論　文

Hebrew Verbs in Dependency Morphology

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要　旨

この論文では，現代ヘブライ語動詞の形態論を論じる。ヘブライ語は，セム語派の言語で，その語族の共通する特徴は非連成的造語法である。本文では，現代ヘブライ語動詞を依存形態論から見る。依存形態論は，過程を元にせず，部分を認めるが，表面構造を記述する学説なので，形態素ではなく，素形態を認める。ヘブライ語のような言語に関して，依存形態論は語根と接超辞を部分（素形態）と見なし，部分が依存関係でつながっているとする。本文では，現代ヘブライ語動詞の造語法に必要な接頭辞，接中辞，接超辞，接尾辞を紹介し，現代ヘブライ語動詞の分類を設ける。本文で述べる研究内容はイスラエルのテル・アビブ大学で調べたもので，愛知大学の海外研修の成果によるものである。

Keywords: dependency morphology, infix, Modern Hebrew, radical, transfix, verb
キーワード：依存形態論，現代ヘブライ語，語根，接中辞，接超辞，動詞

1　Overview

Hebrew is known as a language with non-concatenative morphology (Berman 1978, 1987; Bolozky 1978; Schwarzwald 1981; Goldenberg 1985). The current account assumes, based on a number of authors (Ornan 1983; Bat-El 1986; McCarthy 1981; McCarthy & Prince 1986; Yip 1988; Faust & Hever 2010; etc.) that roots and patterns constitute distinct meaning-bearing entities.[1)] Nevertheless, the literature rejecting the root-pattern approach is substantial (Bolozky 1978, 1999; Horvath 1981; Lederman 1982; Bat-El 1994,

2002, Ussishkin 1999, 2005; Laks 2013; etc.)[2].

Word-based accounts assume stem-modification (McCarthy & Prince 1990; Bat-El 1994) in order to account for the actual shape of the verb. Stems are viewed as being phonologically modified by co-occurring material in word-formation. This contribution will not argue against stem-modification or word-based approaches to morphology. A word-based account of the data addressed here will not be implemented because word-based morphologies deal badly with Priscianic (parasitic) formation, and they are incapable of resolving bracketing paradoxes because they are inherently constituent-based theories. A critique along these lines can be found in Groß (2014b). A brief outline of dependency morphology is provided in section 3.

In this paper, "roots" are called "radicals", and "patterns" are called "transfixes". Based on Groß (2011a, 2014b), radicals and transfixes entertain an immediate dependency relationship, the representation of which is illustrated below in example (2). The Hebrew verb system does, however, also include pre-, in-, and suffixes. These will be detailed in the following sections.

The current account concerns itself with Modern Hebrew (MH), but much of what is proposed below is also applicable to earlier stages of the language. Khan et.al. (2013) provide an overview of the history of the Hebrew language (see section 1).

2 Radicals

One property of Hebrew is its remarkable constancy through time. The main cause of this constancy is that lexical meaning is encoded in consonant groups. Lexical meaning is most often expressed by a tri-consonantal radical, called *shoresh* (pl. *shorashim*). For example, everything that has to do with (re-)counting is expressed by the *shoresh* SFR—the individual consonants appearing as capitals throughout this paper. An example follows that illustrates the ubiquity of the radical SFR:

(1)	a.	SoFeR	'[sg.m] counts'	b.	meSaPeR	'[sg.m] recounts (=tells)'
	c.	SaFuR	'counted' [part.pass.]	d.	SeFeR	'book'
	e.	SoFeR	'writer' [noun]	f.	SaFiR	'countable'
	g.	SFiRa	'count(ing)'	h.	SiPuR	'story'
	i.	SiFRut	'literature'	j.	SiFRija	'library'

k. miSPaR[3] ‘number’

Vowels interspersed with the radical SFR, the middle consonant of which can be realized as /p/, produce a wide variety of expressions. In English, many of these expressions do not share a root. For instance, *count*, *tell*, *write*, *book*, *story*, *literature*, *library*, and *number* derive from different sources. The corresponding Hebrew expressions, however, share the same root, and thus indicate the sharing of meaning. Example (1) is not an isolated one. This rather is the basic formation mechanism in Hebrew. Clearly all the expressions in (1) do have something in common not only in meaning, but also in form. Any account that views the expressions in (1) as morphologically complex, and that can represent this complexity in a piece-based fashion, is in a strong position to contribute to our understanding of the mental lexicon.

