Parasitic Metrification in the Modern Hebrew stress system[1]

OUTI BAT-EL

Introduction and theoretical background

This paper provides an analysis of stress in Modern Hebrew nouns. Modern Hebrew nouns are derived from various historical sources. Due to this variety of sources the lexical distinction found in the stress pattern must be underlyingly specified as there is no one set of rules which can derive all surface forms.

The analysis of Modern Hebrew nouns is based on the Metrical Grid Theory (Halle and Vergnaud 1987, and related studies). According to this theory, stress is represented by a metrical grid, which consists of several planes of headed constituents. The metrical grid is composed of lines of beats, marked with asterisks. On line 0, which is the projection of the stress-bearing elements, the beats are organized into constituents, termed feet. The head of each foot is marked by an asterisk on line 1. On line 1 the head of the feet are organized into word constituents, and the head of these constituents is marked on line 2. In both lines the constituent boundaries are marked by brackets. The syllable marked by an asterisk on the highest line is the stressed syllable in the domain.

In the course of the analysis of stress in Modern Hebrew nouns several problems arise, leading to various theoretical proposals. One proposal is that an inherent accent, which is needed to identify one stress group, is represented by a bracketed line 0 asterisk and not by a line 1 asterisk as employed in previous studies. This is compatible with another proposal, to mark extrametricality by the absence of a line 0 asterisk. These representations, and the representation of a

1. I would like to thank Bruce Hayes, Iggy Roca and the members of the audience of the 1990 workshops on Modern Hebrew (The Israeli Association for Theoretical Linguistics) and Hebrew Computational Linguistics (Ministry of Science and Technology) for productive discussion on many issues presented in this paper. I am also grateful to the anonymous reviewers of The Linguistic Review for their helpful comments and to Michele Segal for her editorial work.

The Linguistic Review 10 (1993), 189–210 0167-6318/93/0010-0189

preaccenting suffix as a bracketed line-0 asterisk suggested in Halle (1990), limit all idiosyncratic information to line 0, and I therefore propose that line 0 should be presented underlyingly, at least when idiosyncratic information must be marked.

The main proposal of this paper is Parasitic Metrification, whereby partial metrical structure, in our case inherent accent, triggers the metrification of the entire domain. This is necessary in order to formulate a unified set of stress rules for Modern Hebrew nouns, where it seems that the same suffixes preserve the structure assigned by the stress rules in accented bases but not in unaccented ones. The proposal is that one of the stress rules is only active before suffixes are attached when the base bears an inherent accent, and it is this inherent accent, which is actually partial metrical structure, that triggers the application of the stress rules.

According to the Metrical Grid Theory, there are several parameters which dictate the construction of the metrical grid. The parameters relevant for the present discussion are Size, Prominence, and Directionality (see Hayes 1991 for additional parameters). The Size parameter can be set to "unbounded", allowing any length of constituent, or to "bounded", restricting the length to binary (see Halle and Vergnaud 1987 for another type of bounded constituent). If feet are bounded, the Directionality parameter must be set for either "left to right" or "right to left" to indicate at which edge of the domain the parsing begins. Each constituent must be marked for its head, and this is done on the basis of the Prominence parameter, which can be set for either "left-headed" or "right-headed". The parameters are separately set for each plane, thus in the presence of two planes, foot and word, we need two rules of metrical constituent construction.

I claim here that it is possible that not all the parameters are set for a given rule. The assignment of secondary stress in Modern Hebrew nouns requires an additional stress rule, which is independent of the rules which assign primary stress. There is free variation in the position of secondary stress, and in order to allow the various options I suggest that not all the parameters are set for the construction of the metrical constituents of the secondary stress.

Halle and Vergnaud (1987) distinguish between cyclic and noncyclic affixes as well as cyclic and noncyclic stress rules. Cyclic affixes activate the cyclic rules while noncyclic affixes activate the noncyclic rules. In addition, noncyclic affixes respect previously assigned metrical structure, while cyclic affixes do not. This latter property of the noncyclic affixes is the main issue of Halle and Kenstowicz (1991), who argue that after the attachment of noncyclic affixes only the free unmetrified elements are parsed.

Modern Hebrew stress rules are noncyclic, while suffixes are divided into cyclic and noncyclic groups. The cyclic suffixes remove the previously assigned metrical structure but they do not activate any stress rules. Only after the attachment of all the noncyclic suffixes do the stress rules apply. As mentioned

above, one of the stress rules is activated not by the affixes but rather by the partial metrification, via Parasitic Metrification.

The paper is organized as follows: Section 1 provides the lexical distinction between plain, accented, and extrametrical stems, and claims that lexical idiosyncrasy, such as accent, should be specified on line 0. Section 2 formulates the stress rules required for Modern Hebrew nouns. In section 2.1 it is shown that the stress rules fail to predict the landing site of a stress shifted from pre-antepenultimate position. It is thus proposed that accented forms, which exhibit the shift, are subject to Parasitic Metrification, where by the partial metrification imposed by the accent triggers foot construction on the base. Section 2.2 is concerned with various types of cyclic suffixes, plain, accented, and pre-accenting. The stress rules established in section 2 can not account for secondary stress, and therefore an additional rule for foot construction is proposed in section 2.3 to assign secondary stress. The variability in secondary stress is achieved by not setting all the parameters, thus allowing several options. Section 3 discusses the stress pattern of two other nominal constructions, compounds (3.1) and numerals (3.2).

1. Lexical representation

Primary stress in Modern Hebrew nouns is distinctive. It can be seen from the (near) minimal pairs in (1) that the position of stress cannot be determined on the basis of segmental or prosodic structure.

