phonology (Lowenstamm 1996, Scheer 2004). In this framework, the basic skeletal unit is the unmarked syllable CV. The guttural ghost, we will argue, is a vowel /a/ matched with a CV unit, as in (3a).[5] Since /a/ is vocalic by nature, it seeks to occupy the V-slot (3b). If that slot is occupied, the /a/ will not be able to associate to it (3c). In such configurations, the onset will be either silent or realized as [ʔ] (see also footnote 18).

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[3] The term *ghost* is used for similar reasons in Zoll 1993 and several works cited therein.

[4] For instance, the Arabic word [baʕsˤa] 'a feeling of depression resulting from disappointment' was loaned into MH and is pronounced [baasa] (or [basa]). From this the verb [bies] 'he depressed' was derived. When the historical guttural finds itself in a coda position, the vowel [a] emerges: [biasu] 'they depressed' (cf. [bikʃu] 'they asked', as well as (1b)).

[5] How the vowel /a/ is attributed to this specific CV is a general issue that concerns the representation of all floating segments (e.g., French latent consonants) that are lexically aligned to word edges without linking to any skeletal position. One can assume that it associated to C but remains silent, or that it shares an x-slot with C.

(3) *A vocalic segment matched with a CV unit*

    a. C V   b. C V   c. C V

                                       [ʔ]

          a   a   a u

We will show that with these generalizations about the representation of the "guttural ghost," all of its realizations follow from general principles of the theory. There is no need to appeal to paradigmatic effects.

In section 4, we will extend the analysis to a hitherto unnoticed puzzle having to do with guttural ghosts. Against the background in (1) and (2), consider the QiTeL verbs in (4a–d). Unlike the verbs in (1), the verbs in (4a–b) have four elements in the base, whether lexically (4a) or via the reduplication of a biconsonantal set (4b). This fact accounts for the vowel [e] in their suffixed form: although the stem's /e/ is arguably absent from the form (i.e., that form is /ʃiʁbt-u/, /ʃikʃk-u/; cf. [ʃigʁ-u]), an epenthetic [e] is still expected, since otherwise there would be a triconsonantal cluster (*[ʃiʁbt-u], *[ʃikʃk-u]). The verb in (4c) has four lexical (i.e., nonreduplicative) stem elements, the second of which is clearly the guttural ghost in its coda realization, [a]. In the suffixed form, this [a] behaves like a vowel: it can be followed by two adjacent consonants without this sequence being considered triconsonantal—as the absence of [e] indicates. Finally, the first form in (4d) has two [a]'s: this is a reduplicated biconsonantal set, analogous to (4b), of which the second element is the guttural ghost. Now recall [ʃigéa]-[ʃig-u]~[ʃigʔ-u] from (1c): there, the sequence [éa] alternates with either Ø or [ʔ] in the suffixed form. In contrast, for the suffixed form of (4d), the only pronunciation we have been able to attest is one with epenthesis, even though none seems to be needed. Indeed, in this word, the first [a] behaves not like a vowel but like a consonant, in disallowing a cluster immediately following it.[6]

(4) *The puzzle*

	3MSG	3PL	
a.	ʃiʁbet	ʃirbet-u	'scribble'
b.	ʃikʃek	ʃikʃek-u	'shake (from fear)' (< Eng. ʃeɪk)
c.	ʃiabed	ʃiabd-u	'enslave'
d.	ʃiaʃéa	ʃiaʃe-u	'amuse' ?ʃiaʃu, ?ʃiaʃʔ-u

Given the nonapplication of epenthesis in [ʃiabd-u] and the possibility of a cluster in [ʃig-u]~[ʃigʔ-u], it is unclear why [ʃiaʃe-u] should be an attested form at all. Why does the [a] in

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[6] On the acceptability of the expected forms marked with ?, see section 4. On the extent of this phenomenon, see online appendix A (https://www.mitpressjournals.org/doi/suppl/10.1162/ling_a_00287).

the second of four stem elements behave like a vowel when followed by two regular consonants, but like a consonant when followed by a consonant and another "guttural ghost"?

1.3 Outline

To summarize, we will aim at answering these questions:

(5) *Questions*
    Q1. What drives the [a] realization in [ʃigéa], [ʃiaʁ-u] in (1)?
    Q2. What drives the Ø~[ʔ] alternation in [ʃig-u]~[ʃigʔ-u] (1c)?
    Q3. Why is epenthesis obligatory in [ufʁe-u] (2c)?
    Q4. Why is epenthesis obligatory in [ʃiaʃe-u] (4d)?

The article is organized as follows. In section 2, we provide empirical and theoretical background. We discuss the fate of gutturals in MH more thoroughly, briefly review prior work, and introduce the basic notions of the Strict CV framework. In section 3, we provide answers for Q1–3. We discuss the status of lexical vowels in suffixed forms and establish the central notion of "responsible" nuclei: empty nuclei are systematically realized in MH if their realization would result in the inhibition of a preceding empty nucleus, through a relation called government. We then propose that historical gutturals in MH are represented as a floating /a/ that is attributed a C-slot, but seeks to associate to a V-slot to its right. If it cannot do so, it remains afloat and the C-slot is free to host an optional [ʔ], which we treat as epenthetic. In this section, we also present corroborating evidence from initial clusters. In section 4, we return to the puzzle in (4) and propose a solution based on the reduplication in [ʃiaʃe-u]. We analyze this unexpected epenthesis as an Obligatory Contour Principle (OCP) effect separating two vocalic elements in the nonaffixal component of the base. Section 5 concludes.

2 Empirical and Theoretical Contexts

In this section, we provide empirical and theoretical contexts for the account in section 3. We first discuss the history of gutturals in Hebrew and previous treatments of the lost gutturals of MH, and then present the Strict CV framework, in which the analysis will be conducted.

2.1 Historical Gutturals in Modern Hebrew: More Data and Background

As mentioned in section 1, the verbs we are concerned with all include in their orthography the letters representing the guttural sounds of BH: [ʔ, h, ʕ, ħ]. These four sounds functioned as a natural class in many respects—for instance, in resisting gemination and placing constraints on the height of surrounding vowels. When the language was revived in the late nineteenth and early twentieth centuries, the dominant class in the target population consisted of speakers of European languages such as Russian, Polish, and Yiddish. The phoneme inventory of these languages did not include pharyngeal /ħ/, and this historical phoneme was revived as [χ], the uvular fricative of Yiddish, which was used in the Eastern European tradition to pronounce Hebrew words written with the letter corresponding to BH /ħ/. [ʔ] and [ʕ] disappeared completely as consonantal phonemes and today are mostly unpronounced. The status of the voiceless glottal fricative [h], which

did exist in Yiddish, is intermediary: although [h] is felt to be less foreign than phonemic [ʕ, ʔ, ħ], nowadays speakers only rarely pronounce it.[7]

The nonrehabilitation of [ʕ, ʔ, h] has resulted in two types of marked syllabic configurations, both of which we have already noted. First, vowels that were separated by one of these consonants are now often found in hiatus configuration: for example, BH [ʃuːʕaːl] > MH [ʃual] 'fox'. Second, preguttural codas are now mostly found adjacent to the vowel that followed the guttural: BH [givʕaː] > MH [giva] 'hill'. While the usual CV syllabification is unmarked, the marked aspect of such words is that they may also be pronounced with a glottal stop, as in [givʔa], suggesting that at some level of representation, the sequence is not the unmarked CV. The glottal stop can be heard especially, but not only, under emphasis. (The two examples in this paragraph had [ʕ] in BH; the glottal stop also replaces absent historical [ʔ, h] under the same conditions, though [h], a sound that does exist in Yiddish, can also be heard on occasion).

The table in (6) summarizes the comparison between BH and MH.

(6) *The fate of Biblical Hebrew gutturals in Modern Hebrew*

Biblical Hebrew	Modern Hebrew
[ʕ]	Ø, optionally [ʔ]
[ʔ]	Ø, optionally [ʔ]
[h]	Ø, optionally [h] or [ʔ]
[ħ]	[χ]

In this state of affairs, it is remarkable that several regularities having to do with the gutturals *have* survived in MH, unlike their phonetic triggers. Indeed, the effects surveyed in section 1 were all true in BH, too, except that in that language, the cause was also surface-true.

In BH, the gutturals [ʕ, ʔ, h] were not legitimate word-internal codas. A short vowel [ᵃ] often emerged when there was no lexical vowel between the guttural and a following consonant (7a) (the quality of this epenthesis was motivated by the place of articulation of the consonant; see Gesenius 1910). As shown in section 1, this [ᵃ] is retained in MH, but it is pronounced with the same length as any unstressed [a], despite the absence of any surface guttural (7b).

(7) *A guttural effect in Modern Hebrew without a surface guttural: Word-internal coda*
   a. BH /jaʕleː/ → [jaʕᵃleː]   'ascend.IMPF.3MSG'
   b. MH /ʔʔʔ/   → [jaale]   'ascend.FUT.3MSG'[8]

Similarly, the ban on triconsonantal clusters discussed in section 1 was also revived from BH (although to a certain extent it is violated in MH by loanwords). Like MH, BH circumvented this ban by inserting an epenthetic vowel between the last two consonants (8a). But again clusters with a third guttural were surface-true in BH (8b), while MH again exhibits the effect without the cause (8c).

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[7] For an overview of the descriptive discussion of gutturals in MH, see Neuman 2015. For discussion of the pronunciation of [h], see Gafter 2014.
   [8] The reflex of the BH imperfective is mostly regarded as future tense in MH. Note further that (7b) cannot be the result of compensatory lengthening, since the guttural regularly leaves behind an [a], regardless of the preceding vowel.

(8) *A guttural effect in Modern Hebrew without a surface guttural: Cluster resolution*

  a. BH /jiktv-u:/ → [jiχtev-u:] 'write.IMPF-3MPL'

       MH /jiχtv-u/ → [jiχtev-u] 'write.FUT-3MPL'

  b. BH /jiʃmʕ-u:/ → [jiʃmeʕ-u:] 'hear.IMPF-3MPL'

  c. MH /???/ → [jiʃme-u] 'hear.FUT-3MPL'

As mentioned, rather than being a property of some limited group of verbs or word-forms, the phenomena in (7) and (8) are generalized, widespread, and fully productive in the native MH system.

