STRESS SHIFT AND TROCHAIC STRUCTURES IN THE NOMINAL SYSTEM OF MODERN HEBREW

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This study examines the stress patterns in the nominal system of Modern Hebrew. It is argued that stress in Modern Hebrew is trochaic, consisting of binary or degenerate feet. Two competing analyses of stress in Modern Hebrew nouns are provided. It is argued that a trochaic analysis is superior to a strong binary analysis (maintaining that feet in Hebrew are obligatory binary), and can accurately predict the adaptation of loanwords in the language.

Keywords: Modern Hebrew, Stress shift, Loanword adaptation

1. Introduction

Modern Hebrew (MH) exhibits a unique metrical system; it is a quantity insensitive language with final default stress. According to Hayes (1995:101), quantity insensitive languages tend to be trochaic; however, final stress does not characterize trochaic languages. To account for this alleged contradiction, two major proposals of analyzing the metrical system of the language have been made. Bolozky (1982), Graf and Ussishkin (2003) and Bat-El (2005) claim that the MH stress system consists of binary strong feet (enclosed in square brackets), either iambic or trochaic ([*ganáv*], [*jéled*]). Becker (2003a), on the other hand, suggests that MH stress consists of trochaic feet, either binary or degenerate ([*jéled*], ga[*náv*]).

In this paper we give further evidence for trochaic structures in the nominal system of MH. The arguments are taken from stress shift and loanword adaptation. We

argue that a metrical analysis based on trochaic foot structure provides a more plausible

description for these phenomena than a binary strong feet analysis does.

2. The metrical system of Modern Hebrew nouns and adjectives

Podolsky (1981, 1991), following Rosén (1957), classifies Hebrew nouns for

stress purposes as having either 'mobile' or 'stable' stress. Melčuk and Podolsky (1996),

who propose a complete account of the Modern Hebrew stress system for nominals - both

borrowed as well as native - postulate a tripartite division between strong affixes which

are obligatorily stressed, weak ones that are never stressed, and neutral ones which may

be stressed, but not obligatorily. In addition, Bat-El (1993) distinguishes between

'accenting' and 'pre-accenting' suffixes. Nouns belonging to the unaccented type have no

underlying accent, are assigned final stress by default, and when suffixes are added, stress

falls on the suffix and not on the stem, as in:

(1)   *píl*   'elephant'
        pilím   'elephants' (with the plural suffix *-im*)
        pilá   'elephant' fem. (with the feminine suffix *-a*)

Borrowed nouns, on the other hand, are not associated with established patterns, and

speakers maintain fixed accent and preserve the base as transparently as possible. They

form the bulk of the other major class of nouns, the accented type, which consists of

words lexically marked for accent, and where suffixation does not shift the place of the

accent (unless the suffix itself is lexically accented). While the largest class of accented

nouns is borrowed, the accented type also includes a number of native nouns. Below are

some illustrations of the accented type, starting with loan group inflections (see Bolozky

2000):

(2) Borrowed nouns and adjectives

Masc. Sg.	Fem. Sg.	Masc. Pl.	Fem. Pl.	Gloss
studént	*studéntit*	*studéntim*	*studéntijot*	student
kabinét		*kabinétim*		cabinet
siméster		*simésterim*		semester
tóster		*tósterim*		toaster
	víza		*vízot*	visa
	filosófja		*filosófjot*	philosophy

Although the vast majority of borrowings have stable accent, there is some variation. To start with, some derivational foreign suffixes have assigned lexical stress themselves, and consequently, they bear the stress when appended to the stem, as in the case of *+íst* and *+áli*:

(3)	Form	Gloss	Derived Form	Gloss
	tánk	tank	*tankíst*	member of tank crew
	balagán	disorder	*balaganíst*	disorderly person
	múzika	music	*muzikáli*	musical
	fízika	physics	*fizikáli*	physical, of physics
	studént	student	*studentjáli*	of student

However, when inflectional affixes are appended, the derived stem maintains its (derived) accent without shifting the accent, which Schwarzwald (1998b) attributes to the inflectional affixes being native:

(4)	Form	Gloss	With Infl. Affix	Gloss
	tankíst	member of tank crew	*tankístim*	ms. pl.
	balaganíst	disorderly person	*balaganístit*	fm. sg.
	muzikáli	musical	*muzikáli(j)im*	ms. pl.
	studentjáli	of student	*studentjálit*	fm. sg.

Thus, the large and very productive class of loanwords maintains stable accent. Another large group of accented nouns, also open and very productive, is acronyms (Bat-El 1994, 2000; Bolozky 1999; Ravid 1990; Zadok 2002).

(5) All acronyms

Masc. Sg.	Fem. Sg.	Masc. Pl.	Fem. Pl.	Gloss
mól	*mólit*	*mólim*	*mólijo*t	publisher
rasár	*rasárit*	*rasárim*	*rasárijo*t	sergeant-major
mankál	*mankálit*	*mankálim*	*mankálijot*	general manager

Although many acronyms appear to follow a discontinuous pattern with *a*, Bat-El

(1994) and Bolozky (1999) have shown that this is not the case; rather, the vowel *a* is

inserted so as to make the acronym pronounceable.

