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The interaction of vowel quality and pharyngeals in Sephardic Modern Hebrew

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Abstract

This paper examines the complex interactions between pharyngeals and vowel quality in Sephardic Modern Hebrew. Phonetically similar to low vowels, gutturals in general and pharyngeals in particular tend to trigger vowel lowering and epenthesis of low vowels. Sephardic Modern Hebrew exhibits multiple strategies in order to avoid the proximity of non-low vowels to pharyngeals. The language processes take into account several factors, including the syllabic position of the pharyngeal (onset or coda), prosody (stress) and lexical category (nouns vs. verbs).

1 Introduction

This paper describes and analyzes the phonological prohibition on the proximity of non-low vowel to pharyngeals in Sephardic Modern Hebrew (henceforth SMH) in the framework of Optimality Theory (OT) (Prince and Smolensky 1993/2004). Indeed, one of the best known properties of pharyngeals is their preference for appearing next to low vowels (McCarthy 1994).

SMH exhibits a multitude of behaviors with regard to this prohibition, depending on the syllabic position of the pharyngeal (onset or coda), the metrical position of the pharyngeal (stressed syllable vs. unstressed syllable) and the morphological system (nouns vs. verbs).

This paper is organized as follows: section 1.1 overviews the SMH data and section 1.2. overviews the necessary language background. Section 2 provides an Optimality theoretic analysis of the data. Section 3 discusses the co-phonology approach taken in this study and its implications, and section 4 concludes the paper.

1.1 SMH Pharyngeals in non-low vowel contexts

SMH permits pharyngeals [ħ, ʕ] to appear after a non-low vowel, if the non-low vowel and the pharyngeal are not syllabified into the same syllable, i.e. the pharyngeal is in an onset position, as in (1):

(1) Non-low vowel and pharyngeals syllabified into different syllables:

ta**.pu.**ħím ‘apples’	cf.	ta.pu.zím ‘oranges’
j**e.**ħa**.**pés ‘he will search’	cf.	je.da.béʁ ‘he will talk’
s**i.**ħék ‘he was playing’	cf.	di.béʁ ‘he talked’
ma**.nó.**ʕa ‘motor’	cf.	ma.nóf ‘crane’
ʃ**i.**ʕéʁ ‘he assumed’	cf.	di.béʁ ‘he talked’

However, when pharyngeals and non-low vowels are syllabified into the same syllable, various processes take place. If the pharyngeal appears after an unstressed high vowel, the vowel is lowered to [a] in the noun system, as in (2), and to [e] in the verb system, as in (3):

(2) Pharyngeal after *an unstressed non-low vowel in the noun system*:[1]

m**a**ʕ^{a}.mád[2] ‘status’	cf.	mig.dál ‘tower’
m**a**ʕ^{a}.ʁé.xet ‘systm’	cf.	mik.té.ʁet ‘pipe’
m**a**ħ.sán ‘warehouse’	cf.	mig.dál ‘tower’
m**a**ħ.bé.ret ‘notebook’	cf.	mik.lé.det ‘keyboard’

[1] An intrusive vowel is heard between the ʕ and the following consonant, represented by [^{a}]; it is a case of an intrusive echo vowel that eases perception of consonant clusters. The value of this vowel is copied from the preceding vowel. **This vowel is non-syllabic** and ʕ is syllabified as coda. For general discussion, analysis and typology of intrusive vowels see Hall (2006); for SMH vowel intrusion and evidence of its non-syllabic nature, see Pariente (2010).

[2] The Underlying Representation is assumed to be /miħsan/ with /i/ before the unvoiced pharyngeal and not /maħsan/ with underlying /a/ due to the fact that a *maCCaC* template is not present in the morphology of the language.

(3) Pharyngeal *after an unstressed high vowel in the verb system*:[3]

n**e**ʕ^{e}**.**káʁ ‘it was uprooted’	cf.	nig.máʁ ‘it was finished’
h**e**ʕ^{e}**.**víʁ ‘he transferred’	cf.	hit.ħíl ‘he began’
n**e**ħ**.**káʁ ‘he/it was investigated’	cf.	nig.máʁ ‘it was finished’

If, however, the unvoiced pharyngeal ħ appears after a stressed non-low vowel, [a] is inserted before it (in both nouns and verbs), as in (4):

(4) ħ after a stressed vowel[4]

ʃa**.**tí**.a**ħ ‘carpet’	cf.	ʃa**.**tíl ‘seedling’
mó**.a**ħ ‘brain’	cf.	ʃót ‘whip’
bi.tú.**a**ħ ‘insurance’	cf.	ni.gún ‘melody’
maf.té.**a**ħ ‘key’	cf.	mav.ʁég ‘screwdriver’
hiv.tí.**a**ħ ‘he promised’	cf.	hit.ħil ‘he began’
him.lí.**a**ħ ‘he salted’	cf.	hit.ħíl ‘he began’
di.vé.**a**ħ ‘he reported’	cf.	di.béʁ ‘he talked’
hit.ka.lé.**a**ħ ‘he took a shower’	cf.	hit.la.béʃ ‘he dressed’

[3] This generalization has one exception: the verb template CaCaC acts like the noun system, i.e. a high vowel is lowered to [a]:

y**a**ħmod ‘he will covet’	cf.	yignov ‘he will steal’
y**a**ħšov ‘he will think’	cf.	yignov ‘he will steal’
y**a**ʕ^{a}zov ‘he will leave’	cf.	yignov ‘he will steal’
y**a**ʕ^{a}mod ‘he will stand’	cf.	yignov ‘he will steal’

The historical reason for this behavior is that the original vowel was [a], and that at some point unstressed [a] in closed syllables became [i]; this did not happen before a pharyngeal. A satisfying synchronic explanation has yet to be suggested.