The examples (1a–d) are analyzed in the following fashion throughout the paper, whenever trees are employed. Transfixes can be recognized by the symbol ‘_’:

(2)

	_o_e_	*transfix* GER		me-	GER
	S F R	*radical* ‘count’		_a_ë_	*t* BASE
a.	SoFeR	‘[sg.m] counts’		S P R	*r* ‘count’
			b.	me-SaPeR	‘[sg.m] recounts/tells’
	_a_u_	*t* part.pass.		_e_e__	*t* NR: object
	S F R	*r* ‘count’		S F R	*r* ‘count’
c.	SaFuR	‘counted’ [part.pass.]	d.	SeFeR	‘book’

Every tree above isolates the radical (in capitals) from the transfix (marked by “_”), and other material, if present. The transfixes clearly express different meanings, and contribute differently to the meaning of the entire expression. In (2a), the transfix $\overline{o}\,\overline{e}$ expresses the gerund form. In (1e), the gerund is interpreted as agency. In (2b) the transfix expresses the base. $\overline{a}\,\overline{e}$ is one of the most common transfixes, appearing mostly, but not exclusively with prefixes. Its function is to create a base from the radical to which other material can be attached. For instance, in (2b) the prefix, rather than the transfix, expresses the gerund. In (2c) the transfix $\overline{a}\,\overline{u}$ expresses the passive participle. In (2d) the transfix $\overline{e}\,\overline{e}$ indicates that the noun is an object of an activity.

The point of the section was to briefly show that radicals express stable meanings across different transfix environments, that the transfixes express grammatical meaning

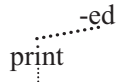
and contribute to word-formation, and that the relationship between radical and transfix can be captured in a dependency-based approach.

3　A brief introduction into dependency morphology

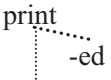
The name “dependency morphology” was first suggested by John Anderson (1980), but the honor of providing the first dependency-based morphological analyses goes to Heringer (1970: 96). The account here shares with this early dependency-based work in morphology two central assumptions: (1) that words consist of pieces, and (2) that these pieces are connected by directed relationships, i.e. dependencies.

The dependency grammar used here is a representational, monostratal, dependency-, piece-, construction-, and catena-based approach to morphology. It is representational because it eschews any form of movement. Displacement phenomena (*wh*-movement, topicalization, scrambling, extraposition, right-/left-dislocation) are analyzed as “rising”, i.e. in terms of syntactic constellations (Groß and Osborne 2009). Monostratal means that the current account acknowledges only one level of description. A tree representation contains nodes, and whether these nodes are syntactic or morphological objects, their connections are, apart from coordination structures, dependency-based. Dependency-based is any theory that views syntactic or morphological objects as being connected by a directed relationship, rather than forming constituents. In dependency syntax, syntactic objects, and the nodes in tree representations, are usually words. In morphosyntax and morphology, objects can be parts of words, known as “pieces”. For instance, the English verb *printed* consists of two pieces, i.e. *print* and *-ed*. Hence there are two possible ways to structure the expression: *print* depends on *-ed*, or vice versa.

(3)



a. print-ed



b. print-ed

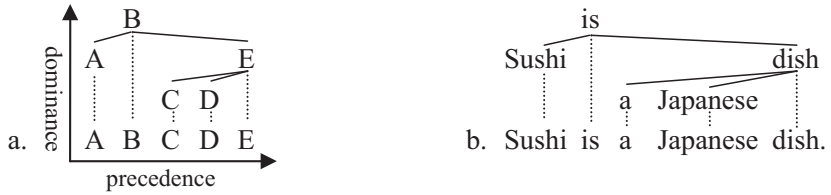
The current account views (3a) as correct, and rejects (3b) because the entire expression *printed* behaves more like a V+*ed* type expression, than a *print*+suffix type expression.

Construction-based means that the current theory views constructs (and their abstractions, i.e. constructions) as the concrete surface and meaning-bearing objects, rather than making rules responsible. Constructs are acquired, fortified by repetition,

and absorbed into memory. Abstractive abilities can generalize specific constructs into constructions.

The proposal here is also catena-based. Dependency grammar distinguishes two dimensions: (1) a horizontal dimension called "precedence", in which linear ordering takes place. Nodes that are immediate in this dimension are called *strings*. (2) The vertical dimension is called "dominance". Dependency relationships operate in this domain. Nodes that are immediate in this dimension are called *catenae*. The next tree representation illustrates these distinctions:

(4)



Tree (4a) shows the nodes A through E. Tree (4b) shows a real sentence with the same tree structure. The vertical arrow represents the vertical dimension "dominance". The horizontal arrow represents the horizontal dimension "precedence". The slanted, solid lines connecting the capitals A through E are "dependency edges". For instance, nodes A and E are dependents of node B, and nodes C and D are dependents of node E. The vertical, dotted lines are "projection edges". A node marked thusly projects a prosodic word structure. Clitics are non-projecting nodes (Groß 2014a).

In the horizontal dimension the node combinations in (5a) below qualify as strings:

(5) a. A, B, C, D, E, AB, BC, CD, DE, ABC, BCD, CDE, ABCD, BCDE, ABCDE
b. AC, AD, AE, BD, BE, CE, ABD, ABE, BCE, BDE, ABCE, ABDE

The node combinations in (5a) qualify as strings because each node in these node combinations is an immediate neighbor of at least one other node. Single nodes count as strings by default. The node combinations shown in (5b) are not strings. For instance AC is not a string because A is not immediately followed by C. Ibidem for the other node combinations in (5b).