Some native nouns have a stable stress as well:

(6) Native nouns

Singular	Gloss	Plural
glída	ice cream	*glídot*
tíras	corn(-on-the-cob)	*tírasim*
pílpel	pepper	*pílpelim*
míʃmiʃ	apricot	*míʃmiʃim*
ʦxók	laughter	*ʦxókim*

Another fairly-large group of lexically-accented items involves ethnicity terms and

residents of geographical locations ending with the suffix –*i*:

(7) Many gentilic terms and residents of cities/towns

Masc. Sg.	Fem. Sg.	Masc. Pl.	Fem. Pl.	Gloss
ʃvédi	*ʃvédit*	*ʃvédim*	*ʃvédijot*	Swedish/Swede
albáni	*albánit*	*albánim*	*albánijot*	Albanian
jeruʃálmi	*jeruʃálmit*	*jeruʃálmim*	*jeruʃálmijot*	(resident) of Jerusalem
telavívi	*telavívit*	*telavívim*	*telavívijot*	(resident) of Tel-Aviv

In other nouns that involve ethnicity terms and residents of geographical locations and

ending with the suffix –*i*, stress is not accented, as in

(8) Other gentilic terms and residents of cities/towns

Masc. Sg.	Fem. Sg.	Masc. Pl.	Fem. Pl.	Gloss
rusí	*rusijá*	*rusím*	*rusijót*	Russian
anglí	*anglijá*	*anglím*	*anglijót*	English(man/woman)
germaní	*germanijá*	*germaním*	*germanijót*	German
polaní	*polanijá*	*polaním*	*polanijót*	Polish/Pole

Other sub-groups in which lexical accent are maintained:

(9) Games (mostly children's)

Singular	Plural	Gloss
kláʃ	kláʃim	card game (vs. *klafím* 'cards')
búl	búlim	stamp collecting (vs. *bulím* 'stamps')

(10)   Some items in familiar, informal register

Singular	Gloss	Plural	Gloss notes
mic	juice	mícim	bottles of juice (vs. *micím* 'types of juice')
marák	soup	marákim	normative *merakím*
ambátja	bath; bath tub	ambátjot	
míʃmiʃ	apricot	míʃmiʃim	
gímel	the letter *gimel*; sick leave day (army)	gímelim	

(11)   Proper names (Bat El 2005)

Proper Name	Plural	Gloss
ʃmúel	ʃmúelim	people named Shmuel
meíra	meírot	people named Meira

A large number of native nouns are disyllabic with the accent falling on the first syllable. However, most of their plurals have the form *CCaC* + the plural suffix *-ím/-ót* with final accent, a behavior consistent with neither the accented nor the unaccented type. Traditionally they are known as 'Segholates'. In Tiberian Hebrew, the second vowel of these nouns is of predictable quality, thus analyzable as epenthetic. As Becker (2002) points out, this analysis cannot be extended to MH, due to pairs such as *mélax* 'salt' / *mélex* 'king', where the quality of the second vowel of the word is not predictable (though it can only be *e* or *a*). This group of nouns is analyzed by invoking extrametricality in Bat-El (1993), whereas Bolozky (1995) and Becker (2003a) characterize its plural form as templatic:

(12) | **Singular** | **Plural Template** | **Plural** | **Glosss** |
| --- | --- | --- | --- |
| *kélev* | *CCaCím* | *klavím* | dog |
| *kéren* | *CCaCót* | *kranót* | fund |

In other words, the plural form of these nouns is not created from the accentual di-syllabic singular plus the plural suffix *-im/-ot*, but rather the template imposes a different prosodic form with the usual final stress.

There are, then, a number of large groups of items and some smaller ones which maintain stable stress: borrowed stems, proper names, acronyms, games (mostly children's), chants, some frequently used items in informal/familiar registers (which in itself suggests trochaic preference), residents of cities, and some individually marked lexical items. Schwarzwald (1998a, b) labels all of these sub-groups 'unintegrated', claiming that they are somehow outside of the mainstream system. Becker (2003b) uses Itô & Mester's model (1995) to give a Lexical Strata analysis of these different groups in the language. Our assumption here, however, is that loanwords and acronyms do not belong to a different stratum, since trochaic structures emerge in all groups of nouns, borrowed and native alike, and though the majority of nouns in the language are unaccented, it is the accented word mechanism that is the productive one in the language. The role of loanwords, which overwhelmingly and productively maintain lexical accent regardless of suffixation, cannot be seen as marginal. The same can be said of acronyms which is also a very productive class, and which we doubt are perceived differently by native speakers from other nouns in the language, especially since there is no common semantic or syntactic denominator characterizing the nouns in these groups.

We assume that speakers move to an accented system since fixed stress coincides with trochaic feet which are expected in a language like Hebrew where syllable weight and phonemic length do not determine stress assignment (Hayes 1995).