4 ʕ does not appear after a stressed non-low vowel in the language since an epenthetic vowel is inserted to syllabify the ʕ into an onset position.

hif.tí.ʕ**a** ‘he surprised’	cf.	hit.ħil ‘he began’.
ʃa.vú.ʕ**a** ‘week’	cf.	tap.úz ‘orange’
ló.ʕ**a** ‘pharynx, throat, maw’	cf.	ʃót ‘whip’

The multiple processes presented in (1)–(4) all aim at creating adjacency between pharyngeals and low vowels, as phonetic studies on pharyngeals[5] (Delattre 1971; Perkell 1971) show that low vowels involve some pharyngeal constriction, with concomitant acoustic similarities between the vowel [a] and the pharyngeals (high F_1). Al-Ani (1970), Ghazeli (1977), Klatt and Stevens (1969) and Butcher and Ahmad (1987) show that pharyngeals have high F1. They also found that at the consonant/vowel boundary, ʕ has a relatively low F2 (1200-1400Hz range). This shared property of low vowels and pharygeals triggers phonological processes in order to avoid the proximity of non-low vowels and pharyngeals (McCarthy 1994).

1.2. Relevant language background

The present study is based on data from SMH spoken by native speakers living in Israel. The data were collected by the author.

Hebrew has two different dialects with almost identical grammars; in the revival of the language, people who spoke Arabic as a first language had no problem articulating the historical pharyngeals, whereas people who spoke European languages (mostly Yiddish and Russian) could not articulate pharyngeals. The descendants of the first group are speaking Sephardic Modern Hebrew, and the descendants of the second group speak General Modern Hebrew.

Since the morpho-phonology of the two groups was directly adopted from Tiberian Hebrew, two distinct grammars have emerged to account for the surface effects of the pharyngeals (see Pariente 2012 for a discussion of General Modern Hebrew). The only

[5] The vast majority of the literature on the pharyngeal consonants focuses on the various dialects of Arabic, due to the fact that pharyngeals are present in all dialects of Arabic and the language is one of the most common languages of the world. Studies on Arabic are relevant for contemporary Hebrew since the early speakers of Sephardic Hebrew were native speakers of Arabic dialects, and indeed Laufer and Bear (1988) found a great deal of similarity in the pronunciation of pharyngeals in the two languages.

difference between the general dialect, which is the main dialect in Israel, and SMH is the existence of pharyngeal consonants in SMH. SMH is used in areas that are populated mostly by speakers of Sephardic origin (mainly Yemenite Jews).

The inventory of consonantal segments, presented in the usual way left to right according to articulatory position, and vertically according to the type of articulation, is presented in Table 1:

Table 1: The consonants of Sephardic Modern Hebrew

	Bilabial	**Labio-dental**	**Alveolar**	**Palato Alveolar**	**Palatal**	**Velar**	**Uvular**	**Pharyngeal**	**Glottal**
Stop	p b		t d			k g			ʔ
Fricative		f v	s z	ʃ ʒ		x		ħ ʕ	h
Affricate			ʦ	ʧ ʤ					
Nasal	m		n						
Liquids			l				ʁ		
Glides					j				

The vocalic system of SMH is identical to the vocalic system of General Modern Hebrew and consists of five phonemic vowels (Table 2):

Table 2: The vowels in Sephardic Modern Hebrew

	Front	**Back**
High	i	u
Mid	e	o
Low	a	

Traditionally, Semitic morphology is referred to as *Root-and-Pattern* morphology. This view assumes a distinction between Consonantal Roots and Templates. Stems consist of the interdigitation of the Consonantal Root and the Template (Nonconcatenative Morphology – McCarthy 1981). The Consonantal Root encodes the core semantic properties, while the

Template encodes the person, number, gender, tense, aspect, mood, voice and other grammatical properties (in Hebrew terminology, the Templates for verbs are called *binyanim* and for nouns *mishkalim*). The root usually consists of three consonants that appear in a fixed order. Every Template is composed of prosodic structure, Vocalic Pattern, and sometimes a prefix (see Bat-El 2003 for a detailed discussion on Modern Hebrew verbal Templates).

Vocalic Patterns are morphemes composed of vowels. The order and quality of these vowels is arbitrary although fixed. The prosodic structure of the language is derived by specific language ranking of universal prosodic constraints, and it determines the syllabic structure of the word.

The existence of the Consonantal Root as an independent morpheme is highly controversial in the literature. Bat-El (1994, 2003) and Ussishkin (1999) offer an approach which is surface-based and eliminates the Consonantal Root completely from the grammar, using stems and words as the base for derivation. That debate is outside the scope of this paper.

To sum up, every word in Nonconcatenative Morphology has to be specified for a Template in the lexicon (Bat El 1989). The following tables survey the verbal and most common noun Templates of Modern Hebrew. The verbs are given in the third-person singular forms. The verb Templates (Binyanim) are abbreviated as B1, B2, etc. The list of Binyanim in (5) is adapted from Bat-El (2003), and the list of noun Templates (Mishkalim) in (6) is adapted from Pariente (2012).