For completeness, the table in (9) adds other word-forms to those already introduced (which appear again in the first two lines). Before a lexical vowel in all positions, the historical guttural has no reflex. Its absence results in the surface adjacency of a preceding consonant and a following vowel (e.g., [ʃig-**u**], but also [te-ʃa**g-i**]); and this configuration always has an alternative, rarer realization with a glottal stop that presents the same syllabification as the regular verb (e.g., [ʃigʔ-u], [te-ʃagʔ-i]). It can further be seen that the [a] realization is found wherever the historical guttural would, by analogy to a verb with no historical guttural, immediately precede either a consonant (e.g., [ʃiaʁ-u]) or the right word-edge ([ʃigéa]). The data in (9) add a reservation to this generalization: while the "guttural" [a] appears after any vowel in an internal coda position (e.g., [ʃaaʁ-u]), it does not surface if it is situated at the right edge of the stem after a lexical [a] ([ʃigá-ti], *[ʃigáa-ti]; [ʃug**a**], *[ʃugáa]).[9] We discuss this reservation briefly in section 3.2.[10]

(9) *Verbs without gutturals vs. verbs with gutturals*

	a. No guttural	b. C$_2$ guttural	c. C$_3$ guttural	Template
Active				
PST.3MSG	ʃigeʁ	ʃieʁ	ʃigéa	QiTeL
PST.3MPL	ʃigʁ-u	ʃiaʁ-u	ʃig-u ~ ʃigʔ-u	QiTL-u
PST.1SG	ʃigáʁ-ti	ʃiáʁ-ti	ʃigá-ti	QiTáL-ti
FUT.2FMSG	te-ʃageʁ-i	te-ʃaaʁ-i	te-ʃag-i ~ te-ʃagʔ-i	te-QaTL-i
Passive				
PST.3MSG	ʃugaʁ	ʃuaʁ	ʃuga	QuTaL
PST.3MPL	ʃugʁ-u	ʃuaʁ-u	ʃug-u ~ ʃugʔ-u	QuTL-u
PST.1SG	ʃugáʁ-ti	ʃuáʁ-ti	ʃugá-ti	QuTáL-ti
Imperative				
SG	ʃageʁ	ʃaeʁ	ʃagéa	QaTeL
PL	ʃagʁ-u	ʃaaʁ-u	ʃag-u ~ ʃagʔ-u	QaTL-u
	'launch'	'estimate'	'madden'	

[9] The data in (9) do not include all the configurations of V+a at the right edge. For completeness, here are examples from the QaTaL verb type and related forms: [lifgóa] 'to hurt', [pagúa] 'hurt (adj.)', [pagía] 'vulnerable', [pogéa] 'hurting', but [pagá], *[pagáa] 'he hurt'. Compare the parallel forms of the verb 'to damage': [lifgom], [pagum], [pagim], [pogem], [pagam].

[10] The table in (9) illustrates stems with medial and final historical gutturals. Stems with initial historical gutturals largely obey the same rules. There are some additional lexical interactions with the vocalization of prefixes that are ignored here for clarity. Similarly, for a specific class of verbs the presence of historical gutturals in the second or third position coincides with a special vocalization of the stem; this issue, too, is tangential to the present discussion.

We emphasize again that whenever the patterning of the guttural ghost creates a hiatus, a glottal stop [ʔ] is possibly inserted, especially if the second vowel is stressed (e.g., [ʃieʁ]~[ʃiʔeʁ]), but also (even more rarely) when it isn't ([ʃigéa]~[ʃigéʔa], [ʃiaʁ-u]~[ʃiʔaru]). As mentioned in section 1, we do not include this unsurprising fact in the transcription: indeed, optional [ʔ]-epenthesis repairs any hiatus in MH, regardless of its origin (e.g., [koreá-ni]~[koreʔá-ni] 'Korean', [koréa]~[koréʔa] 'Korea'). In contrast, it is a fact exclusive to guttural ghosts that they can surface as [ʔ] after a consonant, as in [ʃagʔ-u] in (9), and for this reason this option is emphasized.

   Two previous studies of MH "gutturals" exist: Faust 2005 and Pariente 2012. According to both accounts, there is a vowel /a/—rather than some reconstructed guttural consonant—in MH where there was a guttural consonant [h, ʔ, ʕ] in BH.[11] Faust's and Pariente's analyses rely first and foremost on the fact that [a] is the only stable segmental realization of the phoneme. Indeed, if the underlying phoneme is /a/, realizing it in the position of a consonant would give rise to a problematic hiatus with the following vowel: *[ʃiaer], *[ʃigau] (neither analysis considers autosegmental representations). Yet the appearance of /a/ in a coda position also gives rise to hiatus ([ʃigéa]), as does the nonrealization of this /a/ in an intervocalic onset ([ʃier]). For this reason, Faust's (2005) analysis emphasized the role of inter- and intraparadigmatic relations, rather than hiatus avoidance. These constraints were coupled with faithfulness constraints. For instance, for a word like [ʃigéa] both vowels of the regular vocalization ⟨i,e⟩ must be preserved for the verb to resemble the paradigms of other verbs of this type (interparadigmatic uniformity); but the /a/ that remains from the guttural also must be preserved because it is in the input (faithfulness). For suffixed forms like [ʃig-u] 'they maddened', Faust (2005) argued that they are built on the 3MSG *output* (intraparadigmatic uniformity), rather than on an input of their own, in correspondence with the inflected surface form of a regular verb like [ʃigʁ-u] (interparadigmatic uniformity). Thus, faithfulness to a guttural [a] is not of the same nature in the 3MSG base and in the suffixed 3MPL, and it can be ranked lower than the requirement to resemble the corresponding regular verb form. The form is therefore [ʃig-u] rather than *[ʃiga-u]. The appearance of the guttural /a/ in internal coda position (e.g., [ʃiaru] 'they estimated') remained outside the scope of that work.

   Pariente (2012) adopts Faust's (2005) original idea of intricate interparadigmatic uniformity effects, though he further refines the analysis. He uses moraic theory to explain the emergence

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   It is worth mentioning a difference in the behavior of historical [ʔ] and historical [ʕ, h]: the former does not appear as [a] stem-finally after nonlow vowels (e.g., BH /liqro:ʔ/ > MH [likʁo], *[likʁoa] 'to write'). Such cases can be resolved by assuming a null consonant (i.e., /ikʁo∅/), rather than /a/, in this position. In other positions, however, historical [ʔ] behaves like [ʕ, h] (e.g., by appearing as [a] when it is expected to be an internal coda).

   [11] The analysis in Faust 2005 was inspired by Prunet 1996, which develops the same idea for several Ethio-Semitic languages that lost their gutturals. Also see Brame 1972 for an analysis of Maltese /ʕ/, where it is claimed that the realization of this guttural is [a]. Note that the data of MH are nevertheless very different from those of Ethio-Semitic. Whereas surface hiatuses abound in the former, the loss of gutturals in the latter is signaled mainly by a lowered quality of stem vowels. The MH analysis proposed both in Faust 2005 and here is accordingly very different from the one proposed for Ethio-Semitic, rather than a simple application of previous proposals. The present analysis is also quite different from Brame's account of Maltese, according to which /ʕ/ is a phoneme of the language, even though it is never realized as such. The present proposal derives all surface forms from an underlying /a/.

of "guttural" /a/ in what would be an internal coda position, claiming that as a vowel /a/ is moraic, but that in an onset position it cannot be moraic and so is suppressed. One criticism of that view is that moras are not motivated independently in MH, which is otherwise not weight-sensitive.

Both Faust (2005) and Pariente (2012) appeal to factors that are external to a strict view of phonology, involving output-output correspondences without motivation and unconstrained paradigm uniformity. Use of paradigm uniformity—or, more simply, analogy—always raises the question of why analogy applies to one aspect of a pair of forms (say, their vocalizations) and not to another (say, their size in syllables).[12] Both Faust and Pariente organize constraints in a way that is motivated mainly by the success of the analysis, and do not check—as is required when proposing new constraints—the typological and language-specific predictions of the analysis. In contrast, the account to be presented here is strictly phonological and relies on independently motivated crosslinguistic principles. We submit that such an account is preferable on the grounds of economy, elegance, and cognitive realism, the last because it involves no intricate relations between forms. Moras, which are central to Pariente's account, are also unnecessary in the present analysis. As an introduction to that analysis, we now discuss the theory in which it will be couched, the Strict CV version of Government Phonology.

2.2 Strict CV

In autosegmental phonological representations, segments appear on a different tier than the positions that allow them to be realized. The mapping between tiers can then be manipulated by both lexicalization and phonological processes. Thus, a language distinguishing short vowels from long ones will have the two lexical representations in (10a–b). Length can also be the result of a phonological *process*—for instance, the addition of an empty skeletal position to the representation, which is then associated to a segment (10c).

(10) *Autosegmental representations*
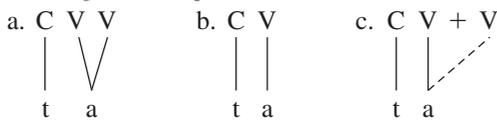
In (10), the skeletal tier is in fact not purely skeletal; its positions are predetermined to be consonantal or vocalic. This view is argued for in the autosegmental theory of CV Phonology (Clements and Keyser 1983).

Semitic languages have played a central role in the development of autosegmental theory at least since McCarthy 1981. In that seminal article, McCarthy defined the templates of Classical Arabic as fixed skeletal structures. For instance, a form like [kaṣ:ar] 'he shattered' was represented

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[12] In addition, we firmly agree with one reviewer that analogy should really be treated as a last resort strategy in phonological analyses.

as in (11a), encoding the length of the second consonant in the template, rather than on the segmental tier. Besides the lexical adjacency of the two C-slots, two other aspects of this representation will be important for our discussion of the puzzle presented in section 1. First, the two identical vowels of the stem were represented as one segment that branches onto the two vocalic positions of the template. Second, McCarthy represented the vocalization and the stem consonants on two different planes, reflecting his analysis of them as different morphemes. During the derivation, a process called Tier Conflation merges the separate planes of (11a) into the configuration in (11b). This process accounts for (a) the absence of locality constraints in the linearization of morphemes and (b) the relevance of locality constraints in the realization of segments (see McCarthy 1986:226). Unless otherwise stated, representations in this article show forms after Tier Conflation.

(11) *Representation of Classical Arabic [kaṣ:ar] 'he shattered' (McCarthy 1981:394)*

a. k   ṣ   r   b.

C V C C V C   C V C C V C

a   k a ṣ a r
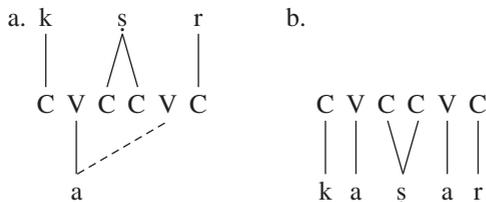
A small challenge to McCarthy's representation of the skeleton is posed by languages exhibiting V-Ø alternation, unlike Classical Arabic. In Qaraqosh Neo-Aramaic (Khan 2002), for instance, the simple verb stem has the form QaTəL in the 3MSG nonpast form, but QaTL before V-initial suffixes: [paθəx] 'that he open' vs. [paθx-a] 'that she open'. All other things being equal, one would need to assume the template CVCVC for the former and CVCC- for the latter, a clearly undesirable analysis. Another view of the Qaraqosh alternation can assume CVCC for both forms, with epenthesis in [paθəx]. However, this view does not solve the problem: epenthetic vowels also need to associate to skeletal slots, or the entire autosegmental enterprise is undermined. As a result, [paθəx] and [paθx-a] would still have different templates.

An attempt to unify such prosodically alternating but productively related word-forms was put forth by McCarthy and Prince (1995): these authors proposed to define the template in terms of number of syllables, rather than number of C- and V-slots. However, more needs to be said: for instance, the suffix [-a] of the Qaraqosh form, rather than the [ə] of the base, somehow needs to end up as heading the second syllable of the template, even though it is clearly a suffix and not part of the template (and a mechanism of erasure is required to account for syncope).