2.1. Stress and related factors

2.1.1. Secondary stress

Secondary stress is discussed in most of the generative literature about stress in Hebrew, beginning with Bolozky (1982), where it is described as appearing on every other syllable to the left of the primary stress. However, Becker (2003a) finds no acoustic evidence for secondary stress either by pitch or by vowel length. In (8), for example, he identified only one point of high pitch and one (phonetically) long vowel:

(13) *hagamadoní:m*   'the little dwarfs'

Becker still reports that some speakers do feel that they hear some prominence associated with every other syllable to the left of the main stress. We will adopt Becker's view in this study, since to our knowledge it is the only study to use acoustic measurements.

2.1.2. Weight sensitivity

The table below demonstrates the (lack) of correlation between stress and syllable weight. All type of syllables acts the same. Hebrew, then, is a quantity insensitive language.

(14) Syllable type and stress assingment

	(C)V.(C)V	(C)V.(C)VC	(C)VC.(C)V	(C)VC.(C)VC
Nouns	*masá* 'burden' *ʃivá* 'return'	*agíl* 'earring' *maxár* 'tomorrow'	*maʃké* 'drink' *kufsá* 'box'	*axbár* 'mouse' *mixtáv* 'letter'
Verbs	*ʃatá* 'drink' [P.M.Sg.] *nisá* 'try' [P.M.Sg.]	*katáv* 'write' [P.M.Sg.] *hevín* 'understand' [P.M.Sg.]	*huftá* 'be surprised' [P.M.Sg.] *hilká* 'beat' [P.M.Sg.]	*hirgíʃ* 'feel' [P.M.Sg.] *nimʃáx* 'be pulled' [P.M.Sg.]

3. Competing analyses

Two competing analyses were suggested in light of Hayes' typology and Hebrew facts: (a) MH stress system consists of binary strong feet (enclosed in square brackets), either iambic or trochaic ([*jéled*], [*ganáv*]) (for example Bolozky 1982; Graf and Ussishkin 2003; and Bat-El 2005); and (b) MH stress consists of trochaic feet, either binary or degenerate ([*jéled*], *ga*[*náv*] (for example, Becker 2003a,b). The theoretical framework of these analyses is Optimality Theory (Prince and Smolensky (1993/2004).

(15)   Stress related constraints

IDENTSTRESS (McCarthy and Prince 1995)
The output syllable corresponding to the input's stressed syllable is stressed (interpreted as gradient – see section 4.1)

TROCH (Prince & Smolensky 1993/2004; McCarthy & Prince 1993)
Feet are left-headed.

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

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 a foot.

3.1. Binary strong feet analysis

The ranking: FTBIN >> IDENTSTRESS >> RIGHTMOST >> TROCHEE.

FTBIN is undominated, so all feet are binary.

(16) Non final lexical stress

/tíras/	FTBIN	IDENTSTRESS	RIGHTMOST	TROCHEE
☞ (a) [tí.ras]			*	
(b) [ti.rás]		*!		*
(c) [tí]ras	*!		*	
(d) ti[rás]	*!	*		

In tableau (16) the input contains a non-final lexical stress. Candidate (b) changes

the position of the lexical stress, thus violating IDENTSTRESS and being ruled out.

Candidates (c) and (d) form a unary foot, thus being ruled out by FTBIN. The winning

candidate (a) preserves the position of the lexical stress and forms a trochaic binary foot,

though it violates RIGHTMOST.

(17) Non final lexical stress with suffixation

/tíras-im/	FTBIN	IDENTSTRESS	RIGHTMOST	TROCHEE
☞ (a) [tí.ra]sim			*	
(b) ti[rá.sim]		*!	*	
(c) ti[ra.sím]		*!*		*

Tableau (17) demonstrates that this analysis can capture the fact that suffixation

does not change the position of the lexical stress. Candidates (b) and (c) change the

position of the lexical stress, thus violating IDENTSTRESS and being ruled out. The

winning candidate (a) preserves the position of the lexical stress and forms a binary foot,

though it violates the lower ranking constraint RIGHTMOST.

(18) Final lexical stress

/studént/	FTBIN	IDENTSTRESS	RIGHTMOST	TROCHEE
☞(a) [stu.dént]				*
(b) [stú.dent]		*!	*	
(c) stu[dént]	*!			

In tableau (18) the input contains a final lexical stress. Candidate (b) changes the

position of the lexical stress, thus violating IDENTSTRESS and being ruled out. Candidates

(a) and (c) preserve the lexical position of the stress. The winning candidate (a) forms a

binary foot, even though this foot is not trochaic due to the ranking of FTBIN above

TROCHEE.

(19) Final lexical stress with suffixation

/studént-im/	FTBIN	IDENTSTRESS	RIGHTMOST	TROCHEE
☞(a) stu[dén.tim]			*	
(b) stu[den.tím]		*!		*
(c) [stu.dén]tim			*	*!