(5) MH Binyanim

Past	
Ca.CáC	B1
niC.CáC	B2
hiC.CíC	B3
Ci.CéC	B4
hit.CaC.éC	B5

(6) Affixed mishkalim in Modern Hebrew

Mishkal	**Example**	**Gloss**	**Example**	**Gloss**
maCCéC	*mavʁég*	*'screwdriver'*	*maʃpéx*	*'funnel'*
maCCeCá	*makdeħá*	*'drill (tool)'*	*matslemá*	*'camera'*
miCCáC	*miʃtáʁ*	*'regime'*	*mivtsáʁ*	*'fortress'*
miCCaCá	*milħamá*	*'war'*	*miʃtaʁá*	*'police'*
tiCCóCet	*tiʁgólet*	*'drill'*	*tixtóvet*	*'correspondence'*
taCCíC	*taʁgíl*	*'exercise'*	*taxtív*	*'dictate'*
taCCúC	*taʃlúm*	*'payment'*	*tamʁúʁ*	*'road sign'*
taCCuCá	*tavʁuʔá*	*'sanitation'*	*taħbuʁá*	*'transport'*
miCCéCet	*mivʁéʃet*	*'brush'*	*mizħélet*	*'sled'*
ʔaCCaCá	*ʔazkaʁá*	*'memorial'*	*ʔavħaná*	*'diagnosis'*
miCCóC	*mitsbóʁ*	*'accumulation*'	*mizmóʁ*	*'psalm'*

Since pharyngeal-triggered lowering and epenthesis are interconnected with the metrical system of the language, I review it here briefly. Hebrew is a quantity insensitive language with default final stress. Two competing analyses have been presented to account for these facts: (i) Hebrew stress consists of binary strong feet (enclosed in square brackets), either iambic or trochaic ([*ganáv*], [*yéled*]) (see, e.g., Bolozky 1982; Graf and Ussishkin 2003; Bat El 2005); (ii) Hebrew stress consists of trochaic feet, either binary or degenerate (*ga*[*náv*], [*yéled*]) (see, e.g., Becker 2002; Pariente and Bolozky 2014).[6] I adopt the trochaic analysis of Hebrew, which claims that the accentual system of Modern Hebrew is best analyzed as consisting of only trochaic feet (see Pariente and Bolozky 2014 for discussion).

(7) Stress related constraints

TROCHEE (Prince and Smolensky 1993/2004; McCarthy and Prince 1993)
Feet are left-headed.

FOOTBINARITY (FTBIN) (Prince 1980; Prince and Smolensky 1993/2004)
Feet must be binary under syllabic or moraic analysis.

[6] Secondary stress in Hebrew is discussed in most of the generative literature on stress, beginning with Bolozky (1982), where it is described as appearing on every other syllable to the left of the primary stress. However, Becker (2003) finds no acoustic evidence for secondary stress either by pitch or by vowel length. In the following example he identified only one point of high pitch and one (phonetically) long vowel: *hagamadoníːm* 'the little dwarfs'.

RIGHTMOST (ALIGN (PRWD, R, HEAD-FT, R)) (Cohn and McCarthy, 1994)
The right edge of every prosodic word is aligned with the right edge of some head foot.

I assume that feet are always trochaic in the language (binary or unary). This means that TROCH is un-dominated in the language and must outrank FTBIN.

(8) Stress and foot structure in Hebrew verbs

/katav/	TROCH	RIGHTMOST	FTBIN
☞ (a) ka[táv]			*
(b) [ka.táv]	*!		
(c) [ká.tav]		*!	

In tableau (8), candidate (c) has non-final stress, so it is ruled out by RIGHTMOST. Candidates (a) and (b) both have final stress, but a different foot structure: binary iamb in (b) and unary in (a). Candidate (a) is chosen over (b) due to the ranking of TROCH above FTBIN.

2 OT analysis

The data above show that the prohibition on the proximity of non-low vowels to pharyngeals is hierarchical, i.e. the prohibition in the domain of the syllable is stronger than the general prohibition on the proximity of non-low vowels to pharyngeals. Formulating a general constraint (9) and a syllable-domain constraint (10) can capture this hierarchy:

(9) *V_{+high}PHARYNGEAL – "high vowels before a pharyngeal are forbidden"

(10) *V_{+high}PHARYNGEAL]$_\sigma$ (*V_{+high}PHAR]$_\sigma$) – "high vowels before a pharyngeal are forbidden within the domain of the syllable"

These constraints are in a fixed ranking in which the constraint militating against the more marked structure outranks the constraint militating against the less marked structure (in accordance with the markedness hierarchy of Smolensky 1993). A language cannot allow a non-

low vowel to precede a pharyngeal within the domain of the syllable without allowing it when the vowel and the pharyngeal are syllabified into different syllables.

(11) *V_{+high}PHARYNGEAL]$_\sigma$ >> *V_{+high}PHARYNGEAL

Nowhere in the language can we find the effects of the constraint *V_{+high}PHARYNGEAL; however, the constraint *V_{+high}PHARYNGEAL]$_\sigma$ affects the phonological system of SMH in different ways, suggesting the ranking in (12):

(12) *V_{+high}PHARYNGEAL]$_\sigma$ >> FAITH >>*V_{+high}PHARYNGEAL

Since high vowels and mid vowels may behave differently with regard to the prohibition of adjacent non-low vowels and pharyngeals, different constraints must be formulated for high vowels and for mid vowels. The constraint in (13) encodes the prohibition on mid vowels preceding pharyngeals.