The autosegmental theory that will be used here, Strict CV (Lowenstamm 1996), avoids these problems in a more principled manner, while maintaining templaticity at the level of the skeleton. The basic tenet of this theory is that the skeletal level consists of a single, repeated constituent: the CV unit. As a consequence, there are never two adjacent V- or C-slots. Under this view, [paθəx] and [paθx] have the same template, namely, CVCVCV. This of course leaves some positions empty. Such positions are taken care of by general principles of the theory, to which we now turn.

The basic unsuffixed triconsonantal form is provided in (12a). We assume that there is only one lexical vowel in the template, /a/, which is associated to the first V-slot. For (12a), then, two facts must be accounted for: the empty position at the right edge and the appearance of epenthetic [ə]. In Strict CV, as in classical Government Phonology (Kaye, Lowenstamm, and Vergnaud 1990), the status of final nuclei is parameterized: depending on the language, they may or may not remain empty.[13] All one needs to say is that in Qaraqosh, the final nucleus may remain empty. In order to understand the insertion of [ə] in (12a), consider (12b). In this form, it is a medial empty V-slot that must be accounted for. This is done by means of another notion inherited from Government Phonology: government. Government is an inhibitory force exerted by a position associated with segmental material on a position that is not, allowing the latter to remain unassociated despite this defectiveness. (12b) involves right-to-left V-to-V government: the final V-slot is filled, and so the preceding, internal V-slot may remain unassociated. Back to (12a), the insertion of [ə] is now clear: the medial V-slot in this form is not governed by the following nucleus (as shown by the barred arrow) because the latter nucleus is empty, and so the former must be associated with segmental material.

(12) *Strict CV: No alternations in the template*

a.

$$
\begin{array}{cccccc}
& & \text{G} & & & \\
& & \downarrow\; \nparallel & & & \\
\text{C} & \text{V} & \text{C} & \text{V} & \text{C} & \text{V} \\
| & | & | & \vdots & | & \\
\text{p} & \text{a} & \theta & \text{ə} & \text{x} &
\end{array}
$$

b.

$$
\begin{array}{cccccc}
& & \text{G} & & & \\
& & \downarrow & & & \\
\text{C} & \text{V} & \text{C} & \text{V} & \text{C} & \text{V} \\
| & | & | & & | & | \\
\text{p} & \text{a} & \theta & & \text{x} & \text{u}
\end{array}
$$
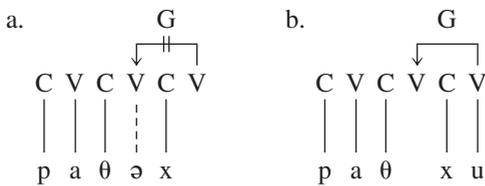
While (nonfinal) empty nuclei require government in order to remain unassociated, empty onsets—unassociated C-slots—may remain unassociated by assumption.

In (13), we summarize the relevant tools of the adopted framework.

(13) *Principles of Strict CV*
   a. The skeleton is composed of strictly alternating Cs and Vs.
   b. Unassociated V-slots remain unrealized through government from a contentful V-slot to their right.
   c. Unassociated C-slots are unproblematic.

Having introduced these principles, we may embark on the analysis of the specters of MH.

3 Analysis

In this section, we present our analysis of guttural ghosts. Yet before we turn to this analysis, two other issues must be made explicit: (a) the locus of epenthesis in MH, and (b) the status of lexical vowels in the verbal system.

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[13] For a summary of the evidence that C-final words in fact end in an empty nucleus, see Gussmann and Harris 1998.

3.1 The Locus of Epenthesis

Strict CV makes a clear prediction for representations involving triconsonantal clusters, such as Palestinian Arabic /jiktb-u/ 'that they write' in (14). Since lateral relations are calculated from right to left, V_3 is governed and therefore need not be associated. This leaves V_2 ungoverned, and so it is realized through epenthesis of [i]. The realized form is [jikitbu].

(14) *Two adjacent empty nuclei in Palestinian Arabic /jiktb-u/ 'that they write'*

$$
\begin{array}{ccccccc}
 & & & G & & G & \\
 & & & \downarrow & \| & \downarrow & \\
C & V_1 & C & V_2 & C & V_3 & C & V_4 \\
| & | & | & \vdots & | & & | & | \\
j & i & k & i & t & & b & u
\end{array}
$$
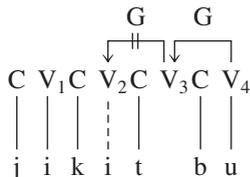
In other words, the first of two adjacent empty nuclei must be realized. The prediction is correct for many cases of epenthesis in Palestinian Arabic: /ʁurf-t-i/ 'my room' is realized [ʁurifti], and so on.

However, the prediction is entirely incorrect for MH. Systematically, it is the *second* of two empty nuclei that must be realized (this pattern is not unprecedented; see Itô 1989:241). Consider the data in (15). In (15ia), the suffix [-χa] 'POSS.2MSG' is attached to a C-final stem. When the same suffix is attached to CC-final stems (the unstressed [e] of the base [dégel] is epenthetic; cf. [digl-i]), a sequence /CC-χa/ is presumably created, which in Strict CV involves two adjacent empty nuclei /C__C__χa/. The epenthetic vowel (in boldface) appears in the governed position between the stem and the suffix, unlike what the theory predicts (the [e]-[i] alternation is irrelevant for present purposes). Similarly, in certain vowel-final verbs, the feminine suffix /-ta/ is attached to the masculine base *minus* the final vowel. If the stem is VC-final, nothing else occurs (15ib); but if it is CC-final, an epenthetic vowel appears between the stem and the suffix (15iib), again in a position that Strict CV designates as governed. (15c) illustrates the agentive template of the MH noun. This template can host three or four consonants. If it hosts three, it is of the shape CaCCan (15ic); but if it hosts four, it takes the shape CaCC**e**Can (15iic). Rather than assuming two vocalizations, a unified account (e.g., Faust and Hever 2010) would derive both forms from the vocalization <a,-an>: (15iic) would be /kalklan/, with epenthesis appearing again in the governed position, between the second and third consonants. Finally, action nouns of verbs of the type QaTaL take the form QTiLa (15id). However, initial clusters involving an initial sonorant are illicit in MH; they are always resolved by epenthesis between the two consonants (15iid), rather than before the cluster: *[enʃiχa]. Lowenstamm (1999) submits that the beginning of the word is marked by an empty CV unit, with a V-slot requiring government (see also section 3.5). If that is the case, then (15iid) is again the realization of the second of two empty nuclei.[14]

---

[14] We will return to initial clusters in section 3.5. In the present context, it is telling that initial clusters in Palestinian Arabic are resolved by prothesis: /kti:r/ → [ikti:r] 'much'. Indeed, the first of two empty nuclei is realized in MH only in final clusters, which are broken like initial clusters, rather than repaired by a final epenthetic [e] (e.g., /digl/ → [dégel] in (15iia)).

(15) *The locus of epenthesis*

	i.		ii.	
a.	pil	'elephant'	dégel	'flag'
	pil-i	'my elephant'	digl-i	'my flag'
	pil-χa	'your elephant'	digl-**e**χa	'your flag'
b.	ʁatsa	'he wanted'	hiʁtsa	'he lectured'
	ʁats-ta	'she wanted'	hiʁts-**e**ta	'she lectured'
c.	klaf	'card'	kalkala	'economy'
	kalfan	'card-player'	kalk**e**lan	'economist'
d.	kalat	'absorb'	naʃaχ	'he bit'
	klita	'an opening'	neʃiχa	'a bite'

While it is usually assumed that the first of two empty nuclei is realized, the pattern found in MH produces a representation that is *also* well-formed according to the theory. As shown in (16), because V_3 is realized, the lexical emptiness of either V_3 or V_2 no longer poses a problem: V_2 is governed, and V_3 does not require government.

(16) *Two adjacent empty nuclei in Modern Hebrew /jixtv-u/ 'they will write'*

$$C \ V_1 C \ V_2 C \ V_3 C \ V_4$$

$$j \quad i \quad χ \qquad t \quad e \quad v \quad u$$
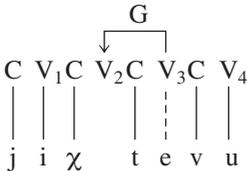
It seems that in MH epenthesis systematically arises if the nucleus in question is a potential governor. We refer to such nuclei as *responsible*. The generalization that emerges for MH is the following:

(17) *Principle of Responsible Nuclei*
    A (nonfinal) empty nucleus that is the potential governor of a preceding empty nucleus must be realized.

This principle will be important for the rest of the article, and specifically in the next section, where we address the syncope of lexical vowels.

3.2 The Status of Lexical Vowels in the Verbal System

We have asserted above that the second vowel of verbal stems is absent from suffixed forms. Here, we clarify what we mean by *absent*: we claim that this vowel is not included in the underlying representation of the suffixed form. In other words, it is not the case that this vowel is syncopated in the suffixed form; it is simply not present in it lexically. This claim is crucial in the ensuing account, so we must begin by arguing for it explicitly.

Consider the data in (18). In (18a), the stressed second vowel of the unsuffixed form is nonhigh. This vowel is also completely absent from the realization of the stem before a V-initial suffix, whose vowel also attracts stress (V-initial suffixes are represented in (18) by the plural

[-u], but the same is true for all V-initial suffixes in the verbal paradigm). The verbs in (18b) are
of a specific type, characterized by a prefix ([i-] or [e-]) and a high [i] in the stem. Unlike in the
verbs in (18a), before a V-initial suffix this vowel not only is present, but also bears stress. This
is so regardless of the number of consonants in the stem (i.e., it is not the case that [i] is maintained
in order to avoid a triconsonantal cluster). Importantly, before a C-initial suffix, [e], [a], *and* [i]
alternate with stressed [á] ([-ti] is the 1sG suffix; there are no C-initial suffixes in the future
paradigm).

(18) *Syncope in the verbal system*

	Unsuffixed 3MSG	__-V	__-C	
a.	kaf**a**ts	kafts-u	kaf**á**ts-ti	'jump (past)'
	ʃig**e**ʁ	ʃigʁ-u	ʃig**á**ʁ-ti	'launch (past)'
	ʃug**a**ʁ	ʃugʁ-u	ʃug**á**ʁ-ti	'be launched (past)'
	nik**a**ʁ	nikʁ-u	nik**á**ʁ-ti	'be apparent (past)'
	jip**o**l	jipl-u	—	'fall (future)'
b.	ifʁ**id**	ifʁ**í**d-u	ifʁ**á**d-ti	'separate (past)'
	eʁ**im**	eʁ**í**m-u	eʁ**á**m-ti	'lift (past)'

There are two ways to treat the absence of the stem vowels before V-initial suffixes in (18a):
(a) as a lexical absence, and (b) as a phonologically derived absence. Under the first approach,
speakers must learn a phonologically conditioned stem allomorphy: before V-initial suffixes, the
stem does not have a second vowel. Under the second approach, there is no stem allomorphy,
because the phonology derives the syncope. We find the second approach problematic and adopt
the first, for the reasons we now present.