(1)	non-final stress	final stress
	náxal 'river'	*nagár* 'carpenter'
	ʔártik 'ice-cream bar'	*nartík* 'sheath'
	tráktor 'tractor'	*prozdór* 'corridor'
	bíra 'beer'	*birá* 'capital city'
	télefon 'phone'	*ʔavirón* 'airplane'
	sabónim 'nerds' (sg. *sabón*)	*saboním* 'soaps' (sg. *sabón*)
	salátim 'salads' (sg. *salát*)	*gamadím* 'dwarfs' (sg. *gamád*)
	románim 'romances' (sg. *román*)	*yomaním* 'diaries' (sg. *yomán*)

Formatives in Modern Hebrew need to be classified into three lexically distinct stress groups. The distinction between the groups is based on the surface correlation of the position of stress in the base form and the position of stress in the corresponding suffixed form (see Rosén 1962 for similar classification).[2]

The three groups are as follows:

2. Only some suffixes, though, which will turn out to be noncyclic, can function as indicators for the classification.

a. Plain formatives: stress is ultimate in the base and ultimate in the suffixed form.
b. Extrametrical formatives: stress is penultimate in the base and ultimate in the suffixed form.
c. Accented formatives: stress remains in the same position when a suffix is added.
Some examples are given below:

(2)

a.	plain formatives		
	gamád	*gamadím*	'dwarf (sg.–pl.)'
	nagár	*nagarím*	'carpenter (sg.–pl.)'
	sabón	*saboním*	'soap (sg.–pl.)'
	tavlín	*tavliním*	'spice (sg.–pl.)'
	gál	*galím*	'wave (sg.–pl.)'
	xatúl	*xatulá*	'cat (masc.–fem.)'
	ʔolám	*ʔolamí*	'world – universal'
b.	extrametrical formatives		
	náxal	*nexalím*	'river (sg.–pl.)'
	kéter	*ktarím*	'crown (sg.–pl.)'
	délet	*dlatót*	'door (sg.–pl.)'
	néxed	*nexadím*	'grandson (sg.–pl.)'
	xóref	*xorafím*	'winter (sg.–pl.)'
	náʔar	*naʔará*	'young boy – young girl'
	xófeš	*xofší*	'freedom – free'
c.	accented formatives		
	salát	*salátim*	'salad (sg.–pl.)'
	méter	*métrim*	'meter (sg.–pl.)'
	tíras	*tírasim*	'corn (sg.–pl.)'
	sabón	*sabónim*	'nerd (sg.–pl.)'
	xamsín	*xamsínim*	'hot weather (sg.–pl.)'
	gáz	*gázim*	'gas (sg.–pl.)'
	profésor	*profésorit*	'professor (masc.–fem.)'

Examination of the data above reveals that both *salát* (2c) and *gamád* (2a) bear final stress, yet they do not belong to the same stress group. When the plural suffix *-im* is added, stress remains in the same position in the former, *salátim*, while it surfaces on the final syllable in the later, *gamadím*. The same distinction is found between *méter* (2c) and *kéter* (2b), which bear penultimate stress. In the former stress remains in the same position when the plural suffix is added, *métrim*, while in the later it shifts to the suffix, *ktarím*.[3] Notice also that *salát*

3. Vowel deletion in *kéter–ktarím* cannot be viewed as the trigger of the stress shift since in *xóref–xoraflm* (2b) the vowel is not deleted, yet the stress shifts.

and *méter* belong to the same stress group (2c) despite their surface dissimilarity, because they display identical behavior in the formation of the plural form.

Every theory of stress which employs the grid (the Pure Grid Theory (Prince 1983; Selkirk 1984) and the Metrical Grid Theory (Halle and Vergnaud 1987; Hayes 1991, and others) allows for this distinction by the assignment of an inherent accent in the relevant forms; stable stress, as in *salát–salátim* and *méter –métrim* is due to the presence of an inherent accent on the stressed syllable, while mobile stress, as in *gamád–ġamadím* and *kéter–ktarím* is due to the absence of an inherent accent.

Similarly, a distinction is found between *náxal* (2b) and *nagár* (2c). In both forms stress is mobile, as evidenced by the final stress in the plural forms *nexalím* and *nagarím* respectively, and therefore the stems must be unaccented. The distinction between ultimate and penultimate mobile stress must then be obtained by marking the final syllable in *náxal* as extrametrical.[4] Extrametricality, as proposed by Hayes (1981, 1991), is indispensable in a theory of stress, and has been adopted by other prosodic and autosegmental theories (McCarthy and Prince 1986 and Itô 1989; Pulleyblank 1983). Extrametrical elements are confined to the edge of the domain, and therefore when the plural suffix is added the last syllable of the stem looses its extrametricality.

A formative must be marked as belonging to one of the stress groups in its underlying representation. The representation of the lexical marking is discussed in the rest of the section, starting with formatives with an extrametrical syllable.

Languages such as Estonian and Latin mark their extrametrical elements by a rule. Modern Hebrew, however, behaves like Spanish and Polish in this respect, since extrametricality seems to be lexically marked (see, however, Bat-El 1989 for an attempt to provide a phonological characterization for these forms). I suggest that extrametrical syllables are marked by the absence of the line 0 asterisk. This type of marking is adopted from Cohn (1989), where the fact that the Indonesian schwa does not participate in the computation of stress is marked by the absence of the line 0 asterisk.[5]

4. Nouns with an extrametrical syllable, traditionally termed "segolates", are historically derived from monosyllabic forms with a final cluster. As argued in Bat-El (1989) there is no straightforward way of accounting for cluster simplification to synchronically derive CVCVC from underlying CVCC, and therefore it must be assumed that these forms are underlyingly CVCVC. See, however, Bolozky (1978), where the synchronic analysis of Modern Hebrew segolates reflects their historical behavior.