(14) *V_{-low}PHARYNGEAL]$_\sigma$ (*V_{-low}PHAR]$_\sigma$) – "non-low vowels before a pharyngeal are forbidden within the domain of the syllable"

Since there is more similarity between the pronunciations of mid vowels and pharyngeals than between the pronunciations of high vowels and pharyngeals, these constraints are also in a fixed ranking. A language cannot allow a high vowel to precede a pharyngeal within the domain of the syllable without allowing a mid vowel to precede a pharyngeal within the domain of the syllable (14).

(14) *V_{+high}PHARYNGEAL]$_\sigma$ >>*V_{-low}PHARYNGEAL]$_\sigma$

The data given in section 1.1. also reveal that the noun system and the verb system in SMH are subject to different processes with regard to the prohibitions on the proximity of high and mid vowels to pharyngeals. Different rankings in one language – one for the noun system and one for the verb system – may account for the fact that nouns act differently to verbs.

In OT, morphologically conditioned phonology (i.e. the nature of a process depends on the morphological category, namely the noun system and the verb system) has been approached in two ways. One approach is to posit a single fixed constraint ranking for the entire language. Constraints within that fixed ranking are parameterized to apply to designated morphological categories, e.g. verbs vs. nouns, words vs. phrases etc. This approach is known as the indexed constraints approach (McCarthy and Prince 1995; Urbanczyk 1996; Pater 2000, among others). The second approach is to keep phonological constraints purely phonological, but to posit a range of distinct co-phonologies (Orgun 1996; Anttila 2002; Inkelas and Zoll 2007, among others)

Following Anttila (2002), who examines data from Finnish and provides persuasive arguments in favor of the co-phonology hypothesis (for example, it is shown that indexed constraints predict unattested systems), I adopt the co-phonology mechanism in my analysis (see also Inkelas and Zoll 2007 for further arguments in favor of the co-phonology approach).

2.1. The noun system

The SMH noun system prohibits non-low vowels from preceding pharyngeals. To deal with this situation the noun system implements different strategies depending on the status of the vowel preceding the pharyngeal: (i) If the vowel is not stressed, it is always lowered to [a] (see (2)); (ii) if the vowel is stressed, it does not change; however, epenthesis of a low vowel occurs if the

pharyngeal is the unvoiced ħ (see (4)) – the voiced ʕ is never syllabified as the coda of a stressed syllable (see footnote 4).

Since lowering of a non-low vowel occur, *V$_{+high}$PHARYNGEAL]$_{\sigma}$ and DEP-IO must outrank the faithfulness constraint militating for identity value of height: IDENT-IO [high/low] (Prince and Smolensky 1993/2014).

(15) IDENT-IO [high/low] – "An output vowel, and its input correspondent, has identical values for the feature [high/low]"

This ranking is demonstrated in tableau (16) below:

(16) Noun system lowering

/miħsan/	*V$_{+high}$PHAR]$_{\sigma}$	*V$_{-low}$PHAR]$_{\sigma}$	DEP	IDENT [high]	IDENT [low]
a. miħ.sán	*!	*			
b. mi.aħ.sán			*!		
c. meħ.sán		*!		*	
☞d. maħ.sán				*	*

In tableau (16), the underlying form /miħsan/ contains a high vowel before a pharyngeal. The faithful candidate (a) is ruled out by *V$_{+high}$PHAR]$_{\sigma,}$ which militates against high vowels before a pharyngeal in the same syllable. In candidate (b), a vowel is inserted between ħ and the high vowel; however, it is ruled out by the high ranking constraint DEP. In candidate (c), the high vowel [i] is lowered to the mid vowel [e] so it does not violate *V$_{+high}$PHAR]$_{\sigma}$; however, it violates the high ranked constraint *V$_{-low}$PHAR]$_{\sigma,}$, which militates against mid vowels before a pharyngeal in the same syllable, and is therefore ruled out. In the winning candidate (d), the high vowel [i] is lowered to the low vowel [a], so none of the high-ranked constraints are violated but the low ranked IDENT constraints are both violated.

Stressed vowels, however, do not change to satisfy *V$_{+high}$PHAR]$_{\sigma}$. This is a case of positional blocking of a phonological process due to the positional privilege of stressed syllables (Beckman 1998); in other words, stressed vowels fail to undergo a process which unstressed vowels are targeted for. This blocking of vowel lowering in stressed syllables results from the effect of the high ranked positional faithfulness constraints, IDENT-σ́ [high/low] (Beckman 1998).

(17) IDENT-σ́ [high/low] – 'Output segments in a stressed syllable and their input correspondents must have identical specifications for the feature [high/low]'

In words with ħ after a stressed vowel, epenthesis takes place (ta.pú.**a**ħ). This result means that IDENT-σ́ [high/low], *V$_{+high}$PHAR]$_{\sigma}$ and *V$_{-low}$PHAR]$_{\sigma}$ are all ranked above DEP, as can be seen in (18):

(18) Noun system epenthesis after a stressed high vowel

/tapuħ/	IDENT-σ́ [high]	IDENT-σ́ [low]	*V$_{+high}$ PHAR]$_{\sigma}$	*V$_{-low}$ PHAR]$_{\sigma}$	DEP	IDENT [high]	IDENT [low]
a. ta.púħ			*!	*			
b. ta.páħ	*!	*				*	*
c. ta.póħ	*!					*	
☞ d.ta.pú.**a**ħ					*		

In tableau (18), the underlying form /tapuħ/contains a high vowel before a pharyngeal. The faithful candidate (a) is ruled out by *V$_{+high}$PHAR]$_{\sigma}$. In candidate (b), the high vowel [i] is lowered to the low vowel [a] and it is ruled out by IDENT-σ́[high/low]. In candidate (c), the high vowel [i] is lowered to the mid vowel [o] and it is ruled out by IDENTσ́[high]. In the winning candidate (d), a low vowel is inserted between ħ and the high vowel violating DEP.