The stance according to which phonology is responsible for syncope is taken for example
in Bat-El 2008. Bat-El argues that size and alignment constraints amount to the stray erasure of
these vowels. To account for (18b), Bat-El posits special faithfulness to high vowels, which are
saved through stress. However, consider the participial forms in (19a). While an /e/ in the base
is absent before the stressed V-initial suffix [-im], lexical /a/ and /o/ do not disappear in participles,
even though phonologically, the environment is identical to that of "syncope" in (18a). The high
vowel /i/ is preserved, too, even though unlike in verbs, stress *does* move to the suffix (19b).[15]

---

[15] What we have been referring to as a lexical /e/ (e.g., [ʃigeʁ]) cannot be epenthetic, because it is stressed. While
stressed epenthetic vowels are not unheard of, such an analysis is best avoided for MH for the following reason. MH is
largely stress-final (this is true principally for its native vocabulary). Excluding the stressless -CV(C) suffixes of the
verbal inflexion, unstressed vowels at the right edge are almost always [e]: for example, [séfeʁ] 'book', [lamád-et] 'you
(FSG) learned' (cf. [katav-t] 'you (FSG) wrote'), [pilégeʃ] 'mistress', and [matéχ-et] 'metal' (these vowels disappear in
VC__CV position: [sifʁ-i] 'my book', [pilagʃ-o] 'his mistress', [mataχ-t-i] 'metallic'). The unstressed status of these
vowels can be explained if stress is taken to ignore epenthetic vowels in MH, in which case the stressed vowel of bases
like [ʃigeʁ] and [ʃikʃek] cannot be regarded as epenthetic. See Faust 2012 for an additional argument for the same claim.

(19) *Lexical /a/, /o/, /i/ not syncopated in participles*

	Unsuffixed SG	__-im (MPL)		
a.	meʃageʁ	meʃagʁ-im	'launch'	cf. ʃigeʁ, ʃigʁ-u in (18a)
	meʃugaʁ	meʃugaʁ-im	'be launched'	cf. ʃugaʁ, ʃugʁ-u in (18a)
	nikaʁ	nikaʁ-im	'be apparent'	cf. nikaʁ, nikʁ-u in (18a)
	nasog	nesog-im	'retreat'	cf. jipol, jipl-u in (18a)
b.	mafʁid	mafʁid-im	'separate'	cf. ifʁid, ifʁíd-u in (18b)

A phonological syncope account must explain why the effects are not general for /a/ and /o/, and why /i/ does not attract stress outside verbs. Bat-El proposes that there are different phonologies for verbs and participles. We consider this reference to morphology to be a weak point of a syncope analysis.

A second weak point, not brought up in Bat-El 2008 and more directly related to the present article, concerns what happens when applying syncope would result in an illicit triconsonantal cluster. As shown in (20), if the lexical vowel really existed in /ʃukʃak+u/, /niʃbaʁ+u/, or /jiʃpot+u/, one would expect this vowel to be maintained in these cases, thereby preventing the illicit cluster. Instead, the vowel [e] appears in the suffixed form, as if the lexical vowel were syncopated and then epenthesis occurred in the responsible V-slot. By analogy, one may assume that the vowel [e] in [ʃikʃek-u] is also not the same vowel as in [ʃikʃek], but rather the epenthetic vowel [e] (see footnote 15).

(20) *Lexical /a, o, i/ replaced by epenthetic [e] if triconsonantal cluster is expected*

Unsuffixed MSG	__-V		
ʃikʃek	ʃikʃek-u	'shake'	cf. ʃigeʁ, ʃigʁ-u in (18a)
ʃukʃak	ʃukʃek-u	'be shaken'	cf. ʃugaʁ, ʃugʁ-u in (18a)
niʃbaʁ	niʃbeʁ-u	'break'	cf. nikaʁ, nikʁ-u in (18a)
jiʃpot	jiʃpet-u	'judge'	cf. jipol, jipl-u in (18a)

One may wish to save the syncope analysis by assuming that these [e] vowels are not epenthetic, but rather reduced versions of the lexical vowels. But then the same problem arises with respect to the participles in (19), which do not exhibit reduction. Indeed, nowhere else in the language are /o, a/ systematically reduced to [e] in this position. Even if the presence of the lexical vowels can somehow be maintained, it is inconsistent with MH phonology to claim that the surface [e]'s are the realizations of these vowels. In contrast, if one assumes that the lexical vowels are simply not there in the suffixed form, the appearance of [e] is completely unsurprising: it is the epenthetic vowel of MH, and the locus of epenthesis is the responsible nucleus.[16]

---

[16] Another possible view is that the realization of the lexical vowel is conditioned by stress. Besides explaining the exact effect of stress, such a view will have to explain (19). For present purposes, note that such an analysis, too, would have to say that the vowel [e] in the suffixed forms in (20) is epenthetic.

Another argument in favor of this conclusion is the substitution of all vowels by [á] before stressless C-initial suffixes (see (18)). As Faust (2012) argues, this cannot be a phonological rule: it is a simple lexical fact about these stems before C-initial suffixes that they lack the lexical vowel. Once this is accepted, extending the allomorphy to V-initial cases becomes less problematic.

In the end, we see only two arguments for retaining these vowels in the lexical representation of the suffixed stem: (a) [ifʁid], [ifʁíd-u], where there is no doubt that the lexical vowel is there, and (b) a general wish to avoid allomorphy. To explain the persistence of /i/ in an account without syncope, one could assume that unlike /a, e, o/, this vowel *is* present in the suffixed stem. This seems no less ad hoc than to assume faithfulness to high vowels. As for the second argument, in our opinion allomorphy seems a lesser price to pay than cophonologies, especially since allomorphy must be admitted in the preconsonantal configuration in (18). We reach the following conclusion:

(21) *The status of stem vowels before V-initial suffixes*
       The stem vowels /a, e, o/ are absent from the representations of verbal bases before V-initial suffixes.[17]

This assumption will be crucial to the coherence of the analysis of guttural ghosts, to which we now finally turn.

3.3 Mysterious Alternations: Ø - [a]

The first set of data to account for, (1), is repeated in (22). The guttural ghost appears as [a] in a coda position, and as an optional [ʔ] when surrounded by vowels and in a postconsonantal onset.

(22) *[a]-Ø~[ʔ] in Modern Hebrew QiTeL*

	PST.3MSG				PST.3PL				
	Q	i	T	e	L	Q	i	T	L	- u
a.	ʃ	i	g	e	ʁ	ʃ	i	g	ʁ	- u	'launch'
b.	ʃ	i	(ʔ)	e	ʁ	ʃ	i	a	ʁ	- u	'estimate'
c.	ʃ	i	g	é	a	ʃ	i	g	(ʔ)	- u	'madden'

Consider the representations in (23) of regular [ʃigeʁ]-[ʃigʁ-u] in Strict CV. In (23a), we see that MH is like Qaraqosh in that it allows final nuclei to remain empty. Other than that, there is nothing to say about the unsuffixed form: all positions are filled. As for the suffixed form, (23b), we have argued that the second vowel is absent from its representation: the position is lexically empty. This emptiness does not pose a problem of any sort, since the position is governed by the final, contentful nucleus.

---

[17] It will be too much of a deviation here to flesh out a full analysis of the verbal system that adopts (21). The beginning of such an analysis can be found in Faust 2012.

(23) *[ʃigeʁ]-[ʃigʁ-u]: Representations in Strict CV*

a.

```
   C V C V C V
   │ │ │ │ │ │
   ʃ i g e   ʁ
```

b.

```
            G
            ↓
   C V C V C V
   │ │ │   │ │
   ʃ i g   ʁ u
```

We thus note that this pair is almost identical to the Qaraqosh case examined in (12). The main difference is that in Qaraqosh, the vowel was considered to be epenthetic. As discussed in footnote 15, although [e] is the epenthetic vowel of MH, the vowel [e] of [ʃigeʁ] should not be regarded as epenthetic.

Moving on to forms with guttural ghosts, we may now feed the idea from Faust 2005 into the representations of Strict CV. Let us begin with the QiTel verbs with a historical guttural in the second position, such as [ʃieʁ]-[ʃiaʁ-u]. Consider (24).

(24) *Stem-medial /a/-∅ alternation in Strict CV*

a.
```
   C V C V C V
   │ │ [ʔ] │ │
   │ │     │ │
   ʃ i a e ʁ
```

b.
```
   C V C V C V
   │ │ [ʔ]╱ │ │
   │ │     │ │
   ʃ i a   ʁ u
```

In (24a), the /a/ is matched with the second CV of the template. It cannot associate to a C-slot because of its vocalic nature. But it cannot associate to its V-slot either, because that V-slot is taken. It remains afloat and therefore unrealized. The form will be realized with the two lexical vowels in hiatus and with the C-slot remaining empty (in accordance with (13c)). To motivate the rare appearance of a glottal stop in such cases, one need only state that *all* empty C-slots are optionally realized with a glottal stop. In (24) and the representations that follow, this fact is represented by [ʔ] below the empty C-slot.

In the suffixed form in (24b), the V-slot of the CV with which /a/ is matched is available. The /a/ therefore associates to it. Consequently, as in the unsuffixed form (24a), the medial C-slot ends up being empty. The resulting /ia/ sequence involves two nuclei and is therefore realized as a hiatus. Like all hiatuses, it is optionally separated by [ʔ].[18]

---

[18] A possible alternative for (24a) is that the floating /a/ associates to the C-slot. Under this view, a C-slot attached to /a/ would be phonetically interpreted as [ʔ]. Indeed, within Element Theory (Kaye, Lowenstamm, and Vergnaud 1985), the basic building blocks of any "segment" are not vocalic or consonantal; therefore, the claim that /a/ is unable to attach to a C-slot because it is a vowel is initially untenable. We are unable to falsify this hypothesis: it is possible that an /a/ associated to a C-slot is realized as [ʔ]. Having said that, recall that all empty C-slots, whether lexically attributed to a floating /a/ or not, are optionally realized with [ʔ] (e.g., [koréa]~[koréʔa] 'Korea'). Moreover, even in cases where the /a/ is realized on the following V-slot (as in (24b) or (25)), the C-slot is also optionally realized with [ʔ]. It seems to us that assuming only one, epenthetic origin for the optional [ʔ] is more economical than assuming two, epenthesis and an /a/ associated to C.

The unifying nature of the Strict CV analysis is especially remarkable in (24). Recall that the alternative to the skeletal template was the syllabic template. When this approach was adopted for MH (e.g., in Bat-El 2003, Faust 2005, or Pariente 2012), a central claim was that the templates of MH stems obey a size restriction of two syllables. Forms like [ʃiaʁ-u] were thus problematic for these accounts, because they involve three syllables. An account with syllabic templates would have to explain this violation of disyllabicity. Of course, disyllabicity can be conceived of as violable and can then be made to interact with all kinds of other considerations, like the analogical pressures of previous accounts. The CV analysis proposed here does not need to resort to such analytic moves; it requires no reference to word size, syllables, number of syllables, or any faithfulness or analogical constraints, and furthermore analyzes [ʃiaʁ-u] as having the same template as [ʃigʁ-u].