5. Using the same notation for extrametrical and unstressable vowels could be problematic, according to an anonymous reviewers, because the Peripherality Condition (Hayes 1991: 51g) may cause unstressable vowels in non-peripheral positions to become stressable. An unstressable vowel is often a schwa (e.g., French, Indonesian, Biblical Hebrew), and a schwa, as argued in Anderson (1982), is a vowel without segmental content, and cannot therefore be an eligible stress bearing unit. The grammar could, therefore, easily prevent the overapplication of the Peripherality Condition, by stipulating that the principle stating that a stress bearing unit must

In order to be able to mark the absence of the line 0 asterisk for the extrametrical syllable, it would be necessary to mark the presence of the line 0 asterisks for the other syllables. It is thus postulated that line 0 is provided underlyingly and not assigned by a rule as suggested in Halle and Vergnaud (1987).

Another reason in favor of accepting that line 0 is present underlyingly is the accent. In studies presented so far (Kiparsky and Halle 1977; Kiparsky 1982b; Halle and Vergnaud 1987; Steriade 1988; and others) the accent has been marked by an asterisk on line 1. Consequently, if line 0 has then to be assigned by a rule, it has to slide under line 1. This seems to contravene the basic principle of constructing the grid by building each line on top of the previous line (see Halle and Vergnaud's 1987 section 1.3 on grids).

The Metrical Grid Theory accepted to date allows marking of lexical information on line 1 (e.g., accent) and line 0 (e.g., preaccenting suffixes; see below). A theory that allows the assignment of idiosyncratic metrical structure on more than one line seems to be too powerful. It is thus proposed to restrict any idiosyncratic metrical structure to one line only, and for the reasons outlined above, it should be line 0. Thus, whenever there is idiosyncratic information line 0 must be present in the underlying representation.

It is thus necessary to establish a way of representing accent on line 0. This could be done by employing a bracket. This type of marking has been used in Halle (1990) to assign idiosyncratic stress to heavy syllables in Cairene Arabic, and in Halle and Kenstowicz (1991) to mark preaccenting suffixes in Turkish. In the stress system of Turkish feet are binary right-headed, and if a preaccenting suffix is marked with an opening bracket ([*) the asterisk that precedes the bracket (and also the asterisk on the right of the marked one) must then be the head of its foot. In a system based on these parameter settings, an asterisk with a closing bracket (*]) would ensure that this particular asterisk is the head of its foot, exactly what is indicated by an inherent accent. This type of notation allows the following options:

(3)

	accented	pre-/postaccenting
binary right-headed feet	*]	[*
binary left-headed feet	[*	*]

Assuming the above notations for accent and extrametricality, the lexical representation of the three stress groups in Modern Hebrew is as follows.

---

have segmental content overrides the Peripherality Condition. The same notation can be then maintained for extrametrical and unstressable vowels, as it reflects the fact that they are both ignored by stress rules.

(4)	plain	extrametrical	accented	
	ʔavirón	*náxal*	*télefon*	
	* * *	* -	*] * *	L0
	ʔa vi ron	na xal	te le fon	

In plain formatives the number of asterisks on line 0 corresponds to the number of syllables (Modern Hebrew phonology does not seem to be sensitive to weight contrast). In extrametrical formatives there is no asterisk over the final syllable (marked -). In accented formatives the asterisk over the accented syllable is accompanied by a closing bracket.

2. Metrical constituent construction

The location of word stress in Modern Hebrew is governed by the following principle:

(5) Stress the rightmost accented syllable or, in the absence of an accented syllable, stress the rightmost syllable.

Within the Metrical Grid Theory this principle can be formally represented by the following set of rules:

(6) a. On line 0 construct unbounded right-headed constituents and assign line 1 asterisks to the heads.
b. On line 1 construct an unbounded left-headed constituent and assign a line 2 asterisk to the head.

The fact that words with suffixes are treated exactly like words without suffixes may suggest that the suffixes are cyclic. Halle and Vergnaud (1987) propose that cyclic affixes are subject to the Stress Erasure Convention, which removes previously assigned stress. Thus when a cyclic suffix is added the base is free of metrical structure.

A problem arises with accented forms. If cyclic suffixes remove previously assigned metrical structure, we would expect them to remove inherent accent as well. This, however, is not the case; inherent accent is preserved in suffixed forms. Consider the accented formative *salát* versus the plain formative *gamád*. After the application of the rules in (6) the metrical structure of the two forms is identical. Therefore, as it is not possible for the Stress Erasure Convention to distinguish between the two, we would not expect to find the difference evidenced in the stress patterns of the respective plural forms *salátim* and *gamadím*.

It is thus claimed that the stress rules in (6) must be noncyclic, and as such they apply to the entire word after the addition of suffixes. Some suffixes are

cyclic, and others are not. The cyclic suffixes are subject to the Stress Erasure Convention but they do not activate the stress rules since the stress rules are noncyclic. The rest of this section is concerned with the noncyclic suffixes only; the behavior of cyclic suffixes will be discussed in section 2.2 below.

The application of the stress rules in (6) on forms with the noncyclic suffix *-im* 'plural' and one non-suffixed forms is given below (UR stands for underlying representation. Underlying brackets are represented by square brackets, and rule-derived brackets by round brackets):

(7)

plain stem			extrametrical stem			accented stem			
gamád	*gamadím*		*náxal*	*nexalím*		*salát*	*salátim*		
* *	* * *		* -	* * *		* *]	* *] *		UR
ga mad	ga ma dim		na xal	ne xa lim		sa lat	sa la tim		
*	*		*	*		*	*		L2
(*)	(*)		(*)	(*)		(*)	(* *)		L1
(* *)	(* * *)		(*) -	(* * *)		(* *]	(* *](*)		L0
ga mad	ga ma dim		na xal	ne xa lim		sa lat	sa la tim		

Notice that in order to preserve the stress on the accented syllable in *salátim* line 1 constituents must be left-headed (6b). Similarly, in order to obtain final stress in the other forms, line 0 constituents must be right-headed (6a). The extrametrical syllable of *náxal* loses its extrametricality in *nexalím*, since it is not any longer at the edge of the stress domain. I assume an automatic assignment of the line 0 asterisk for syllables which lose their extrametricality.