        Suffixation again does not change the position of the lexical stress. Candidate (b)

changes the position of the lexical stress, violating IDENTSTRESS and being ruled out.

Candidates (c) and (a) preserve the position of the lexical stress, thus they both violate

RIGHTMOST. Candidate (a) is the winning candidate, since it forms a trochaic right

aligned foot, which is preferred by TROCHEE over the left aligned iamb foot of candidate

(c).

(20) Default stress

/ganav/	FTBIN	RIGHTMOST	TROCHEE
(a) [gá.nav]		*!	
☞ (b) [ga.náv]			*
(c) ga[náv]	*!		

        In tableau (20) the input is not lexically specified for stress. Candidate (a) has

non-final stress, so it is ruled out by RIGHTMOST. Candidates (b) and (c) both have a

final stress but a different foot structure, unary (c) and binary iamb (b). Candidate (b) is

chosen over (c) due to the ranking of FTBIN above TROCHEE.

(21) Default stress with suffixation

/ganav-im/	FTBIN	RIGHTMOST	TROCHEE
(a) ga[ná.vim]		*!	
☞ (b) ga[na.vím]			*
(c) ga.na[vím]	*!		

In suffixed forms stress is final, and the foot is again binary and iambic.

As the tableaux above show, IDENTSTRESS competes with RIGHTMOST when the lexical stress is not ultimate (or when a suffix is added to a noun with final lexical stress). Due to the fact that IDENTSTRESS is ranked higher, the violation of RIGHTMOST is unavoidable.

Following Graf and Ussishkin (2003), the analysis isolates the constraints assigning feet from those assigning foot prominence. The constraint that assigns stress to the final syllable in the prosodic word is RIGHTMOST. IAMB (The rightmost unit in the foot is prominent) does not play any role in the determination of the foot structure in an output form such as [*ganáv*], and TROCHEE does not play any role in the determination of the foot structure in an output form such as [*tíras*].

3.2. Trochaic analysis

Following Becker (2003a, b) we assume that feet in nouns are always trochaic (unary or binary).

(22) The ranking: TROCHEE >> IDENTSTRESS >> RIGHTMOST >> FTBIN

In this analysis TROCHEE is undominated, so all feet are trochaic. Under this analysis, TROCHEE must outrank FTBIN.

(23) Non final lexical stress

/tíras/	TROCHEE	IDENTSTRESS	RIGHTMOST	FTBIN
☞ (a) [tí.ras]			*	
(b) [ti.rás]	*!	*		
(c) [tí]ras			*	*!
(d) ti[rás]		*!		*

In tableau (23) the input contains a non final lexical stress. Candidate (b) changes the position of the lexical stress, thus violating TROCHEE and IDENTSTRESS and is ruled

out. Candidate (c) forms a unary foot; however, stress is not final, so it is ruled out by

RIGHTMOST. Candidate (d) forms a unary foot as well; however, it changes the location

of the lexical stress, so it is ruled out by IDENTSTRESS. The winning candidate (a)

preserves the position of the lexical stress and forms a trochaic binary foot, though it

violates the low ranking constraint RIGHTMOST.

(24) Non final lexical stress with suffixation

/tíras-im/	TROCHEE	IDENTSTRESS	RIGHTMOST	FTBIN
☞ (a) [tí.ra]sim			*	
(b) ti[rá.sim]		*!	*	
(c) ti[ra.sím]	*!	**		

Tableau (24) demonstrates that suffixation does not change the position of the

lexical stress. Candidate (b) changes the position of the lexical stress and is ruled out by

IDENTSTRESS. Candidate (c) forms an iambic foot, thus violating TROCHEE (and

IDENTSTRESS) and is ruled out. The winning candidate (a) preserves the position of the

lexical stress and forms a binary trochaic foot.

(25) Final lexical stress

/studént/	TROCHEE	IDENTSTRESS	RIGHTMOST	FTBIN
(a) [stu.dént]	*!			
(b) [stú.dent]		*!	*	
☞ (c) stu[dént]				*

In tableau (25) the input contains a final lexical stress. Candidate (b) changes the

position of the lexical stress, thus violating IDENTSTRESS and is ruled out. Candidates (a)

and (c) preserve the position of the lexical stress. Candidate (a) forms a binary trochaic

foot and candidate (c) forms a unary foot. Candidate (c) wins even though the foot it

forms is not binary due to the ranking of TROCHEE above FTBIN.

(26) Final lexical stress with suffixation

/studént-im/	TROCHEE	IDENTSTRESS	RIGHTMOST	FTBIN
☞(a) stu[dén.tim]			*	
(b) stu[den.tím]	*!	*		
(c) [stu.dén]tim	*!		*	

Suffixation again does not change the position of the lexical stress. Candidate (b) changes the position of the lexical stress, violating IDENTSTRESS and is ruled out. Candidates (c) and (a) preserve the position of the lexical stress, thus they both violate RIGHTMOST. Candidate (a) is the winning candidate, since it forms a trochaic foot which is preferred over the binary iambic foot of candidate (c).