Tableau (19) below demonstrates that the same ranking yields the same result (epenthesis) when the vowel preceding the pharyngeal is a mid vowel.

(19) Noun system epenthesis after a stressed mid vowel

/moħ/	IDENT-σ́ [high]	IDENT-σ́ [low]	*V$_{+high}$ PHAR]$_σ$	*V$_{-low}$ PHAR]$_σ$	DEP	IDENT [high]	IDENT [low]
a. móħ				*!			
b. máħ		*!					*
☞c. mó**a**ħ					*		

In sum, the ranking of the noun system is as represented in Figure 1:

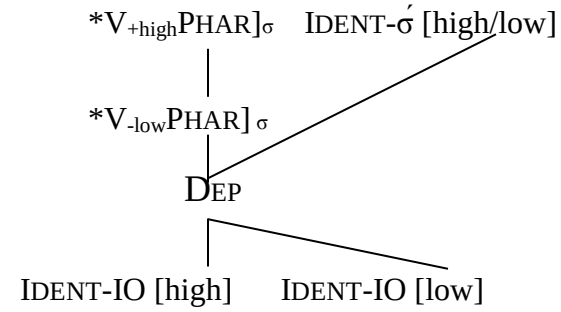

Figure 1: Ranking of the noun system

2.2 The verb system

The SMH verb system also prohibits non-low vowels from preceding pharyngeals, but is slightly less strict than the noun system. A high vowel preceding a pharyngeal in the verb system it is lowered; however, the lowering is not total in the sense that the vowel is not lowered to [a], but rather to [e]. The data from (3), are repeated here as (20).

(20) Pharyngeal *after an unstressed high vowel in the verb system*:

n**e**ʕ^{e}**.**káʁ ‘it was uprooted’	cf.	nig.máʁ ‘it was finished’
h**e**ʕ^{e}**.**víʁ ‘he transferred’	cf.	hit.ħíl ‘he began’
n**e**ħ**.**káʁ ‘he/it was investigated’	cf.	nig.máʁ ‘it was finished’

Semi-lowering is optimal if IDENT-IO[high] and IDENT-IO[low] are ranked above *V-$_{low}$PHAR] σ.

(21) Semi-lowering in the vowel system

/niħkaʁ/	*V_{+high} PHAR]$_\sigma$	DEP	IDENT-[high]	IDENT-[low]	*V_{-low} PHAR]$_\sigma$
a. niħ.kaʁ	*!				*
☞b. neħ.kaʁ			*		*
c. naħ.kaʁ			*	*!	
d. ni.**a**ħ.kaʁ		*!			

In tableau (21), the underlying form /niħkaʁ/ contains a high vowel before a pharyngeal. The faithful candidate (a) is ruled out by *V_{+high}PHAR]$_\sigma$. In candidate (c), the high vowel [i] is lowered to the low vowel [a], thus violating the IDENT constraints and is ruled out. In candidate (d), a vowel is inserted between ħ and the high vowel and it is ruled out by DEP. In candidate (b), the high vowel [i] is lowered to the mid vowel [e], so it does not violate *V_{+high}PHAR]$_\sigma$, though it violates *V_{-low}PHAR]$_\sigma$, which militates against mid vowels before ħ in the same syllable. Since in the verb system this constraint is ranked lower than the IDENT constraints and in fact is the lowest constraint in the hierarchy, (b) is the winning candidate.

As in the noun system, stressed vowels in the verb system do not change to satisfy *V_{+high}PHAR]$_\sigma$, and epenthesis takes place when the pharyngeal is ħ. Consider some of the data from (4), repeated here as (22); note that the voiced ʕ is never syllabified as the coda of a stressed syllable (see footnote 4).

(22) ħ *after a stressed vowel in the verb system*

hiv.tí.**a**ħ ‘he promised’	cf.	hit.ħil ‘he began’
him.lí.**a**ħ ‘he salted’	cf.	hit.ħíl ‘he began’

(23) Verb system epenthesis after a stressed high vowel

/himliħ/	IDENT-σ́ [high]	IDENT-σ́ [low]	*V$_{+high}$ PHAR]$_σ$	DEP	IDEN- [high]	IDENT- [low]	*V$_{-low}$ PHAR]$_σ$
a. him.líħ			*!				*
b. him.láħ	*!	*			*	*	
c. him.léħ	*!				*		
☞ d. him.lí.aħ				*			

As tableau (23) shows, the ranking of IDENT-σ́ [high] above DEP ensures that epenthesis will be preferred over vowel lowering.

The ranking given in (23), however, gives the wrong output when underlying /e/ surfaces as the stressed vowel. On the basis of the ranking established so far, epenthesis should not take place before the pharyngeal consonant, yet it does occur in such verbs (see tableau 24)).