In the discussion so far I have established the lexical representation of the three groups of nouns and provided the stress rules. I claimed that line 0 asterisks are underlyingly assigned, not only to provide the available structure on which to mark lexical extrametricality (which would otherwise need to be marked in some *ad hoc* fashion), but also to facilitate the representation of accent as a bracketed line 0 asterisk. As will be shown in section 2.1 the later representation is crucial for the present discussion since the line 0 bracket triggers the metrification of the entire line.

2.1. *Stress Shift and Parasitic Metrification*

As can be seen from data in (8) below, when a suffix attaches to forms with an antepenult accent, stress shifts two syllables to the right.[6]

6. For some lexically marked forms Stress Shift is optional (*?ótobusim–?otobúsim* 'buses') and for others it is inapplicable (*mínibusim–*minibúsim* 'minibuses'). It varies among speakers, but no speaker consistently applies or does not apply Stress Shift.

(8)

télefon	'phone'	*telefónim*	'phones'
ʔótobus	'bus'	*ʔotobúsim*	'buses'
ʔálkohol	'alcohol'	*ʔalkohólit*	'alcoholic (fem.)'

Since feet are unbounded, the metrical structure of the complex forms in (8), presented in (9) below, does not distinguish between the penultimate and antepenultimate syllables, and therefore cannot explain why the landing site of the shifted stress is always the penultimate syllable.

(9)

	*	L2
	(* *)	L1
*] * * *	(*](* * *)	L0
te le fo nim	te le fo nim	
UR	Stress (6)	

The metrical structure on the left side in (10), however, can predict the landing site of the shifted stress, whereby the line 2 asterisk shifts to the next available asterisk on line 1.

(10)

*		*	L2
(* * *)		(* * *)	L1
(*](* *) (*)	— Stress Shift →	(*](* *) (*)	L0
te le fo nim		te le fo nim	

The metrical structure in (10) could be obtained by modifying the stress rules in (6), but none of the possible modifications are suitable for the rest of the data. Right to left binary foot construction, which is preserved when the noncyclic suffixes are added, could be assume, but then *ʔavirón* would have been assigned initial stress, as word constituents are left-headed (11b). Similarly, a right-headed word constituent could be postulated, but this would wrongly assign final stress in *télefon* (11c).

(11)

	foot: binary right-headed word: unbounded left-headed		foot: binary right-headed word: unbounded right-headed	
a.	*télefon*	b. **ʔáviron*	c. **telefón*	d. **ʔavirón*
	*	*	*	*
	(* *)	(* *)	(* *)	(* *)
	(*](* *)	(*) (* *)	(*](* *)	(*) (* *)
	te le fon	ʔa vi ron	te le fon	ʔa vi ron

Another option would be to stipulate that the stress rules are cyclic, and that metrical structure assigned on an earlier cycle is respected by the plural suffix. The problem with this solution is that in complex plain forms stress would

surface on the last syllable of the stem, i.e., *gamadím* would surface as **gamádim*.

The explanation for the invariable landing site of the shifted stress, which at the same time accounts for the stress contour in all other forms, is Parasitic Metrification, whereby accent triggers foot construction.

(12) Parasitic Metrification

Partial metrification on line n triggers metrification of the entire domain on line n.

I proposed in section 1 above that accent is underlyingly represented by a closing boundary; this means that accented stems are partially metrified on line 0, and therefore Parasitic Metrification (12) triggers foot construction (6a). Since Parasitic Metrification is accomplished by a stress rule of the language and the stress rules are noncyclic, it must take place in the noncyclic block. Unlike the regular application of the stress rules, a stress rule triggered by Parasitic Metrification applies prior to suffixation, otherwise its effect would not be distinct from that of the regular application of the stress rules. When a noncyclic suffix is added the metrical structure on the base is preserved and, as claimed in Steriade (1988) and in Halle and Kenstowicz (1991), only the unparsed asterisks are subject to metrification.

Thus, when the plural suffix *-im* attaches to *télefon*, line 0 of the base is already metrified. After suffixation the stress rules apply, providing the appropriate environment for Stress Shift.

(13)

			*	*	L2
	* *	* *	(* * *)	(* * *)	L1
*] * *	(*](* *)	(*](* *) *	(*](* *) (*)	(*](* *) (*)	L0
te le fon	te le fon	te le fo nim	te le fo nim	te le fo nim	
UR	Parametric Metrification	Suffixation	Stress rules	Stress Shift	

As can be seen from (13), a line 2 asterisk which is the left head of a constituent of at least three elements moves a position above the next available line 1 asterisk. This can be simply formulated as follows:

(14) Stress Shift

*	*	L2
(* * *) ⟶	(* * *)	L1

(15)

			*	L2
	* *	* *	(* * *)	L1
*] *	(*)(*)	(*)(*) *	(*)(*)(*)	L0
ti ras	ti ras	ti ra sim	ti ra sim	
UR	Parasitic Metrification	Suffixation	Stress rules	

After the application of the stress rules in (15) the structural description of Stress Shift is met, yet, the rule does not apply as the form is *tírasim* and never **tirásim*.

I claim that the inapplicability of Stress Shift in (15) is due to the clash. A clash is defined in Prince (1983) as two adjacent asterisks on line n with no intervening asterisk on line n-1. It is thus proposed that a Destressing rule deletes the medial line 1 asterisks in *tírasim*. This rule resolves the clash and at the same time blocks the application of Stress Shift, as desired.

Notice, however, that after the application of the stress rules in *telefónim* (13) there is also a clash, and although deletion of the final line 1 asterisk will indeed resolve the clash it will, at the same time, incorrectly block the application of Stress Shift. To accommodate this discrepancy the following rule ordering must be stipulated: Stress, Stress Shift, and then Destressing, where Stress Shift and Destressing apply in that order whenever their structural description is met (see, however, the discussion on compounds in section 3.1, where Destressing does not apply). This is represented in (16) overleaf.