(27) Default stress

/ganav/	TROCHEE	RIGHTMOST	FTBIN
(a) [gá.nav]		*!	
(b) [ga.náv]	*!		
☞ (c) ga[náv]			*

In tableau (27) the input is not lexically specified for stress. Candidate (a) has a non final stress, so it is ruled out by RIGHTMOST. Candidates (b) and (c) both have final stress, but a different foot structure; unary (c) and binary iamb (b). Candidate (c) is chosen over (b) due to the ranking of TROCHEE above FTBIN.

(28) Default stress with suffixation

/ganav-im/	TROCHEE	RIGHTMOST	FTBIN
(a) ga[ná.vim]		*!	
(b) ga[na.vím]	*!		
☞ (c) ga.na[vím]			*

Any additional suffix will be stressed and the foot structure will always be unary due to the influence of TROCHEE and RIGHTMOST.

TROCHEE outranks FTBIN, so all nouns in the language are necessarily trochaic but not necessarily binary.

None of these analyses is elegant and straightforward. The advantage of the binary analysis over the trochaic one is that it does not force us to assume that **a major part** of the Hebrew lexicon is characterized by unary feet such as in *ga[náv];* rather, *[ganáv]* and [*jéled]* still have the universally preferred binary foot structure, whether trochaic or iambic. The trochaic analysis, on the other hand, places TROCHEE higher in the hierarchy than FTBIN, and in doing so, it unifies the analysis of MH as a trochaic language. In other words, the advantage is in not using two different foot structures (trochaic and iambic) in the same language.

4. Stress shift

Stress shift occurs in a number of items with four syllables or more (Podolsky 1991, Bat-El 1993)[1]. Stress can fall only on one of the three last syllables.

(29) Stress shift

Singular	Gloss	Plural
ótobus	bus	*otobúsim*
télefon	telephone	*telefónim*
téleskop	telescope	*teleskópim*
éskimo	Eskino (Innuit)	*eskimósim*
ámbulans	ambulance	*ambulánsim*

Stress cannot stay on its original syllable, more than three syllables from the end; it shifts to the three window syllable (*ótobus+im → o.to.bú.sim* and not *ó.to.bu.sim*)[2]. We formulate this prohibition as a positive constraint:

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[1] In connected speech, stress shift may occur as a result of stress clash (e.g., *atá bá* 'are you coming' > *àta bá* – see Bolozky 1982). This kind of stress shift is outside the scope of this paper.

 (30) THREESYLLABLEWINDOW (TSW)[3]
        Stress must fall on one of the three last syllables in a word

4.1 Gradient and categorical interpretation of IDENTSTRESS

The obvious opponent to TSW is IDENTSTRESS, which militates against changing the original position of the stress. IDENTSTRESS can be interpreted as gradient or as categorical. A gradient constraint means that a constraint can assign multiple violation mark per locus according to the degree of modification a candidate exhibits from the input (or other output in OO constraints). Categorical interpretation of constraints means that a constraint can assign only one violation mark per candidate. No degree of deviance is measured per locus by the constraint, and a candidate can either violate or satisfy it. A categorical constraint can assign multiple violation marks to a candidate if the candidate has multiple violations in different loci (e.g. ONSET will assign two violation marks to a candidate with two onsetless syllables). Gradient constraints have been attacked in recent years (most notably by McCarthy 2003) as inaccurate and as predicting unattested patterns in the languages of the world (McCarthy 2003 § 5-7). We do not accept this view insofar as IDENTSTRESS is concerned, for two reasons. The first is theoretical: stress location in accented nouns is the result of lexical transparency and word recognition. A deviation from the original position makes suffixed forms less transparent and harder to recognize. Changing the location of stress from the initial syllable to the final syllable, for example, is worse than changing it one syllable to the right. The closer the stress is to its original position, the easier it is for speakers to identify the word.

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[2] In all the words above, stress shift is optional, however as Bat El (p.c.) observes, in *télefonim/telefónim* 'telephones' it is distinctive, i.e. *telefónim* means phone calls and *télefonim* means telephones (instrument).
[3] This constraint is descriptive in nature; however, it is sufficient for the current purpose.

The second reason is empirical: we will show that a categorical interpretation of IDENTSTRESS never predicts the right output, under any analysis, whether trochaic or binary. However, a gradient interpretation of IDENTSTRESS in the trochaic analysis yields the right outcome.