(24) Ranking paradox

/ʃoleħ/	IDENT-σ́ [high]	IDENT-σ́ [low]	*V$_{+high}$ PHAR]$_σ$	DEP	IDEN- [high]	IDENT- [low]	*V$_{-low}$ PHAR]$_σ$
☜a. ʃoléħ							*
b. ʃoláħ		*!				*	
☞ e. ʃoléaħ				*!			

According to Beckman (1998, chap. 3), stressed syllables are more prominent than unstressed syllables; as a result, the languages of the world exhibit stress-based positional neutralization, stress-based triggering of processes and stress-based blocking of phonological processes. However, a case where a marked structure can appear in unstressed syllables (a mid vowel before a pharyngeal as in the word ***n*e*ħkáʁ**) but is blocked in stressed syllables (as in the word *ʃoléaħ* where [a] is inserted between the mid vowel and the pharyngeal), is not attested in the languages of the world.

I argue that this paradox is a case of Gang Effect (Keller 2006; Farris-Trimble 2008; Pater 2009). A Gang Effect refers to cases where two violable lower-ranked constraints "gang up"

against a higher-ranked constraint in order to rule out a candidate that violates both of them. This results in a win by another candidate – the one that violates the higher-ranked constraint only once. I argue that the this ranking paradox is the outcome of the combined forces of the markedness constraint *V$_{\text{-low}}$PHAR]$_{\sigma}$ and the constraint FTBIN.

Gang Effects are usually analyzed within the theoretical framework of Harmonic Grammar (Legendre, Miyata and Smolensky 1990), since Gang Effects can be easily analyzed in a theory that consists of weighted constraints rather than strict domination. Within OT, a solution to gang effects was proposed by Smolensky (1995) using Local Conjunction (LC). In Local Conjunction, two constraints can be combined, whereby a combined constraint is violated only by candidates that violate both combining constraints, and whereby the combined constraint is ranked above its combining constraints. Tableau (25) below shows the ranking of DEP in respect of *V$_{\text{-low}}$PHAR]$_{\sigma}$ and FTBIN.

(25) The ranking of DEP in respect of *V$_{\text{-low}}$PHAR]$_{\sigma}$ and FTBIN

/ʃoleħ/	DEP	*V$_{\text{-low}}$ PHAR]$_{\sigma}$	FTBIN
☜a. ʃo[léħ]		*	*
☞ b. ʃo[léaħ]	*!		

DEP outranks each of the constraints individually. Candidate (b) is ruled out by DEP, and candidate (a) violates both *V$_{\text{-low}}$PHAR]$_{\sigma}$ and FTBIN. However, if DEP is ranked below the combined constraint *V$_{\text{-low}}$PHAR]$_{\sigma}$&FTBIN ("no mid vowels before a pharyngeal within the domain of the syllable" and "feet are binary"), candidate (b) will win, since candidate (a) is ruled by the combined constraint, as seen in tableau (26):[7]

[7] I again do not consider a candidate such as [ʃoléħ] in the tableau since feet are always trochaic in the language (Becker 2003;, Pariente and Bolozky 2014). A candidate such as [ʃóleħ] does not appear in the tableau since it will be ruled out by the high ranking constraint RIGHTMOST, which militates against non-final stress.

(26) The ranking of DEP and *V$_{-low}$PHAR]$_{\sigma}$&FTBIN

/ʃoleħ/	*V$_{-low}$PHAR]$_{\sigma}$ &FTBIN	DEP	*V$_{-low}$ PHAR]$_{\sigma}$	FTBIN
a. ʃo[léħ]	*!		*	*
☞ b. ʃo[léaħ]		*		

The combined constraint will have no effect on words like *neħ[káʁ]*, since word stress is ultimate and epenthesis will not create a binary foot (**neaħ[káʁ]*).

In sum, the ranking of the noun system is as represented in Figure 2:

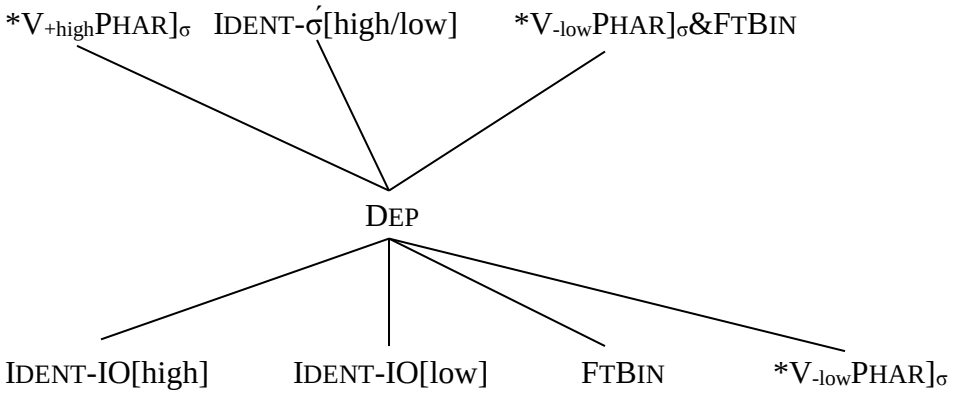

Figure 2: Ranking of the verb system

3. Discussion – Co-phonology and privilege

Category specific phonological processes are becoming the interest of large and growing linguistic investigations (Myers 2000; 2011; Bobaljik 2008; Smith 2001, among others). With regard to suprasegmental and prosodic processes, it has been argued that nouns are more privileged than verbs, thus allowing for more marked features (Smith 2011). Verbs are arguably less faithful to the Underlying Representation and allow for more changes to the Underlying Representation material. In this section, I examine this hypothesis in a featural process and show that in the case of pharyngeal triggered vowel lowering, it is verbs that are more faithful and preserve more UR material than nouns.