After Parasitic Metrification the structural description of Stress Shift is not met in *tíras* or *télefon*. Destressing then deletes the head of the second foot only in *tíras*, as there is no clash in *télefon*. As argued in Halle and Kenstowicz (1991), the deletion of the head triggers the deletion of the brackets of its constituent, similar to the parasitic delinking of a syllable when its vowel is deleted (Hayes 1989). Thus, when the plural suffix is added, the stress rules construct one binary unbounded foot over the free asterisks in *tírasim*, which are then metrified to a binary word constituent. This type of word constituent is not affected by Stress Shift since it includes only two asterisks. In *telefónim*, however, the only free asterisk is that of the suffix, over which a degenerate foot is built. Stress Shift first applies and only then does Destressing eliminate the clash.[7]

Destressing can be then formulated as depicted in (17).

7. I assume that unmetrified asterisks which stay as such until the end of the derivation are adjoined to the metrical structure of the word by the universal convention of Stray Syllable Adjunctive, proposed in Hayes (1981) for the the adjunction of extrametrical syllables. Stray Syllable Adjunction is triggered by the Prosodic Licensing (Itô 1986) which requires that phonological units must be dominated by a higher prosodic structure, i.e., syllables must be dominated by feet.

(16)

tírasim	*telefónim*	
*] * ti ras	*] * * te le fon	UR
* * (*](*) ti ras	* * (*](* *) te le fon	Parasitic Metrification
* (*] * ti ras	—	Destressing
* (*] * * ti ra sim	* * (*](* *) * te le fo nim	Suffixation
* (* *) (*](* *) ti ra sim	* (* * *) (*](* *) (*) te le fo nim	Stress rules
—	* (* * *) (*](* *) (*) te le fo nim	Stress Shift
—	* (* *) (*](* *) * te le fo nim	Destressing

(17) $* \rightarrow \emptyset \,/\, \begin{matrix} * \\ * \; * \end{matrix} \_\_$

Prince (1983) and Cohn (1989) show that there are two ways to guarantee a clash-free output, either by a Destressing rule or by a Clash Avoidance principle that governs the assignment of asterisks. The fact that Destressing must be ordered with respect to other rules and that it has lexically marked exceptions (see below) suggests that in Modern Hebrew clash is indeed resolved by a rule. It will however be shown in section 2.3 that the Clash Avoidance principle governs the assignment of secondary stress.

There are two accented forms which display an unexpected stress shift. One is *dolárim*, the plural form of *dólar* 'dollar', where main stress shifts to the

penultimate syllable (cf. the regular form *tíras – tírasim*). I postulate that this form is marked as an exception to Destressing, and as such, its metrical structure of three degenerate feet meets the structural description of Stress Shift.

(18)

			*	*	L2
	* *		(* * *)	(* * *)	L1
*] *	(*](*)		(*](*)(*)	(*](*)(*)	L0
do lar	do lar	—	do la rim	do la rim	
UR	Parasitic Metrification	Destressing	Suffixation and Stress Rules	Stress Shift	

The second form with an unexpected stress pattern is *ʔuniversitaʔót*, the plural form of *ʔunivérsita* 'university', which analogously to *télefon–telefónim* should have been *ʔuniversitáʔot*. Assuming that the suffix *-ʔot* is the irregular allomorph of *-ot*, it should, according to Kiparsky (1982a), be a level 1 suffix. In section 2.2 below it is shown that in Modern Hebrew level 1 suffixes are cyclic, so it follows that *-ʔot* is a cyclic suffix, and as such it removes previously assigned metrical structure. Thus, the final stress in *ʔuniversitaʔót* does not result from Stress Shift but rather from the application of the stress rules to the unmetrified form. This account is supported by the fact that while Stress Shift allows in most cases free variation (see note 5), the position of stress in *ʔuniversitaʔót* is invariable, and therefore cannot be attributed to Stress Shift.

There is another possible plural form for *ʔunivérsita* and that is *ʔunivérsitot*, where the regular plural suffix is added. I assume that the final stem vowel in *ʔunivérsita* is extrametrical (this assumption is compatible with the account given above for *ʔuniversitaʔót*).[8] Destressing deletes the head of the foot built over the penultimate syllable, and therefore, after the plural suffix is added there are three free asterisks on line 0. The final stem vowel is then deleted by a regular rule of the language (see Bat-El 1989), leaving a binary foot over the right edge of the word. As there are only two feet over the entire plural form, the structural description of Stress Shift is not met.

8. There is a good reason to assume that final stem vowels in Modern Hebrew nouns are extrametrical. Nouns which are formed from acronyms bear penultimate stress if they resemble a segolate form, otherwise stress is final. If, however, the form ends in a vowel, stress is usually penultimate.

(19)

* * *] * -	* * (* * *] (*) -	* (* * *] * -
ʔu ni ver si ta	ʔu ni ver si ta	ʔu ni ver si ta
UR	Parasitic Metrification	Destressing

* (* *)	* (* *)
(* * *] (* * *)	(* * *] (* *)
ʔu ni ver si ta ot	ʔu ni ver si tot
Suffixation and Stress Rules	Vowel Deletion

To conclude this section, the landing site of Stress Shift could not have been predicted without Parasitic Metrification, which, by triggering foot construction in partially metrified forms (i.e., accented) establishes the environment for Stress Shift.[9]

2.2. *Cyclic suffixes*

2.2.1. *Plain suffixes.* There are several suffixes in Modern Hebrew, like *-an* 'Agent', which do not respect the lexically marked accent. Such suffixes, according to Halle and Vergnaud (1987), must be cyclic as they trigger the Stress Erasure Convention. Cyclic suffixes always precede the noncyclic ones, and therefore it is possible that this distinction also correlates with level 1 (cyclic) versus level 2 (noncyclic) of the lexical morphology of Modern Hebrew (though Halle and Vergnaud do not maintain the level ordering proposal outlined in Kiparsky (1982a) and subsequent work in Lexical Phonology).