If a categorical interpretation of IDENTSTRESS is adopted, once the stress has to shift from its original position due to TSW, any other location is equally good (or bad) as far as IDENTSTRESS is concerned. According to such view, stress is evaluated by all other stress related constraints **exactly as other unaccented forms in the language are**. This means that under the binary analysis stress will fall on the last syllable which is the head of an iambic foot, and a trochaic analysis will produce final stress in a unary foot:

(31) Binary strong feet with categorical IDENTSTRESS

/ótobus+im /	TSW	FTBIN	IDENT STRESS	RIGHT MOST	TROCHEE
(a) [ó.to]bu.sim	*!			*	
(b) [o.tó]bu.sim			*	*!	*
(c) o.to[bú.sim]			*	*!	
☞(d) o.to[bu.sím]			*		*
(e) o.to.bu[sím]		*!	*		

(32) Trochaic analysis with categorical IDENTSTRESS

/ótobus+im /	TSW	TROCHEE	IDENT STRESS	RIGHT MOST	FTBIN
(a) [ó.to]bu.sim	*!				
(b) [o.tó]bu.sim		*!	*		
(c) o.to[bú.sim]			*	*!	
(d) o.to[bu.sím]		*!	*		
☞ (e) o.to.bu[sím]			*		*

Both analyses predict that stress will be final, whereas stress shifts to the penultimate position. We argue that this is the result of the speakers' desire to minimize the shift from the original syllable (i.e. interpret IDENTSTRESS as gradient).

As shown in tableau (33), gradient interpretation of IDENTSTRESS also predicts the wrong outcome under the binary analysis.

(33) Binary strong feet with gradient IDENTSTRESS

/ótobus+im /	TSW	FTBIN	IDENT STRESS	RIGHT MOST	TROCHEE
(a) [ó.to]bu.sim	*!			*	
☞ (b) [o.tó]bu.sim			*	*	*
(c) o.to[bú.sim]			**!	*	
(d) o.to[bu.sím]			**!*		*
(e) o.to.bu[sím]		*!	***		

Since the binary strong feet analysis makes no demand for a specific foot structure, any output that does not violate TSW, violates IDENTSTRESS minimally, and is binary, will be optimal. At the table above candidate (b) is that candidate. Candidate (a) violates the TSW constraint, so it is disqualified. Candidate (e) violates FTBIN and is ruled out. All remaining candidates violate IDENTSTRESS. Since (b) violates it the least, it is the optimal candidate. This outcome is wrong, of course.

(34) Trochaic analysis with gradient IDENTSTRESS

/ótobus+im /	TSW	TROCHEE	IDENT STRESS	RIGHT MOST	FTBIN
(a) [ó.to]bu.sim	*!			*	
(b) [o.tó]bu.sim		*!	*	*	
☞(c) o.to[bú.sim]			**	*	
(d) o.to[bu.sím]		*!	***		
(e) o.to.bu[sím]			***!		*

In the table above, candidate (a) violates TSW, so it is disqualified. Candidate (b) and (d) violate TROCHEE and are ruled out. Candidates (c) and (e) violate IDENTSTRESS. Since (c) violates it the least, it is the optimal one. This outcome is correct. Under this analysis, the candidate that does not violate TSW and violates IDENTSTRESS minimally, and is trochaic, will win. Candidate (c) does just that.

4.2 Exceptions

4.2.1. The suffixes *ʧik* and *nik*

According to Bat-El (1993), *ʧik* 'diminutive' and *nik* 'agent' are pre-accenting

suffixes. This means that stress will fall on the syllable preceding them regardless of the

number of syllables:

(35)	*kibúts*	'Kibbutz'
	kibútsnik	'A member of a Kibbutz'
	kibútsnikim	'A member of a Kibbutz' pl. (with the plural suffix *-im*)
	kibútsnikit	'A member of a Kibbutz' fem. (with the feminine suffix *-it*)
	kibútsnikijot	'A member of a Kibbutz' fem.pl. (with the plural feminine suffix *-ijot*)

The noun *kibuts* is not accented as shown by the plural form *kibutsím*. The stress

will always fall on the vowel preceding the suffix *nik*, even if it violates TWS

(*kibútsnikijot*) as shown in tableau (37):

(36) ALIGNR(*nik*, Foot)
The right edge of *nik* is aligned with the right edge of a foot

(37) ALIGNR(nik, Foot) analysis

/kibuts-nik-ijot/	ALIGNR (*nik*, Foot)	TSW	TROCHEE	IDENT STRESS	RIGHT MOST	FTBIN
☞ (a) ki[búts.nik]i.jot		*			*	
(b) ki.buts[níki]jot	*!				*	
(c) ki.butsni[kí.jot]	*!				*	
(d) ki.buts.ni[ki.jót]	*!					

Any candidate which violates ALIGNR(*nik*, Foot) (the vowel preceding the suffix

nik must be stressed) is ruled out by it.

4.2.2. The suffix *on*

Another interesting suffix (brought to our attention by a reviewer) is the diminutive suffix *on*. This suffix is always stressed when it is the last suffix in the word, and in fact it attracts stress from lexically stressed syllables; however when another suffix is added, stress shifts to the last suffix.

(38) Forms with the *on* suffix

Singular	Gloss	Diminutive	Plural
ʃnícel	schnitzel	*ʃnicelón*	*šniceloním*
pílpel	pepper	*pilpelón*	*pilpeloním*

The suffix *on* cannot be lexically stressed, as shown by forms like *pilpeloním*. Descriptively, it seems that the suffix *on* neutralizes the lexical stress of words, making their stress pattern the default pattern. We argue that *on* actually attracts lexical stress from the stem *ʃnícelon → ʃnicelón*, thus *on* is always stressed in simplex forms either by stress attraction in accented stems or by final default stress in unaccented stems.