A similar case can be made for forms with a stem-final guttural ghost. As shown in (25), nothing needs to be added in order to derive [ʃigéa]: as in (24b), the vowel /a/ can associate to the final empty nucleus. Its consonantal position can remain unassociated (recall that this form, too, would have a much rarer alternative pronunciation [ʃigéʔa], with [ʔ]-epenthesis in the empty C-slot). While previous accounts had to explain [ʃiaʁ] and [ʃigéa] separately, the Strict CV analysis covers both forms in one fell swoop.[19]

(25) *Stem-final /a/-Ø alternation in Strict CV: Unsuffixed stem*

```
C  V  C  V  C  V
|  |  |  |  |  [ʔ] ╱
|  |  |  |  |      ╱
ʃ  i  g  e  a
```

The last realization to account for is that of the postconsonantal guttural in [ʃig-u]~[ʃigʔ-u]. The lexical representation of such forms is as follows:

(26) *Stem-final /a/-Ø alternation in Strict CV: Lexical representation of suffixed stem*

```
C  V  C  V  C  V
|  |  |      [ʔ] |
|  |  |       |
ʃ  i  g      a  u
```

As in [ʃigʁ-u] and [ʃiaʁ-u], the second V-slot of the stem is empty. It is expected to attract government, as shown in (27a). As in [ʃieʁ], the C-slot remains unassociated. Unless this position is realized by epenthesis, the form will be pronounced [ʃigu]. If optional epenthesis applies, the pronunciation will be [ʃigʔu]. Note that in order to rule out (27b), where the /a/ associates to the

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[19] As for the placing of stress, it is possible that stress is assigned "before" the association of the guttural. We leave this issue for further study.

nucleus to its left, one must assume that this floating vowel can only associate to the right. A way of motivating this restriction is to limit the association of /a/ to its "original" CV unit. We leave this restriction at this speculative level.

(27) *Stem-final /a/-Ø alternation in Strict CV: Two scenarios in suffixed stem*

    a.   G   b.

    C V C V C V   *C V C V C V

    ∫ i g   a u   ∫ i g   a u   [ʔ]

By way of interim summary, we may now answer Q1 and Q2 of section 1.

(28) *Questions and answers*

    Q1. What drives the [a] realization in [∫igéa], [∫iaʁ-u] in (1)?

    A1. An /a/ is matched with a CV unit and will be realized on the V-slot of that unit unless it is occupied.

    Q2. What drives Ø~[ʔ] in [∫ig-u]~[∫igʔ-u] (1c)?

    A2. If the following V-slot is occupied, the /a/ remains afloat and the C-slot remains unassociated. Empty C-slots are optionally realized as [ʔ].

We now turn to cases such as [ufʁe-u], where an epenthetic vowel is inserted before the guttural ghost.

3.4 Who Put That Vowel There? /a/ Ghost

The data in (29) are repeated from (2). They contrast the homophonous bases [ufʁa] (29c) and [ufʁa] (29d). The homophony does not survive in the suffixed plurals: while the base vowel appears in neither case—in conformity with (21)—it is replaced by the suffix vowel in (29d) and by epenthetic [e] in (29c). Indeed, the suffixed [ufʁe-u] parallels the triconsonantal stem [ufʁed-u] in (29b). The epenthetic status of the vowel can be deduced from the facts in (29a): (a) it does not surface when the cluster resulting from the absence of a vowel is licit, and (b) it occurs in a responsible position.

(29) *[e]-epenthesis without surface motivation in Modern Hebrew passive huQ(T)aL*

	a. 'take off'	b. 'separate'	c. 'disturb'	d. 'fertilize'	Template
PST.3MSG	uʁad	ufʁad	ufʁa	ufʁa	huQTaL
PST.3MPL	uʁd-u	ufʁed-u	ufʁe-u	ufʁ-u	huQTLu

The resemblance between [ufʁed-u] and [ufʁe-u] points to the presence of a third, unpronounced "consonant" in the latter. As illustrated in (9), unpronounced consonants at the right edge of the stem after a vowel /a/ are possibly guttural ghosts. Indeed, in the corresponding active form of

'disturb' [ifʁía] we find the typical realization [a] of a historical guttural. This fact unequivocally points to the identity of the unpronounced "consonant" of [ufʁa]-[ufʁeu]: it is a guttural ghost.

Regarding the elision of the "guttural" /a/ in [ufʁa] 'disturb', we are satisfied with leaving this at the level of an empirical generalization: two /a/ vowels at the right edge of the stem are impossible. While we do not propose an analysis, we emphasize the fact that this occurs only at the right edge of the stem: it does not occur across an affix boundary ([hafra-a] 'disturbance', [ja-akov] 'he will follow') or stem-internally ([ʃaal-u] 'they asked').[20]

Turning now to the epenthesis in [ufʁed-u] and [ufʁe-u] (29b–c), consider first the representation of the triconsonantal stem in (30). Since, once again, the stem vowel is absent from the representation of suffixed forms, this form has two, rather than one, empty nuclei: V_2 and V_3. In accordance with the Principle of Responsible Nuclei (17), V_3 is realized in (30), thereby inhibiting the realization of V_2.

(30) *Two consecutive empty nuclei; the responsible nucleus is realized*

$$C \; V_1 C \; V_2 C \; V_3 C \; V_4$$

G

u f ʁ e d u
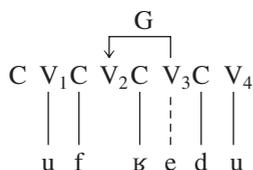
If V_3 is realized because it is responsible in a normal triconsonantal verb like (30), the same should be true in the suffixed form of [ufʁa] 'disturb', which has a final guttural ghost. And the same *is* true, as shown for [ufʁe-u] in (31). V_3 is a responsible V-slot, and as a result it must be realized.

(31) *A responsible empty nucleus is realized before a guttural ghost*

$$C \; V_1 C \; V_2 C \; V_3 C \; V_4$$

G

[ʔ]

u f ʁ e a u
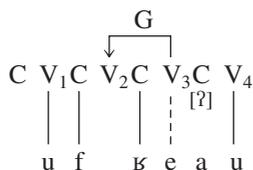
We have thus answered Q3 from section 1, "Why is epenthesis obligatory in [ufʁe-u] (2c)?"

It is worthwhile to note that in this very short section and the last, we have explained the basic facts of guttural ghosts in MH, which occupied a much larger space in previous accounts. Indeed, once the proposal in Faust 2005 is married with Strict CV templates, the facts follow

[20] Moreover, the sequence [aa] may appear at the right edge if the second [a] is stressed. This situation comes about when a guttural ghost is surrounded by two lexical /a/'s (e.g., [taá] 'he erred' (< /taˤa/)).

almost effortlessly. In the next section, we provide corroborating evidence from initial clusters, a domain in which the behavior of guttural ghosts was hitherto unexplored.

3.5 Initial Clusters

MH is quite permissive in its initial clusters: on the surface, almost any two consonants can form an (apparent) initial cluster (32a–d).[21] Three exceptions are (a) if the first consonant is a sonorant (regardless of the identity of the second consonant: (32e–f)); (b) if the second consonant is a historical guttural (regardless of the identity of the first consonant: (32g–i)); and (c) if the first consonant is a historical guttural (regardless of the identity of the second consonant: (32j–l)). In the first two cases, an epenthetic vowel [e] (in boldface) intervenes between the two consonants. In the third, one finds an [a] instead of the first stem consonant (underlined). Importantly, like all onsetless vowels in MH, this vowel is optionally preceded by a glottal stop [ʔ] (unlike in the rest of the article, in (32) we include the optional realizations of [ʔ] in order to make our claims explicit).[22]

(32) *Initial clusters*

| 3MSG.PST QaTaL	Action noun QTiLa	
a. ʃakal	ʃkila	'weigh'
b. takaf	tkifa	'assault'
c. bagad	bgida	'betray'
d. kaʁats	kʁitsa	'blink'
e. nakat	n**e**kita	'execute'
f. lamad	l**e**mida	'learn'
g. taam ~ taʔam	t**e**ima ~ t**e**ʔima	'taste'
h. ʃaal ~ ʃaʔal	ʃ**e**ila ~ ʃ**e**ʔila	'borrow'
i. naal ~ naʔal	n**e**ila ~ n**e**ʔila	'lock'
j. atam ~ ʔatan	<u>a</u>tima ~ ʔ<u>a</u>tima	'seal'
k. afaχ ~ ʔafaχ	<u>a</u>fiχa ~ ʔ<u>a</u>fiχa	'invert'
l. amad ~ ʔamad	<u>a</u>mida ~ ʔ<u>a</u>mida	'stand'

[21] According to the traditional understanding of the biblical scripture, there were no initial clusters on the surface in BH.

[22] The array of licit initial clusters in MH is still little understood. The language is sometimes described in classrooms as permitting both rising sonority and sonority plateaus in initial position, but this characterization does not cover the illicitness of sonorant plateaus. Initial clusters in MH are not the topic of this article, and the acceptability of obstruent plateaus has no bearing on the analysis of initial clusters with guttural ghosts. For Romance languages that allow similar plateaus, see Passino 2013.

We will now show that the behavior of guttural ghosts in initial clusters is predicted by the analysis of sections 3.3–3.4.

As mentioned in section 3.1, Lowenstamm (1999) treats epenthesis in initial clusters by assuming the existence of an empty CV unit at the left extremity of the word ("the initial CV"). Scheer (2004 et seq.) argues at length for this proposal, developing Lowenstamm's view of the initial CV as a nondiacritic way to mark the left edge of the word, which in *SPE* (Chomsky and Halle 1968) was simply marked with the diacritic #. When the intervening nucleus of an initial cluster is realized, it happens so that the nucleus can govern this initial CV. This is represented for [nekita] in (33a). Also following Scheer (2004), we assume that when such epenthesis does not take place, the initial cluster forms a domain above which government may hold ((33b); the domain is enclosed in square brackets).[23]

(33) *Initial clusters with no guttural ghost: [nekita] 'execution', [bgida] 'treason'*
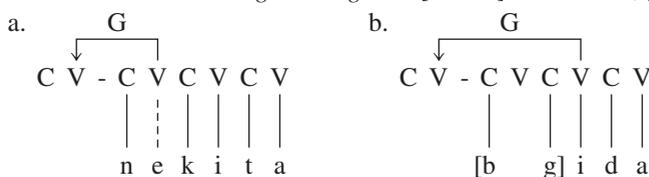
With these assumptions in place, we can proceed to examine cases of initial clusters with guttural ghosts. First, consider cases where the ghost is in C_1, such as [atima] (32j). The quality of the first vowel is unsurprising under the present account. As shown in (34), the /a/ in the initial position is unable to associate to the C-slot and thus appears in the vocalic position. This effectively results in the government of the V-slot of the initial CV. (As elsewhere, a glottal stop will optionally realize the stem-initial C-slot.)

(34) *Initial cluster with first guttural ghost: [(ʔ)atima] 'sealing'*
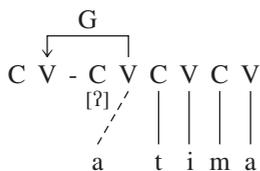
In initial sequences with a guttural ghost in C_2 (32g–i), /a/ floats after a governed empty nucleus and before a vowel (35). This is equivalent to the situation in [ʃig(ʔ)u]. Again, by hypothesis the

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[23] In Scheer's (2004) analysis, domains are reserved for branching onsets of the obstruent+liquid type. According to this view, sequences like [bg] should not form domains, roughly because they do not involve rising sonority. As mentioned in footnote 22, why MH permits such domains is beyond the scope of this article and has little bearing on its topic.

floating /a/ cannot be associated to the position to its left. As a consequence, it remains unassociated. However, unlike in [ʃig(ʔ)u], the empty nucleus preceding the /a/ (V_1) is a responsible nucleus. It is therefore realized through epenthesis.