The stress rules proposed in (6) above are noncyclic. Thus, in level 1, when the cyclic suffixes are attached the partial metrical structure imposed by the inherent accent is erased, but the stress rules are not activated. In level 2, Parasitic Metrification triggers foot construction, and thus, after suffixation the stress rules apply only once as they are noncyclic.[10]

9. Within the Pure Grid Theory (Prince 1983) the environment for Stress Shift could be obtained by the prior application of Perfect Grid (see Bat-El 1991). This theory, however, has been recently abandoned in favor of the Metrical Grid Theory.

10. An anonymous reviewer pointed out that there is no work within the Halle and Vergnaud framework which mentions a language with cyclic affixes but no cyclic rules. Nonetheless, there is nothing in the theory which does not allow such a system.

(20)	*tráktor*	*traktorán*	*tráktorim*	*traktoraním*
UR:				
	*] *	*] *	*] *	*] *
	trak tor	trak tor	trak tor	trak tor
Level 1 (cyclic)				
Suffixation		* * *		* * *
and SEC	___	traktor+an	___	traktor+an
Level 2 (noncyclic)				
Parasitic	* *		* *	
Metrification	(*] (*)	___	(*] (*)	___
	trak tor		trak tor	
Destressing	*		*	
	(*] *	___	(*] *	
	trak tor		trak tor	___
Suffixation			*	
			(*] * *	* * * *
	___	___	traktor+im	traktoran+im
Stress	*	*	*	*
	(*)	(*)	(* *)	(*)
	(*] *	(* * *)	(*] (* *)	(* * * *)
	trak tor	trak to ran	trak to rim	trak to ra nim

2.2.2. *Accented suffixes*. Some cyclic suffixes are accented, such as *-ist* 'Agent'. When an accented suffix is attached to an accented base, stress surfaces on the rightmost accent. When a noncyclic suffix is then added, stress remains on the rightmost accented syllable, that is, on the accented suffix.

(21) *tráktor* 'tractor' *traktoríst* 'tractor driver' *traktorístim* (pl.)
télefon 'phone' *telefoníst* 'phone operator (masc.)' *telefonístim* (pl.)
telefonístit 'phone operator (fem.)' *telefonístiyot* (pl.)

Since the accented suffixes are cyclic they do not respect the partial metrical structure assigned by the accent, but are themselves accompanied by a closing bracket.[11]

11. Segmental phonology: *telefonist+it+ot* →t-Deletion→ *telefonistiot* →y-Insertion→ *telefonistiyot* (see Bat-El 1989).

(22)

	traktorist	*traktoristim*	*telefonistiyot*
UR:	*] *	*] *	*] * *
	trak tor	trak tor	te le fon
Level 1 (cyclic) Suffixation and SEC	* * *]	* * *]	* * * *]
	traktor+ist	traktor+ist	telefon+ist
Level 2 (noncyclic) Parasitic Metrification	* (* * *]	* (* * *]	* (* * * *]
	trak to rist	trak to rist	te le fo nist
Suffixation	—	* (* * *] * traktor+ist+im	* (* * * *] * * telefonist+it+ot
Stress	* (*) (* * *]	* (* *) (* * *] (*)	* (* *) (* * * *] (* *)
	trak to rist	trak to ris tim	te le fo nis ti tot

2.2.3. *Preaccenting suffixes.* There are two preaccenting suffixes in Modern Hebrew, *-čik* 'diminutive', which is relatively rare, and *-nik* 'agent' which is quite productive. This type of suffix induces a stress on the preceding syllable, regardless of the number of syllables that follow it.

(23)

kibúcnik	'a person (masc.) from a kibbutz'
kibúcnikim	'persons (masc.) from a kibbutz'
kibúcnikit	'a person (fem.) from a kibbutz'
kibúcnikiyot	'persons (fem.) from a kibbutz'

Notice that *kibúc* is not accented as its plural form is *kibucím* and not **kibúcim*.

Following Halle and Kenstowicz (1991) preaccenting suffixes are marked with a bracketed accent ([*). Feet in Modern Hebrew are right-headed, and therefore an opening bracket next to the asterisk of the suffix will ensure that the asterisk on the syllable that precedes it will be the head of its constituent. The left-

headed foot construction will in turn ensure that that syllable will be the stressed syllable.[12]

(24)

	*		*
	(* *)		(* *)
* * [* *	(* *) [* *)	* * [* * *	(* *) [* * *)
ki buc ni kim	ki buc ni kim	ki buc ni ki yot	ki buc ni ki yot
UR	Stress rules	UR	Stress rules

Notice that in *kibúcnikiyot* the stress is four syllables away from the right edge of the word (as in *telefónin* before Stress Shift) yet it does not shift. This is because the structural description of Stress Shift, which requires three asterisks in the word constituent, is not met.

There are no forms where a preaccenting suffix is attached to an accented base and therefore it cannot be determined whether the preaccenting suffixes are cyclic or not. According to the level ordering morphology of Modern Hebrew, however, it is likely that preaccenting suffixes would be cyclic. The prediction (and the native speaker's intuition) is that if we add *-nik* to *tráktor* we will get *traktórnik* and not *tráktornik*, which indicates that the Stress Erasure Convention is activated by the suffix.

2.3. *Secondary stress*

The rules of metrical constituent construction given in (6) properly derive primary stress in Modern Hebrew nouns, but fail to assign secondary stress. Since feet are unbounded, secondary stress is not marked in plain forms. In accented forms, where Parasitic Metrification applies, secondary stress would surface as follows:

(25) *télefòn, tèlefónim, mínibùs, mínibùsim, tírasìm*

Apparently, judgements about secondary stress vary among speakers, and there are many speakers who fail to identify secondary stress at all. The forms below reflect the variability found in the language (see, however, Bolozky 1982 and Bat-El 1991).