We formulate the constraint in (39) to account for the stress attraction of *on*:

(39) Coincide (lexical stress, *on*) (Zoll, 1996, 1998)
Lexical stress coincides with the suffix *on*.

(40) Coincide (lexical stress, *on*) analysis

/ʃnícel-on/	Coincide (LS, on)	TROCH	IDENT STRESS	RIGHT MOST	FTBIN
(a) [ʃnícel]on	*!			*	
☞ (b) ʃnice[lón]			*		*

Since Coincide (LS, on) dominates IDENTSTRESS, the optimal candidate (b) must shift the lexical stress to the suffix *on*. The faithful candidate (a) is ruled out by Coincide (LS, on).

The plural form *ʃniceloním* behaves like a free stem i.e. the effects of the lexical stress are not present in the plural form and stress does not fall on the original stressed syllable or on the suffix *on*. This means that the input of the plural form does not contain any lexical marking for stress. We argue that the lack of lexical stress in the plural form suggests that the input for the plural is the output form with the suffix *on* e.g. *ʃnicelon-im* and not *ʃnícel-on-im*. When the plural suffix –*im* is added, stress falls on the final syllable due to the default stress assignment in the language. Since the input of this evaluation is the output form with *on* and with final stress, it is perceived as a free noun which is not marked for lexical stress (A very similar suggestion was made by Bat-El (2008) for verbs, adjectives and participles in MH).

(41) Coincide (lexical stress, *on*) analysis of plural

/ʃnicelon-im/	Coincide (LS, on)	TROCH	IDENT STRESS	RIGHT MOST	FTBIN
(a) [ʃnícel]onim				*!	
(b) ʃnice[lónim]				*!	
☞ (c) ʃnicelo[ním]					*

In the absence of lexical stress Coincide (lexical stress, *on*) does not play a role in the selection of the winning candidate.

4.2.3 The suffix *er*

The suffix *er* 'occupation' behaves like an accented suffix in the language e.g. *maʃjonér* 'mafia member' *ʃirjonér* 'tanks person'; however when a whole word with *er* is borrowed (possibly with the -*er* unanalyzed), it keeps its original stress, even if it violates the TSW constraint: *béjbisiter* 'babysitter', *kópirajter* 'copywriter'.

When a suffix is added, some speakers do not change the original position of the stress: *béjbisiterim* 'babysitters', *kópirajterim* 'copywriters' while others do: *bejbisíterim*

'babysitters', *kopirájterim* 'copywriters'. One reviewer suggested that (for speakers who change the stress position) that the three syllable window is a derived environment effect. Such an explanation seems very plausible; MH speakers may shift stress only in derived words. However, the number of simplex loanwords with original initial stress and more then three syllables is too small to make a firm generalization.

The variation between speakers can be easily accounted for by different constraint rankings: IDENTSTRESS >>TSW for speakers who do not change the original stress position and TSW >> IDENTSTRESS for speakers who do.

5. A note on loanwords

A central factor motivating the study of loanword phonology has been their role in determining the productivity of phonological rules and constraints. In some cases crucial evidence from loans has been used to determine the analysis of data that had otherwise remained inconclusive from the standpoint of the native L_1 system (Hyman 1970; Kenstowicz and Sohn 2001; Shinohara 1997; Silverman 1992, among many others).

In our study, loanwords can help us determine which of the two analyses presented above is more accurate. When foreign nouns are adapted into MH, they must be assigned a pitch peak and longer duration. Since almost any syllable of the word can be accented in the native lexicon, the accent of the donor language (typically Yiddish, English, German, French or Arabic) is copied faithfully.

Since default stress is always final, loan words with final stress can be adapted as accented or as unaccented. Let us now examine what predictions each analysis makes.

When a word with final stress in the donor language such as *bagét* enters the language, it can be adapted in two ways, accented (a) or unaccented (b):

a. bagét ⟶ bagétim (accented)

(42) bagét

b. bagét ⟶ bagetím (unaccented)
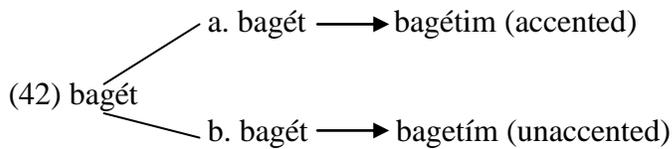
An emergent iamb analysis such as Graf and Ussishkin's (2003) does not demand any specific type of foot (trochaic or iambic); however, the foot must be binary. If the word is adapted as accented, the demand for binarity is satisfied by parsing the simplex singular form as a binary iambic foot ([*ba.gét*]) and the plural form as a binary trochaic foot (*ba*[*gét.im*]). If the word is adapted as unaccented, the demand for binarity is satisfied by parsing the simplex singular form and the plural form as a binary iambic foot ([*ba.gét*]), (*ba*[*ge.tím*]). Since the requirement for binarity is satisfied either way, this analysis does not make any prediction about the preferred way speakers will choose to treat the word when it enters the language. If this analysis is indeed the correct one, we would expect that since foot structure does not play a role in adaptation, other factors will influence the way a loan word with final accent is adapted in Hebrew. The crucial factor in this case is **frequency**. Since in MH the vast majority of nouns are unaccented, we would have expected nouns with final accent to be treated in the language as unaccented.