In a cross-linguistic survey of phonological differences among lexical categories, Smith (2011) has found that nouns exhibit more preservation of lexical material in most languages. For example, in Spanish, stress can be antepenultimate or penultimate (i.e. stress is contrastive: [sáβana] ‘sheet’ [saβána] ‘savanna’. In verbs, on the other hand, stress is predictible and is determined by inflection: [láβ-o] ‘wash-1SG.PRS.IND’ [laβ-é] ‘wash-1SG.PRET.IND’. This tendency is, however, restricted to suprasegmental and prosodic effects: “the overwhelming majority of cases involve prosodic and suprasegmental phenomena rather than segmental or featural phenomena” (Smith 2011: 20).

SMH is an example of a language that has different featural phenomena for different lexical categories (Nouns vs. Verbs). In the noun system, high vowels cannot appear before a pharyngeal and the vowel is lowered to [a] (*m**a**ʕᵘmád* 'status', *m**a**ħsán* ‘warehouse’). In the verb system, high vowels cannot appear before a pharyngeal as well, but the vowel is lowered to [e] (*n**e**ʕᵉkaʁ* ‘it was uprooted’, *n**e**ħkaʁ* ‘he/it was investigated’). SMH exhibits a case of verbal privilege with regard to pharyngeal triggered vowel lowering. In featural terms, the generalization can be formulated as follows: in the verb system, a vowel which is specified for [+high] cannot appear before a pharyngeal in the domain of a syllable; in the noun system, a vowel which is specified for [-low] cannot appear before a pharyngeal in the domain of a syllable.

In SMH, the prohibition on adjacent non-low vowels and pharyngeal is stricter in the noun system than in the verb system. This results in a full lowering of high vowels to low vowels in nouns and semi-lowering of high vowels to mid vowels in verbs. Full lowering from a high vowel to a low vowel changes both the value of the feature [high] from [+high] to [-high] and the value of the feature [low] from [-low] to [+low]. Semi-lowering from a high vowel to a mid

vowel changes only the value of the feature [high] from [+high] to [-high] but not the value of the feature [low] which stays [-low]. Changing the value of only one feature is more faithful to the Underlying Representation than changing the value of two features. This less marked situation is found in verbs in SMH.

4. Conclusion

This paper has presented an optimality-theoretic analysis of the behavior of pharyngeals in a non-standard variety of Hebrew. An OT account of the language's prohibition against a sequence of a non-low vowel immediately preceding a coda pharyngeal was provided.

After presenting the data and generalizations, I outlined the strategies used to avoid the disallowed sequences. It was shown that SMH considers multiple factors with regard to this prohibition, such as syllabic position, stress and lexical category.

Since nouns and verbs show a different behavior with respect to the processes under examination, different co-phonologies were proposed in order to analyze them separately. It was also shown that in SMH, verbs exhibit a greater resistance to vowel lowering than nouns.

References

Al-Ani, Salman. H. 1970. *Arabic phonology: An acoustical and physiological investigation*. The Hague: Mouton.

Anttila, Arto. 2002. Morphologically conditioned phonological alternations. *Natural Language and Linguistic Theory* 20. 1–42.

Bat-El, Outi. 1989. *Phonology and word structure in Modern Hebrew*. Los Angeles, CA: UCLA dissertation.

Bat-El , Outi. 1994. Stem modification and cluster transfer in Modern Hebrew. *Natural Language and Linguistic Theory* 12. 571–593.

Bat-El, Outi. 2003. Semitic verb structure within a universal perspective. In Joseph Shimron (ed.), *Language, processing, and language acquisition in a Root-based Morphology*, 29–59. Amsterdam: John Benjamins.

Bat-El, Outi. 2005. The emergence of the binary trochaic foot in Hebrew hypocoristics. *Phonology* 22. 1–29

Becker, Michael. 2002. Hebrew Stress: Can You Hear Those Trochees? M.A. thesis, Tel-Aviv University.

Beckman, Jill. 1998. *Positional faithfulness*. Amherst, MA: University of Massachusetts dissertationt.

Bobaljik, Jonathan David. 2008. Paradigms (Optimal and otherwise): A case for skepticism. In Asaf Bachrach & Andrew Nevins (eds), *Inflectional identity*, 29–54. Oxford: Oxford University Press.

Bolozky, Shmuel. 1982. Remarks on rhythmic stress in Modern Hebrew. *Journal of Linguistics* 18. 275–289.

Butcher, Andrew & Ahmad, Kusay. 1987. Some acoustic and aerodynamic characteristics of pharyngeal consonants in Iraqi Arabic. *Phonetica* 44. 156–172.

Cohn, Abigail & McCarthy, John. 1998. Alignment and parallelism in Indonesian phonology *Working Papers of the Cornell Phonetics Laboratory* 12. 53–137.

Delattre, Pierre. 1971. Pharyngeal features in the consonants of Arabic, German, Spanish, French, and American English. *Phonetica* 23.129–155.

Farris-Trimble, Ashley. 2008. *Cumulative faithfulness effects in phonology*. Bloomington, IN: Indiana University dissertation.