(26) *gamadón, gàmadón,* 'little dwarf'
gamadoním, gamàdoním, gàmadoním, 'little dwarfs'
hagamadoním, hàgamàdoním, hagàmadoním 'the little dwarfs'

12. Stress assignment in (24) involves Parasitic Metrification, but due to Destressing it does not affect the stress pattern.

I follow Kadmon's (1986) proposal of free assignment of secondary stress. Within the Pure Grid Theory adopted in Kadmon, secondary stress is optionally assigned by adding asterisks on level 1. The only principle that governs the assignment of secondary stress is Clash Avoidance.

Within the Metrical Grid framework, stress must be represented by metrical constituents, and therefore secondary stress must be assigned by a rule of foot construction. The properties of the rule which assigns secondary stress in Modern Hebrew are as follows: (i) The rule is noncyclic, thus respects previously assigned metrical structure, that is, main stress. (ii) The rule must be optional in order to allow for the option with no secondary stress. (iii) To account for the variability in the position of secondary stress, the only parameter set for the rule is that the feet are binary; Directionality and Prominence are not specified. In the absence of values for these parameters several options are available.

(27)			
Left to right, right-headed	1. *hagàmadoním*	5. *gamàdoním*
left-headed	2. *hàgamàdoním*	6. *gàmadoním*
Right to left, right-headed	3. (= 2)	7. (= 5)
left-headed	4. (= 1)	8. (= 6)

The parameter setting, although free, is governed by the Clash Avoidance principle. Thus, in *kibúcnikìyot*, for example, the only possible option for secondary stress foot construction is based on the settings "left to right" and "right-headed", which would yield *kibúcnikìyot* ; any other option would yield a clash.

I assume that the line 1 asterisks assigned in accented forms by the stress rules in (6), including Parasitic Metrification, is removed by Conflation, prior to secondary stress assignment. Conflation, as proposed in Halle and Vergnaud (1987), removes line 1 asterisks which do not have line 2 asterisk above them, and thus eliminates all but the main stress in the word. This allows a form like *mínibusim* to appear without secondary stress, or, if secondary stress is assigned, with secondary stress on the penultimate syllable, *mínibùsim*. I suspect that secondary stress treats a final unstressed syllable as extrametrical since *mínibusìm* does not seem to be a possible form.

3. Stress in other nominal constructions

3.1. *Compound stress*

Most Modern Hebrew compounds are composed of two nouns of which the first is the head. In compounds the main stress of the rightmost element is the main stress of the compound, and secondary stress falls on the main stress of the first element.

(28)

kélev 'dog' + *rexóv* 'street'	→	*kèlev rexóv*	'street dog'
koxáv 'star' + *caméret* 'top'	→	*koxàv caméret*	'superstar'
gán 'garden' + *šošaním* 'roses'	→	*gàn šošaním*	'rose garden'
medinát 'state' + *yisra?él* 'Israel'	→	*medinàt yisra?él*	'the State of Israel'

It is therefore necessary to add a line in the metrical grid to assign stress in compounds. The rule responsible for stress in compounds is as follows:

(29) On line 2 construct an unbounded right-headed constituent and assign a line 3 asterisk to the head.

This rule applies after the stress rules in (6) have assigned main stress to each member of the compound separately. The application of the rules is illustrated below:

(30) *medinàt yisra?él*

	*	L3 (compound)
(*	*)	L2 (w ord)
(*)	(*)	L1 (f oot)
(* * *)	(* * *)	L0
me di nat	yis ra ?el	

With regard to Clash Avoidance, it should be noted that clash is acceptable when the first member of the compound bears final stress, and the second member of the compound bears initial stress.

(31)

taxanàt ?ótobus 'bus stop'		*tarmìl gáv* 'backpak'	
*		*	L3
(* *)		(* *)	L2
(*)	(* *)	(*) (*)	L1
(* * *)	(*)(* *)	(* *) (*)	L0
ta xa nat	?o to bus	tar mil gav	

This suggests that Destressing does not reapply after compounding, and that the Clash Avoidance affects rule application (secondary stress) but not representations.

3.2. *Numerals*

Modern Hebrew numerals from eleven to nineteen appear to be composed of number-plus-ten-plus-*e*, with some segmental alternation which will not concern us here. For instance, in *?exádesre* 'eleven' we find *?exád* 'one', *?éser* 'ten', and a residual segment *e*. The stress pattern of the numerals is given below (after a

consonant ʔ appears only in very slow speech; after a vowel ʔ can appear also in casual speech):

(32)

1	*ʔexád*	11	*ʔexádesre*	6	*šéš*	16	*šéšesre*
2	*štáim*	12	*štémesre*	7	*šéva*	17	*šváʔesre*
3	*šalóš*	13	*šlóšesre*	8	*šmóne*	18	*šmonáʔesre*
4	*ʔárba*	14	*ʔarbáʔesre*	9	*téša*	19	*tšáʔesre*
5	*xaméš*	15	*xamésesre*				

Non-final stress in the simple forms is due to extrametricality; as will be shown in (34) below, when a plural suffix is added in order to form the numerals twenty, thirty etc. stress is final.

The numerals eleven, twelve, and so on, cannot be treated as compounds, in spite of the fact that they are apparently composed of two stems, since it is the first element, rather than the second, which bears the main stress. Moreover, as can be seen from 'fourteen' and 'eighteen', the position of main stress in the complex form is not necessarily identical to that in the simple form; primary stress is always antepenultimate in the complex form regardless of the position of stress in the simple form.

I suggest that the numerals from eleven to nineteen are not in fact compounds, but rather stems with the preaccenting suffix *-esre*.[13] Preaccenting suffixes, as proposed in section 2.2.3, are marked by an opening bracket on line 0. The syllable that precedes the suffix must then be the head of its foot, and since the word constituent is left-headed this syllable bears main stress.