(35) *Initial cluster with second guttural ghost:* [t**e**ima] *'tasting'*

```
        G
        ↓      
  C V - C V₁C V C V
      |   ┊ [ʔ] | | |
      |   ┊   | | |
      |   ┊   | | |
      t   e a i m a
```
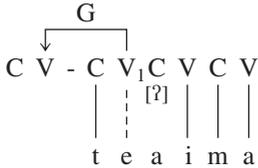
To summarize, initial clusters fully support our analysis. The same principles are at work in the realization of the floating /a/ as elsewhere in the language. Interestingly, the same cannot be said for the analyses in Faust 2005 and Pariente 2012, which do not treat this issue. If the guttural is simply a vowel seeking to be realized, it is unclear why it should be realized when it is the first "consonant" of a cluster, but not when it is the second. In the present account, this distribution follows the general pattern in which the /a/ may not branch to the left.

We have thus covered nearly all the regular phenomena associated with guttural ghosts, which now no longer haunt us. Or do they still? There is one last, disturbing case of an interaction between these ghosts and epenthesis, which we have not yet covered: the case of [ʃiaʃe-u] in the puzzle from section 1. Indeed, the analysis developed hitherto cannot explain this form. As we will now show, the key to understanding this interaction does lie in the present analysis, but another factor is at play: namely, reduplication.

4 Epenthesis and the Obligatory Contour Principle

The puzzle in section 1 constitutes an exception to the analysis in the previous section. In this puzzle, the form [ʃiaʃeu] includes an instance of epenthesis (in boldface) that does not seem to be handled by the government relations that we previously introduced. In this section, we will show that epenthesis in this case is an OCP effect, along the lines already proposed by McCarthy (1986) for MH.

Let us first reprise the facts, repeated from (4) in (36). Quadriconsonantal verbs can have four different lexical consonants (36a), or they can come to have four consonants by a process of reduplication, such as the full reduplication of a biconsonantal base (36b). In both cases, an epenthetic [e] appears in the suffixed form. By now, we know why. This V-slot is responsible for governing the preceding empty V-slot. But when that position is filled by a "guttural" [a], as it is in [ʃiabdu] (36c), it does not require government, and therefore V_3 is not responsible and can remain empty (37a). The puzzle is posed by the suffixed form of the fully reduplicated biconsonantal entity in (36d), [ʃiaʃeu], which involves a surprising case of epenthesis. There are 14 verbs of this type in MH, and each displays several cases of this unexpected epenthesis; for more quantitative data, see online appendix A.

(36) *The puzzle*

	3MSG	3PL	
a.	ʃiʁbet	ʃirbet-u	'scribble'
b.	ʃikʃek	ʃikʃek-u	'shake (from fear)' (< Eng. ʃeɪk)
c.	ʃiabed	ʃiabd-u	'enslave'
d.	ʃiaʃéa	ʃiaʃe-u	'amuse' ?ʃiaʃu, ?ʃiaʃʔ-u

Before we proceed, it is important to comment on the alternative pronunciations in (36d). According to the judgment of the native-speaker author of this paper, [ʃiaʃeu] is the only possible pronunciation. To corroborate this judgment, this author conducted an experiment, in which 15 native speakers in their 30s and 40s were asked to provide plural versions of six sentences, three of which contained forms of the type (36d). *All 15 native speakers* provided *only* forms with epenthesis.[24]

Several native speakers who are linguists, including an *LI* reviewer, reported that alongside [ʃiaʃeu], they accept the two alternative pronunciations in (36d). For this reason, we chose to mark these forms with "?" rather than "*". Having said that, we should emphasize that the reported acceptability of these forms has no bearing on our analysis: given that the "guttural" [a] is treated like a vowel in (36c), and given that the guttural ghost disappears (and the position possibly realized by [ʔ]) in the context VC__V#, the unattested ?[ʃiaʃu], ?[ʃiaʃʔ-u] are the expected, well-behaved forms. What requires explanation given these facts is the now undeniable existence and grammaticality of the form with the unexpected epenthesis, [ʃiaʃeu], which is both attested and accepted by *all* native speakers.

The question still stands: why is the first "guttural" [a] treated like a vowel for the purpose of dealing with epenthesis in (36c), but like a consonant in (36d)? Answering this question will also help elucidate the grammar of speakers who accept the unsurprising ?[ʃiaʃu], ?[ʃiaʃʔ-u].

In representational terms, the configuration of [ʃiabd-u] and the configuration of [ʃiaʃe-u] should be exactly the same: V_3 is governed and does not need to govern V_2 (37). Thus, it is disturbing to observe an absence of epenthesis in the first case (37a), but not in the second case (37b).

(37) *Unexpected epenthesis in [ʃiaʃeu]*

a.   G   b.   G

     C V₁C V₂C V₃C V₄   C V₁C V₂C V₃C V₄
        [ʔ]   [ʔ]   [ʔ]
     ʃ i a   b d u   ʃ i a   ʃ e a u

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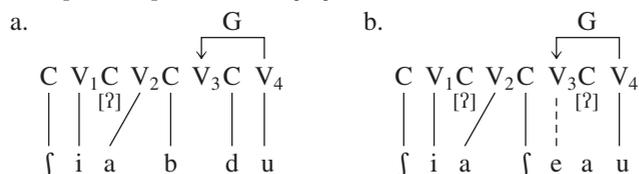
[24] The participants were also asked to provide a judgment about alternative pronunciations. The experiment and the findings with respect to judgments are provided in online appendix B (https://www.mitpressjournals.org/doi/suppl/10.1162/ling_a_00287).

Reduplicated verbs with gutturals are therefore an unexpected case of epenthesis. However, this is not the only case where epenthetic [e] is surprisingly realized in the surface form. Epenthesis is also systematically found between *tautomorphemic* identical consonants.[25] Compare (38a) with (38b). An epenthetic vowel occurs in the suffixed form if and only if C_2 and C_3 are identical.

(38) *Examples of antigemination in Modern Hebrew*

	3MSG	3PL		
a.	ʃigeʁ	*ʃigeʁ-u	ʃigʁ-u	'launch'
b.	simem	simem-u	*simm-u	'drug'
	ginen	ginen-u	*ginn-u	'garden (v.)'
	χided	χided-u	*χidd-u	'sharpen'

It must be stressed that this epenthesis is not motivated by government. First, the position of epenthesis can be governed (39). Second, it does not need to govern an empty nucleus on its left. Accordingly, we should not expect epenthesis; that is, we should expect *[ginnu], which is unattested.

(39) *Epenthetic [e] is not motivated by government*
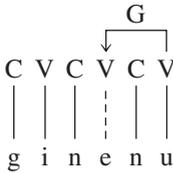
In what follows, we introduce an analysis proposed by McCarthy (1986) for epenthesis between identical consonants. We then show how this analysis also accounts for cases like [ʃiaʃeu].

4.1 The Obligatory Contour Principle in Modern Hebrew

To account for the pattern in (38b), Schwarzwald (1973) and McCarthy (1986) independently suggest that the epenthesis in [ginen-u] is motivated by identity avoidance. More specifically, McCarthy (1986) proposes to interpret this identity avoidance effect as an instance of the Obligatory Contour Principle, first introduced by Leben (1973:51) for tonal phenomena. McCarthy's redefinition is formulated as follows:

(40) *Obligatory Contour Principle (OCP) (McCarthy 1986:208)*
    At the melodic level, adjacent identical elements are prohibited.

---

[25] MH does not allow geminates, except optionally across morpheme boundaries (e.g., [dan-nu] 'we discussed'; see McCarthy 1986:238).

According to this version of the OCP, a sequence of identical consonants is ill-formed (41a). McCarthy (1986), followed by Bat-El (1994, 2006), thus assumes that the addition of an epenthetic vowel is a repair mechanism that aims to separate identical feature matrices (41b). More generally, the separation of identical matrices via epenthesis has been further developed by Yip (1988) for English and by van Oostendorp (1998) for Dutch.

(41) *Epenthesis separates identical feature matrices*

a. C V C V C V

g i [n = n] u

OCP

b. C V C V C V

g i n e n u
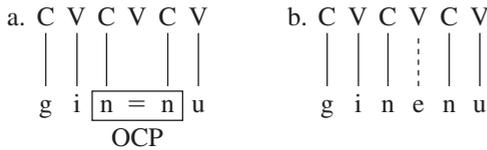
Interestingly, this phenomenon also applies to adjacent guttural ghosts that result from the repetition of C_2 in biliteral sets. Consider verbal type hit-QoTeL in (42). Suffixed forms of verbs with distinct consonants in C_2 and C_3 do not show any [e] in V_2 (42a). However, [e] occurs between identical consonants (42b), including guttural ghosts that are not phonetically realized as consonants ((42c); guttural ghosts are represented here as superscript /ᵃ/).

(42) *Examples of epenthesis between guttural ghosts in Modern Hebrew*

|		hit-QoTeL		hit-QoTL-u		
a.	ʁkn	/it-ʁoken/	[it-ʁoken]	/it-ʁokn-u/	[it-ʁokn-u]	'empty (intr)'
b.	kf	/it-kofef/	[it-kofef]	/it-koff-u/	[it-kofef-u]	'bend'
	nf	/it-nofef/	[it-nofef]	/it-noff-u/	[it-nofef-u]	'wave'
	ln	/it-lofef/	[it-lonen]	/it-loff-u/	[it-lonen-u]	'complain'
c.	na	/it-noᵃeᵃ/	[it-noea]	/it-noᵃᵃ-u/	[it-noe-u]	'wiggle'
	ʁa	/it-ʁoᵃeᵃ/	[it-ʁoea]	/it-ʁoᵃᵃ-u/	[it-ʁoe-u]	'hang out with someone'

This case specifically shows that the OCP effect proposed by McCarthy (1986) cannot be reduced to a constraint banning geminates. Indeed, due to the usual realization of historical gutturals (i.e., Ø or [a]), we do not expect any geminate resulting from an absence of epenthesis in [it-noe-u] (i.e., *[it-noʔʔu]). It follows that epenthesis does not result from a simple ban on geminates in the surface form. Instead, this case necessarily points to a more abstract OCP effect applying to different kinds of segments: consonants, vowels, and floaters (43).