Ghazeli, Salem. 1977. *Back consonants and backing coarticulation in Arabic*. Austin, TX: University of Texas dissertation.

Graf Dafna & Adam Ussishkin. 2003. Emergent iambs: Stress assignment in Modern Hebrew. *Lingua* 113. 237–270.

Hall, Nancy. 2006. Cross-linguistic patterns of vowel intrusion. *Phonology* 23. 387–429.

Inkelas, Sharon & Cheryl Zoll. 2007. Is grammar dependence real? A comparison between cophonological and indexed constraint approaches to morphologically conditioned phonology *Linguistics* 45. 133–172.

Keller, Frank. 2006. Linear Optimality Theory as a model of gradience in grammar. In Gisbert Fanselow, Caroline Fery, Ralph Vogel & Matthias Schlesewsky (ed.), *Gradience in grammar: Generative perspective*s, 270–287. Oxford: Oxford University Press..

Klatt, Dennis H. & Kenneth N. Stevens. 1969. Pharyngeal consonants. *Quarterly Progress Report* 93. 207–216.

Laufer, Asher & Thomas Baer. 1988. The emphatic and pharyngeal sounds in Hebrew and in Arabic. *Language and Speech* 31. 181–205.

Legendre, Géraldine, Yoshiro Miyata & Paul Smolensky. 1990. Can connectionism contribute to syntax? Harmonic Grammar, with an application. In M. Ziolkowski, M. Noske, and K. Deaton (eds.), *Proceedings of the 26th Regional Meeting of the Chicago Linguistic Society*, 237–252. Chicago: Chicago Linguistic Society.

McCarthy, John J. 1981. A prosodic theory of nonconcatenative morphology. *Linguistic Inquiry* 12. 373–418.

McCarthy, John J. 1994. The phonetics and phonology of Semitic pharyngeals. In Patricia A. Keating (ed.), *Phonological structure and phonetic form: Papers in laboratory phonology III*, 191–233. Cambridge: Cambridge University Press.

McCarthy, John J. & Alan Prince. 1993. Generalized alignment. In: Geert Booij & Jaap van Marie (eds.), *Yearbook of morphology*, 79–153. Dordrecht: Kluwer.

McCarthy, John & Alan Prince (1995). Faithfulness and reduplicative identity. In Jill Beckman, Laura Walsh Dickey & Suzanne Urbanczyk (eds), Papers in Optimality Theory. (University of Massachusetts Occasional Papers in Linguistics 18.) Amherst, MA: Graduate Linguistic Student Association. 249-384.

Myers, Scott. 2000. Boundary disputes: The distinction between phonetic and phonological sound patterns:. In Noel Burton-Roberts, Philip Carr & Gerard Docherty (eds.), *Phonological knowledge: Conceptual and empirical issue*, 245–272. Oxford: Oxford University Press.

Orgun, Cemil Orhan. 1996. *Sign-based morphology and phonology: With special attention to Optimality Theory*. Berkeley, CA: University of California dissertation.

Pariente, Itsik. 2010. Pharyngeal related non-lexical vowels in Sephardic Modern Hebrew. *Linguistics in Amsterdam* 3.1–19.

Pariente, Itsik. 2012. Grammatical paradigm uniformity. *Morphology* 22. 485–514.

Pariente, Itsik. & Bolozky, Shmuel. 2014. Stress shift and trochaic structures in the nominal system of Modern Hebrew. *Brill's Journal of Afroasiatic Languages and Linguistics* 6. 1–26.

Pater, Joe. 2000. Non-uniformity in English secondary stress: The role of ranked and lexically specific constraints. *Phonology* 1. 237–274.

Pater, Joe. 2009. Weighted constraints in generative linguistics. *Cognitive Science* 33. 999–1035.

Perkell, Joseph. 1971. Physiology of speech production: A preliminary study of two suggested revisions of the features specifying vowels. *MIT Research Laboratory of Electronics Quarterly Progress Report* 102. 123–139.

Prince, Alan. 1980. A metrical theory for Estonian quality. *Linguistic Inquiry* 11. 511–562.

Prince, Alan and Paul Smolensky. 1993/2004. *Optimality Theory: Constraint interaction in generative grammar* (RuCCS Technical Report 2). Piscateway, NJ: Rutgers University Center for Cognitive Science, Rutgers University. Revised version published 2004, Oxford: Blackwell.

Smith, Jennifer L. 2001. Lexical category and phonological contrast. In Robert Kirchner, Joe Pater & Wolf Wikely (eds.) *Workshop on the lexicon in phonetics and phonology*, 61–72. Edmonton: University of Alberta..

Smith, Jennifer L. 2011. Category-specific effects. In Marc van Oostendorp, Colin Ewen, Beth Hume & Keren Rice (eds.), *The Blackwell companion to phonology*, 2439–2463. Malden, MA: Wiley-Blackwell.

Smolensky, Paul. 1993. Harmony, markedness, and phonological activity. Handout of keynote address, *Rutgers Optimality Workshop* 1, October 23. ROA-87.

Smolensky, Paul. 1995. On the structure of the constraint component Con of UG. Ms, University of California at Los Angeles.

Urbanczyk, Suzanne. 1996. *Patterns of reduplication in Lushootseed*. Amherst, MA: University of Massachusetts dissertation.

Ussishkin, Adam. 1999. The inadequacy of the consonantal root: Modern Hebrew denominal verbs and output-output correspondence. *Phonology* 16. 401–442.