(33) *xamésesre*

	*
	(* *)
* * [* *	(* *) [* *)
xa me šes re	xa me šes re
UR	Stress

The numerals twenty, forty, and so on are formed by adding the plural suffix *-im*. Stress is always final in these numerals, which indicates that none of the stems is accented.

(34)

10	*ʔéser*	20	*ʔesrím*
3	*šalóš*	30	*šloším*
4	*ʔárba*	40	*ʔarbaʔím*
5	*xaméš*	50	*xamiším*
9	*téša*	90	*tišʔím*

13. The status of the suffix *-esre* is similar to that of English *-land* in *Iceland* and *Greenland*. Both instances show that an independent formative may have a bound formative as a lexical variant.

Numerals beyond twenty are phrasal, as can be seen from *ʔesrím veʔexád* 'twenty one (twenty and one)' and *xamiším vetéša* 'fifty nine (fifty and nine)'.

The stress pattern in numerals reflects the fact that no group of numerals is formed by compounding. The numerals which could be suspected of being compounds (eleven to nineteen) are actually simple words whose suffix is preaccenting.

4. Conclusion

In this article I have offered an analysis of word stress in Modern Hebrew nouns. The main theoretical proposal in this paper is the requirement for Parasitic Metrification. Any metrical theory of stress that does not allow a language to select Parasitic Metrification fails to account for the stress pattern in plain and accented forms while at the same time predicting the landing site of the Stress Shift. Parasitic Metrification, which constructs feet over accented stems, is able to provide the appropriate structural description for the Stress Shift without intervening with the regular application of the stress rules.

Another suggestion offered is that it is possible for a language to choose not to set some of its parameters. I have demonstrated this, presenting an account for the variability of secondary stress. I have proposed that some of the parameters of the rule assigning secondary stress are not set, as the position of secondary stress can be anywhere as long as there is no clash. This allows for the various options found in the language.

These proposals are necessary to provide a unified account for the stress pattern in all Modern Hebrew noun, and therefore must be incorporated into the Metrical Grid Theory, as an option available for selection by a language.

Received 3 November 1992
Revised version
received 8 April 1993

Department of Linguistics
Tel-Aviv University

References

Anderson, Stephen (1982). The analysis of French shwa: Or, how to get something for nothing. *Language* 58: 534–573.

Bat-El, Outi (1989). Phonology and word structure in Modern Hebrew. Unpublished Ph.D. dissertation, University of California, Los Angeles.

—(1991). Word Stress in Modern Hebrew Nouns. Unpublished manuscript, Tel-Aviv University.

Bolozky, Shmuel (1978). Some aspects of Modern Hebrew phonology. In *Modern Hebrew Structure*, Robert A. Berman (ed.), 11–67. Tel-Aviv: Universities Publishing Projects.

—(1982). Remarks on rhythmic stress in Modern Hebrew. *Journal of Linguistics* 18: 275–289.

Cohn, Abigail (1989). Stress in Indonesian and Bracketing Paradox. *Natural Language and Linguistic Theory* 7: 167–216.

Halle, Morris (1990). Respecting metrical structure. *Natural Language and Linguistic Theory* 8: 149–176.

Halle, Morris and Michael Kenstowicz (1991). The Free Element Condition and cyclic versus noncyclic stress. *Linguistic Inquiry* 22: 457–501.

Halle, Morris and Jean-Roger Vergnaud (1987). *An Essay on Stress*. Cambridge, MA: MIT Press.

Hayes, Bruce (1981). A metrical theory of stress rules. Unpublished Ph.D. dissertation, Massachusetts Institute of Technology, Cambridge.

—— (1989). Compensatory lengthening in moraic phonology. *Linguistic Inquiry* 20: 253–306.

—— (1991). Metrical stress theory: Principles and case studies. Unpublished manuscript, University of California, Los Angeles.

Itô, Junko (1986). Syllable theory in prosodic phonology. Unpublished Ph.D. dissertation, University of Massachusetts, Amherst.

—— (1989). A prosodic theory of epenthesis. *Natural Language and Linguistic Theory* 7: 217–259.

Kadmon, Nirit (1986). Vowel deletion and nonprimary stress in Modern Hebrew. In *UMass Occasional Papers* 10, David Lebeaux and Armin Mester (eds.), 1–22. Amherst: Graduate Linguistics Student Association, department of Linguistics, University of Massachusetts.

Kiparsky, Paul (1982a). From cyclic to lexical phonology. In *The Structure of Phonological Representations*. Part I, Harry van der Hulst and Norval Smith (eds.), 131–175. Dordrecht: Foris.

—— (1982b). The lexical phonology of vedic accent. Unpublished manuscript, Massachusetts Institute of Technology, Cambridge.

Kiparsky, Paul and Morris Halle (1977). Towards a reconstruction of the Indo-European accent. In *Studies in Stress and Accent*, Larry M. Hyman (ed.), 209–238. Los Angeles: Southern California Occasional Papers in Linguistics 4. Department of Linguistics, University of Southern California, Los Angeles.

McCarthy, John and Alan Prince (1986). Prosodic Morphology. Unpublished manuscript, University of Massachusetts, Amherst and Brandeis University, Waltham, MA.

Prince, Alan (1983). Relating to the grid. *Linguistic Inquiry* 14: 19–100.

Pulleyblank, Douglas (1983). Tone in lexical phonology. Unpublished Ph.D. dissertation, Massachusetts Institute of Technology, Cambridge MA.

Rosén, Haiim (1962). *Contemporary Hebrew*. The Hague: Mouton.

Selkirk, Elisabeth (1984). *Phonology and Syntax: The Relation between Sound and Structure*. Cambridge, MA: MIT Press.

Steriade, Donca (1988). Greek accent: A case for preserving structure. *Linguistic Inquiry* 19: 271–314.