(43) *Epenthesis results from identity avoidance*

a. /it-noᵃᵃ-u/

C V C V C V

n o [a = a] u

OCP

b. [it-noe-u]

C V C V C V

n o a e a u
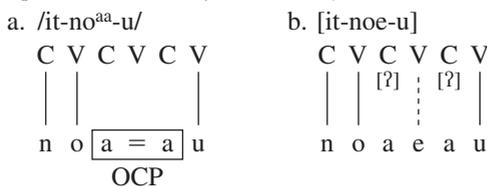
This point is crucial for the following issue. McCarthy (1979, 1981, 1982) argues that *repeated* base consonants found in Semitic languages generally result from spreading before Tier Conflation (44).[26] But if the repeated consonant results from spreading, then it should not violate the OCP.[27]

(44) *Spreading consonants should not violate the Obligatory Contour Principle*

$$[\text{g} \quad \text{n}]$$

```
[g      n]
 |      |\
 |      | `
C  V  C  V  C  V
```
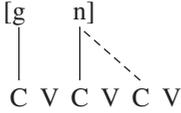
Though this apparent contradiction between consonant spreading and the OCP seems to be problematic for the theory, it does not really undermine Schwarzwald's (1973) and McCarthy's (1986) generalization. We will show that (a) the reasoning about the OCP is correct, but (b) the spreading in (44) is not. In line with proposals by Gafos (1998) and Bat-El (2002, 2006), we will argue that the repetition of consonants in (44) is the result of reduplication (i.e., copying), not spreading.

In the following section, we look briefly at the status of repetition in MH. To preserve McCarthy's (1986) analysis, we argue that, unlike other Semitic languages, MH repeats base consonants via reduplication only, not spreading.

4.2 Reduplication in Modern Hebrew

4.2.1 Reduplication and Spreading in Biblical Hebrew and Classical Arabic   Since McCarthy 1979, it has often been assumed that Semitic languages have morphological templates that need to be filled by consonants (45). When a base has a deficient number of segments, the template can trigger the repetition of a subset of these segments (compare (45a) and (45b)).

(45) *Examples of templatic repetitions in Classical Arabic*

	Base	Form I: CCC-	
a. Triliteral bases	ktb	katab	'write'
	ksb	kasab	'earn'
	jbs	jabis	'dry'
b. Biliteral bases	sm	samam	'poison'
	md	madad	'extend'
	ħd	ħadad	'define'

---

[26] Here we refer to the casual iteration of some base segments as *repetition.* This term avoids stating whether the two copies of the segment are the result of reduplication or spreading.

[27] To avoid this problem, McCarthy (1986) assumes a rule inserting an epenthetic vowel between the two components of a geminate. After Tier Conflation, despite a general rule of epenthesis deletion, the inserted epenthesis cannot be dropped because of the OCP.

In CCCC templates (i.e., templates with four consonantal slots), biliteral bases generally show a contrast between two filling patterns: either the last base consonant is repeated twice (46a), or both base consonants are repeated once (46b). The examples in (46) are from Classical Arabic, but the same patterns occur in BH (compare *pillēl* 'to make an assessment' and *pilpēl* 'to assess persistently').

(46) *Repetition of the final consonant and repetition of the whole base in Classical Arabic*

	Biliteral bases	Form II: CCCC-	
a. $C_iC_jC_jC_j$	sm	sammam	'poison'
	md	maddad	'extend'
	ḥd	ḥaddad	'define'
b. $C_iC_jC_iC_j$	zl	zalzal	'shake'
	ws	waswas	'whisper'
	ǧr	ǧarǧar	'gargle'

Thus, it is necessary to distinguish two filling mechanisms. McCarthy (1979) assumes that these are spreading (47a) and reduplication (47b).

(47) *Contrast between spreading and reduplication*

The two mechanisms differ in that spreading can repeat *one* segment *twice* and *locally*, while reduplication can repeat *several* segments *once* and *at a distance*.

4.2.2 Modern Hebrew Has Only Reduplication   Unlike Classical Arabic or BH, MH does not show any explicit contrast between spreading and reduplication. Due to the nonrecovery of BH geminates in MH (e.g., BH *qillēl*, MH [kilel] 'he cursed'), the last base consonant is never repeated twice. In other words, either the last base consonant is repeated once (48a), or several base consonants are repeated once (48b) (data are from Faust 2015b).[28]

[28] For a detailed analysis of these two patterns, see Bat-El 2006 and Faust 2015b.

(48) *Repetition of the final consonant and repetition of the whole base in Modern Hebrew*

	Biliteral bases	Form II: CC(C)C-	
a.	mʃ	miʃeʃ	'feel'
	lk	likek	'lick'
	dl	dilel	'dilute (trns)'
b.	mʃ	miʃmeʃ	'feel repeatedly'
	lk	liklek	'lick repeatedly'
	dl	dildel	'thin down over a period'

This raises a question: is it relevant to distinguish spreading and reduplication in MH? In fact, the distinguishing characteristic of spreading (i.e., repeating a segment twice *or more*) is not attested in this language. Accordingly, reduplication alone seems to be able to account for both repetition of a single consonant (49a) and repetition of several consonants (49b). Note that in (49a), we need to assume that only a subset of the base consonants associates to the template.
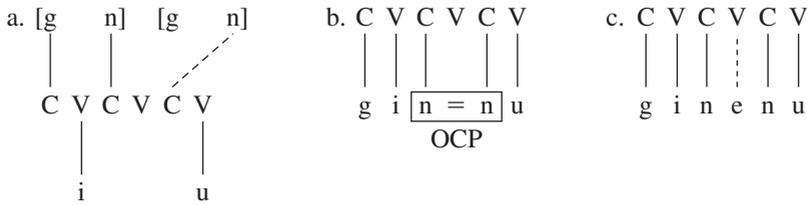
(49) *Reduplication can account for both types of repetition (segment and base)*
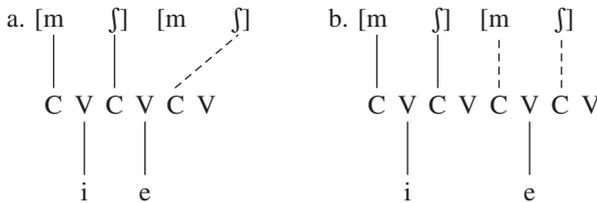
To (in)validate this theoretical possibility, we need to check (a) if repetitions of one or several segments can occur in the same morphological contexts; and (b) if reduplication can result in the repetition of a subset of the base consonants in MH, regardless of the hypothetical case in (49a).

We argue that repetitions of one or several segments have the same morphological function. Y. Greenberg (2010) points out that full reduplication can be used to derive pluractional verbs from biliteral bases (50a). Such pluractional verbs can also be derived from triliteral bases via repetition of the last base consonant only (50b) (see De Belder, Faust, and Lampitelli 2014).

(50) *Partial and full repetition of the base have the same morphological function*

		Base Cs	Pluractional	
a.	Biliteral base	mʃ	miʃmeʃ	'feel repeatedly'
		lk	liklek	'lick repeatedly'
		dl	dildel	'thin down over a period'
b.	Triliteral base	kfts	kiftsets	'jump around'
		tsχk	tsiχkek	'giggle'
		lχʃ	liχʃeʃ	'whisper quietly'

The repetition in (50a) is clearly reduplication. However, the repetition in (50b) can result from reduplication *or* spreading. We must therefore choose: (a) we can assume that pluractional verbs can be derived with two different mechanisms; or (b) we can assume that pluractional verbs are always derived by the same mechanism, reduplication. Obviously, the second choice is more economical since the same morphological operation is involved. A reduplicated base does not require all of its segments to be associated to the template (49a).

Corroborating evidence comes from cases of repetition of only the second and third consonants of bases with three consonants (51), found in the derivation of some diminutive nouns (Faust 2015a).[29]

(51) *Repetition of several base consonants and Modern Hebrew diminutives*

Base: $C_iC_jC_k$		Diminutive: $C_iC_jC_kC_jC_k$	
ʃaχoʁ	'black'	ʃχaʁχaʁ	'blackish'
ʃamen	'fat'	ʃmanman	'chubby'
agol	'round'	agalgal	'roundish'
katan	'small'	ktantan	'minuscule'

Such cases cannot be derived by spreading without line crossing, because spreading is strictly local (52a). But they are predicted by a view that allows full reduplication followed by partial association (52b).

(52) *Partial repetition of base consonants via reduplication*

Consequently, we contend that the repetition of a single last base consonant results from a reduplication of the base followed by right-to-left association to the template. This reduplication can be incomplete depending on the number of available slots in (49a), just as in (52b).

If indeed repetition is not a spreading phenomenon, there is no longer any contradiction between template satisfaction and the OCP (53). Deficient bases fill templates via reduplication only (53a). Accordingly, resulting adjacent identical consonants are not cases of spreading; see the representation after Tier Conflation in (53b). They therefore violate the OCP (53b) and must be repaired by epenthesis (53c).

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[29] The semantic relation between diminutives and pluractionality is further pointed out by De Belder, Faust, and Lampitelli (2014).

(53) *Repetition of the final base segment does violate the Obligatory Contour Principle*

a. [g   n] [g   n]   b. C V C V C V   c. C V C V C V

   (diagram: C V C V C V with i and u; g i [n = n] u OCP; g i n e n u)

4.3 The OCP and Guttural Ghosts

After this parenthesis on template satisfaction, we return to the case of epenthesis in words like [ʃiaʃeu]. It is striking to observe that, in both [ginenu] and [ʃiaʃeu], vowel insertion is related to a repetition of segments. In [ginenu], this repetition concerns only a single base consonant. In [ʃiaʃeu], it concerns the whole base (54a). After Tier Conflation (54b), it is tempting to think that epenthesis occurs in [ʃiaʃeu] for the same reasons as in [ginenu]: in order to separate identical segments (boxed).

(54) *Hypothesis: Epenthesis separates guttural ghosts in [ʃiaʃeu]*

a. [ʃ   a] [ʃ   a]   b.

   (diagrams: C V C V C V C V with i and u; C V C V C V C V with [ʔ], ʃ i [a] ʃ e [a] u)
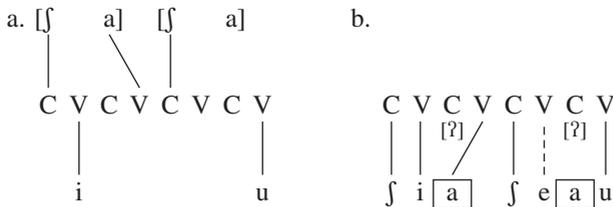
Nevertheless, there is an important difference between [ginenu] and [ʃiaʃeu]. In [ginenu], identical segments are underlyingly adjacent, but in [ʃiaʃeu], they are not (they are separated by /ʃ/).

The idea that the OCP can apply at a distance is not problematic in itself: long-distance similarity restrictions are attested in several languages (see, e.g., Odden 1994, Suzuki 1998). But can we confirm that such a constraint is attested in MH? Independently, J. Greenberg (1950), Pierrehumbert (1993), and Frisch, Pierrehumbert, and Broe (2004) argue that a long-distance similarity avoidance applies in Semitic roots. They show that homorganic consonants tend not to cooccur in the same root. This generalization relies on a gradient OCP effect: homorganic consonants are more common in C_1–C_3 than in C_1–C_2 (J. Greenberg 1950:178). Regarding the situation in C_1–C_3, MH shows a strong contrast between consonant classes. While there are many examples of homorganic consonants in C_1 and C_3 (55a–d), including several cases of complete identity or homorganicity when the consonants are not gutturals (e.g., in [ʃémeʃ] 'sun' or [tsijets] 'tweet (v.)', [χataχ] 'cut (v.)'), only one root with first and last guttural ghosts is attested (55e).[30] With respect to this fact, one of two conclusions is possible: either (a) the asymmetry between

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[30] This root appears in the related words [erúa] 'event' and [meora] 'occasion'. Its problematic nature is further revealed in the fact that its verbal paradigm is both irregular and highly defective. Interestingly, the gutturals of this root are not etymologically the same.