In reality, speakers **always**[4] prefer treating loanwords as accentual. This fact can be explained if we assume the strong trochaic foot analysis. In the strong trochaic foot analysis, if the word is adopted as accented, the demand for trochaic foot is satisfied by

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[4] Cohen (2009) found that 98.2% of all English loanwords in Hebrew preserve their original stress. The remaining 1.8% of words that exhibit stress changes is explained by variable stress patterns in English or the influence of a third language.

parsing the simplex singular form as a unary trochaic foot (*ba*[*gét*]), and the plural form as a binary trochaic one (*ba*[*gétim*]). If the word is adapted as unaccented, the demand for trochaic foot is satisfied by parsing the simplex singular form as a unary trochaic foot (*ba*[*gét*]) and the plural form as a unary trochaic foot as well (*ba.ge*[*tím*]).

In this analysis nouns will be parsed as trochaic whether they will be adapted as accented or unaccented. If a final accent word is adopted as unaccented, the parsing will always be unary trochaic foot, but if a final accent word is adopted as accented, the parsing will be unary trochaic foot only in the simplex form (*ba*[*gét*]) and binary trochaic in the affixed form (*ba*[*gétim*]). We argue that **this difference in the parsing of the suffixed form is the reason speakers prefer adapting finally accented nouns as accented. Binary feet are less marked than unary feet.**

One reviewer pointed out that in many languages loanwords preserve the position of stress due to perceptual salience, or in OT terms due to IDENTSTRESS. In this approach, foot structure does not play a role in the determination of whether the stress will be lexical or not. We agree that perceptual salience is a factor in the placement of stress in **simplex nouns**. Hebrew speakers always preserve the position of the stress of the donor language. If the stress is not final, its placement will serve as a phonological cue for lexical stress; however, our argument relates to loanwords with final stress, **in which the place of the stress is not a phonological cue**. Once a noun with final stress enters the language, it will preserve its final stress due to perceptual salience; however, once the simplex form entered the language and retained its final stress, perceptual salience to the donor language no longer plays a role. Once the noun becomes a lexical entry in Hebrew, it is bound by Hebrew sound pattern rules and constraints which allow

speakers to treat it as accented or unaccent when adding a native suffix. That Hebrew speakers choose to adapt these nouns as lexically specified for stress is the result of the foot structure of the **suffixed form**.

It is important to mention that in a Lexical Strata analysis of Hebrew (as in Becker 2003b), which assume that loanwords belong to a different stratum than native words, one can assume that lexical stress is part of the grammar of loanwords stratum (co-phonology), but is not a part of the phonology of native words. In this scenario, foot structure will indeed not play a role in the adaptation of loanwords but rather perceptual salience and faithfulness (IDENTSTRESS) will establish stress as always lexical.

5. Alternative approaches

A similar division was proposed by Becker (2003b), who observes that some borrowed nouns that are similar to a native word in syllable structure and vocalic pattern (*mishkal*) shift from accented to unaccented through time (*balón → balónim ~ baloním*, *salát → salátim ~ salatím*). These examples are used by Becker to support the existence of different strata in the languages. A movement of native words to the accented group is observed by Schwarzwald (1998b) (e.g. *káma ~ kamá* 'how many', *támid ~ tamíd* 'always').

Becker's (2003b) analysis provides indexed constraints for each stratum to account for their different behaviors. Mobile stress is the result of a disyllabic restriction; other stems that are not subject to size restriction exhibit fixed stress. This approach is different than the analysis given in this study in two ways: (i) we provide an account of fixed and mobile stress using one set of constraints with no strata indexation. (ii) Fixed

stress in loanwords is the result of foot structure and not size restriction. We argue that a restrictive analysis that unifies both groups and does not use different strata in one language is superior, since it captures the same generalizations using fewer assumptions.

A reviewer proposed that stress preservation in the accented group may be the result of Output-to-Output (OO) constraints. We see no need to complicate the analysis with an extra mechanism. An OO analysis between the simplex form and suffixed forms can be easily accounted for by IDENTSTRESS; however, OO constraints cannot explain non-final stress in simplex form, i.e. IDENTSTRESS is still needed even if we employ OO constraints.

6. Conclusion

The Modern Hebrew nominal system consists of two main groups, the unaccented type and the accented type. A unified trochaic analysis was proposed to account for both groups. Loanwords are always analyzed as accentual by speakers, and it was argued that the binary trochaic foot is more plausible in light of loanword adaptation and stress shift patterns.

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