QTQ and GTG (*G* standing for *guttural ghost*) is accidental, or (b) guttural ghosts have a specific status with respect to locality. We argue for the second option.

(55) *Examples of Modern Hebrew roots with homorganic C_1 and C_3*

    a. Labials {b, p, v, f, m}

       pgam 'defect (n.)'; bósem 'perfume'; balam 'break (car) (v.)'; bijem 'direct (a play)'; behem-a 'beast'; paʁam 'untie'; mum 'deformity'; makaf 'hyphen'; pizem 'hum'; peχam 'carbon'; pitem 'fatten'; pnim 'interior'; pa(ʔ)am 'time'; . . .

    b. Coronal obstruents {d, t, s, z, ʃ, ts}

       dod 'uncle'; taχat 'behind'; tlat 'tri-'; tamid 'always'; tit 'clay'; délet 'door'; dageʃ 'emphasis'; daχus 'dense'; daʃ 'flap (n.)'; dfus 'print (n.)'; daʁas 'run over'; daʁaʃ 'demand (v.)'; zaz 'move (v.)'; ziz 'ledge'; zajit 'olive'; zéfet 'tar (n.)'; ziʁez 'hurry (v.)'; tavas 'peacock'; tajas 'pilot'; tékes 'ceremony'; topaz 'Topas'; tófes 'form (document)'; tipeʃ 'stupid'; i-trid 'bother (v.)'; tris 'shutter (n.)'; sagad 'worship (v.)'; e-sit 'derail'; e-sit 'move aside'; sus 'horse'; i-skit 'be attentive'; saχat 'squeeze'; sid 'lime'; salad 'dislike (v.)'; sa(ʔ)ad 'nurse (v.)'; safad 'mourn'; séʁet 'film (n.)'; siʁes 'castrate'; tsavat 'pinch (v.)'; e-tsit 'ignite'; tsémed 'pair (n.)'; ʃibets 'slot in'; ʃibeʃ 'interfere'; ʃájiʃ 'marble'; i-ʃχiz 'sharpen'; ʃiχed 'bribe (v.)'; ʃaloʃ 'three'; ʃemeʃ 'sun'; ʃimeʃ 'be used'; ʃines 'prepare'; ʃaʁats 'lie around'; talaʃ 'tear off'; tsijets 'tweet (v.)'; . . .

    c. Dorsals {k, g, χ, ʁ}

       kadaχ 'drill (v.)'; karaχ 'envelop'; χataχ 'cut (v.)'; χaʃak 'desire (v.)'; χibek 'hug (v.)'; giléaχ 'shave (v.)'; e-gíaχ 'emerge surprisingly'; gihek 'hiccup (v.)'; χalak 'share (v.)'; χazak 'strong'; χóʃeχ 'obscurity'; χaʁaχ 'slit (n.)'; χaʁag 'protrude'; χasaχ 'save (v.)'; ʁiʁ 'saliva'; gezeʁ 'carrot'; gadeʁ 'fence (n.)'; géveʁ 'man'; keʃeʁ 'relation'; χaveʁ 'friend'; χagoʁ-a 'belt (n.)'; i-ʁvíaχ 'profit (v.)'; χataʁ 'strive'; χakaʁ 'investigate'; χijeg 'dial (v.)'; ganaχ 'moan (v.)'; kéveʁ 'grave (n.)'; χanak 'strangle'; χanaχ 'inaugurate'; χaseʁ 'missing (adj.)'; χaziʁ 'pig'; χazaʁ 'return (v.)'; kodeʁ 'dark'; χatseʁ 'court (n.)'; ʁétsaχ 'murder (n.)'; . . .

    d. Coronal sonorants {l, n}

       lul 'coop'; lajl-a 'night'; naval 'rogue'; ni(h)el 'manage'; na(ʔ)al 'lock (v.)'; ná(ʔ)al 'shoe (n.)'; náχal 'stream (n.)'; nétel 'burden (n.)'; nafal 'fall (v.)'; namal 'port'; nitsel 'exploit (v.)'; naʃal 'fall off'; natan 'give'; nin 'great-grandson'; nigen 'play (instrument, v.)'; láχan 'melody'; t-lun-a 'complaint'; lavan 'white'; laʃon 'tongue'; . . .
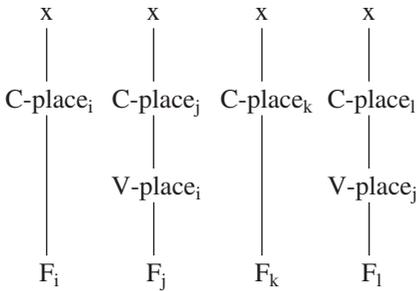
    e. Guttural ghosts {ʔ, ʕ, h}

       ʔeʁúa 'event'

In sections 2 and 3, we claimed (following an analysis proposed in Faust 2005) that guttural ghosts have a very specific representation: they are underlying vowels. Interestingly, vowels have a particular relation to adjacency. They assimilate and dissimilate at a distance much more

commonly than consonants do (van der Hulst and van de Weijer 1995:508, Hansson 2001:2). Dissimilations at a distance are especially relevant for the case at hand since these are often assumed to result from an OCP effect (see Yip 1988).
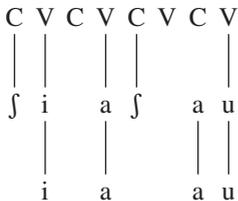
A popular way to represent locality can be found in the Feature Geometry framework introduced by Clements (1985). Proposals in Feature Geometry often assume that vowels and consonants are partly segregated (see, e.g., Clements 1991, Hume 1992, Odden 1994, Clements and Hume 1995). More specifically, vowels are supposed to involve an additional V-place node dominated by a C-place node (56). As a consequence, the contrast between vowel and consonant long-distance interactions is encoded by the fact that vowels can communicate on two different levels, while consonants can communicate on one level only. Following Odden's (1994:298) Locality Condition, A and C are separated by B if and only if A, B, and C share the same tier and are immediately dominated by nodes cooccurring on the same tier. Accordingly, in representation (56), (a) V-place$_i$ and V-place$_j$ are adjacent, (b) F$_j$ and F$_l$ are adjacent, and (c) F$_i$ and F$_k$ are adjacent, but (d) C-place$_i$ and C-place$_k$ are not adjacent.

(56) *Adjacency in Feature Geometry*

$$
\begin{array}{cccc}
x & x & x & x \\
| & | & | & | \\
\text{C-place}_i & \text{C-place}_j & \text{C-place}_k & \text{C-place}_l \\
| & | & | & | \\
 & \text{V-place}_i & & \text{V-place}_j \\
| & | & | & | \\
F_i & F_j & F_k & F_l
\end{array}
$$

In MH, the contrast between guttural ghosts and other consonants can be represented with an OCP effect applying at the V-place level. Given that gutturals are represented with a vowel /a/, they also involve a V-place node. This node is schematically represented with vowels projecting on an additional level in (57). On this projection tier, guttural ghosts are not separated by a consonant. They are adjacent.
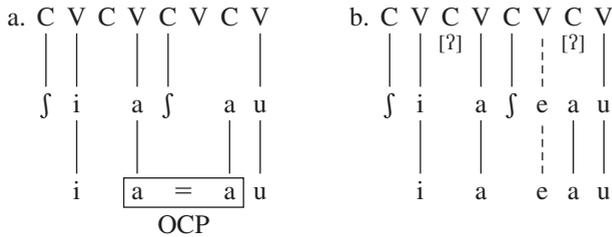
(57) *Guttural ghosts of [ʃiaʃeu] are adjacent*

$$
\begin{array}{cccccccc}
C & V & C & V & C & V & C & V \\
| & | & | & | & & | & & | \\
\text{ʃ} & i & a & \text{ʃ} & & a & & u \\
| & | & & | & & | & | \\
 & i & a & & & a & u
\end{array}
$$

Accordingly, the puzzling facts about [ʃiaʃeu] become clearer. This class of exceptions does not fundamentally differ from the case of [ginenu]. Just as in [ginenu], a sequence of *tautomorphemic*

identical segments on a given tier violates the OCP (58a). And just as in [ginenu], this violation is repaired by epenthesis (58b).[31]

(58) *Epenthesis in [ʃiaʃeu] results from the Obligatory Contour Principle*

a. C V C V C V C V   b. C V C V C V C V
                                   [ʔ]   [ʔ]

   ʃ i   a ʃ   a u   ʃ i   a ʃ e a u

   i   a = a u   i   a   e a u
        └─OCP─┘

This multitiered view explains the epenthesis in [ʃiaʃeu], which was the bothersome piece of the puzzle in this section. It is worth emphasizing at this point that the account relies crucially on the proposal in sections 2–3, namely, the representation of guttural ghosts as vocalic segments.[32]

We have shown that an autosegmental representation can predict [ʃiaʃeu] on the basis of two language-specific assumptions only: (a) gutturals are vowels (see sections 2–3), and (b) OCP violations are repaired via epenthesis (see McCarthy 1986). Nothing else is required. To conclude, we can now answer Q4, "Why is epenthesis obligatory in [ʃiaʃe-u] (4d)?" As we have shown, the two guttural ghosts violate the OCP and must be separated by a realized V-slot.

5 Conclusion

In this article, we claimed that the gutturals [ʔ, ʕ, h] of Biblical Hebrew were rehabilitated into Modern Hebrew as a vowel /a/. This /a/, being vocalic, cannot be realized in the C position attributed to it. It is thus realized on a following V-slot, when this is possible. Other aspects of the behavior of the C-slot were motivated by the principles of the theory adopted, the Strict CV version of Government Phonology. The account constitutes progress over its predecessors in Faust 2005 and Pariente 2012, which resort to very specific constraints about paradigmatic interactions and faithfulness. In our view, there is nothing but phonology at work.

Further support for our proposal was provided by the OCP analysis of the puzzle from reduplication. We claimed that because guttural ghosts are vocalic, two copies of the same ghost violate the OCP even when they are separated by a consonant.

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[31] This analysis also implies that identical tautomorphemic vowels cannot be adjacent in MH. While this issue is closely related to the analysis we propose, to address it seriously would require a separate article. Fundamentally, the heart of the issue lies in the representation of Semitic vocalizations. If we assume the representations in McCarthy 1981, 1986, vocalizations involving a single quality should always be analyzed as a unique spreading segment (as illustrated in (11)). Other approaches can suppose that vowels occurring in different syllables are always distinct segments. As things stand, none of these approaches can be viewed as an argument for or against the present analysis without a certain degree of circularity. For this reason, we reserve this prediction for further scrutiny. We believe that the reasoning proposed here is interesting and sufficient in itself, whatever its future may be.

[32] The alternative pronunciations without epenthesis can be explained by assuming that the OCP effect in (58) is optional for some speakers.

With regard to empirical coverage, many other guttural-related phenomena remain to be investigated: for instance, the synchronic interpretation of *ħ and the interaction of gutturals with stem and affix vocalizations. We hope that the present work will prove fruitful for the analysis of these issues, too.

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