In the vertical dimension, the node combinations in (6a) qualify as catenae, while those in (6b) fail to do so:

(6) a. A, B, C, D, E, AB, BE, CE, CD, ABE, BCE, BDE, CDE, ABCE, ABDE, BCDE, ABCDE
b. AC, AD, AE, BC, BD, CD, ABC, ABD, BCD, ABCD

Again, individual nodes count as catenae. AB is catena because B immediately dominates A. ABE is catena because B immediately dominates A and E. ABCE is a catenae because ABE is a catena, and E immediately dominates C. The node combinations in (6b) are not catenae. For instance, AC is not a catena because neither is A a dependent of C, nor vice versa. ABC is not a catena because, even though B immediately dominates A, neither A nor B immediately dominate C, nor are they immediately dominated by C. The same goes for the remaining node combinations in (6b).

The catena has been shown to be a versatile unit of syntax that can be used to explain a number of phenomena such as idiom formation, ellipsis, predicate structure, constructions, etc. (Groß and Osborne 2009; Osborne, Putnam and Groß 2011, 2012; Osborne and Groß 2012a, 2012b; Groß and Osborne 2013; Groß 2014a; Osborne 2014; etc.). The catena has also been suggested as the principal unit of morphology (Groß 2010, 2011a, 2014b). In two areas, catenae are especially useful tools: bracketing paradoxes (see Groß 2011b, 2011c, 2014b: 20) and Priscianic formation (Groß 2014b: 18–19). Their use obviates many objections coming from lexicalist quarters, i.e. processed-based morphologies. Groß (2014b: 18–21) discusses bracketing paradoxes and Priscianic formation in light of constituent-based and catena-based morphologies.

Process-based i.e. word-, lexeme-, or paradigm-based, theories of morphology point out that morpheme-based, i.e. piece-based, theories of morphology face difficulties in the areas of reduplication, transfixation, suprafixation, infixation, tmesis, etc. The proposal made here (for Modern Hebrew) shows that transfixation and infixation do not constitute an insurmountable problem for a piece-based approach.[4)]

4 Verb classification

This section cannot but stay brief, but some remarks on verb classification are necessary. MH verbs come in five major classes: Pa'al, Nif'al, Pi'el, Hif'il, and Hitpa'el. The subclasses Pu'al and Huf'al have lost their productivity, and are often expressed analytically. A verb class (or *binyan*) is defined by the type and number of transfixes that can attach to a radical. The phonological make-up of the radical can influence what type of affix must

appear. Usually, such a property transcends the major verb classes. For instance, radicals with the third radical in /i/ or /h/ mark their 3sg.f in the past tense with the suffix *-ta*, rather than the usual *-a*. The third radical, i.e. /i/ or /h/, is then absent:

(7) a. XaZR-a Pa'al
'she returned [to…]'

b. LaV-**ta** Pa'al
'she borrowed'

(8) a. he-XZiR-a Hif'il
'she returned [sth.]',

b. h-iLVe-**ta** Hif'il
'she lent'

The (a)-examples show a standard tri-consonantal radical, which receives the suffix *-a*. The (b)-examples show that the radical LV(I/H) forces the appearance suffix of the suffix *-ta*. This behavior is consistent across verb classes.

The examples above just serve as a reminder that matters are always more complicated. The issues to be addressed below remain with standard and representative cases. In that vein, the classifications provided below are necessarily rough, and the need for further refinement is acknowledged. Table 1 summarizes verb class distinctions according to transfix distribution for their most common members.

Class	Pa'al 1	Pa'al 2	Pa'al 3	Nif'al	Pi'el	Hif'il	Hitpa'el
p-				n-	me-	m-	
t	_a_	o e	a e	i_a	a e	a i	_a e
pst		a a			i e	i i	
fut	u i	o a	a	a e	a e	a i	

Table 1: Verb classes by transfix distribution

Briefly, the verb class Pa'al consists of three large subclasses. Across Pa'al, there are no prefixes (**p-**) co-occurring with the gerund. In Pa'al, the gerund is always a transfix (**t**). In Pa'al 1 verbs, the middle consonant of the radical is present only in the future tense (**fut**), and in the infinitive. The transfix *a* appears across gerund and past tense (**pst**). Future tense transfixes vary according to further subclassification. Pa'al 2 verbs have *o e* as the gerund, *a a* as the past tense, and *o* or *a* in the future tense, according to further subclassification. Nif'al, Pi'el, Hif'il, and Hitpa'el verbs all require a prefix in their gerund form. The remaining verb classes are defined by the transfixes shown in Table 1, in the same fashion.

5 Gerund

MH does not possess a non-past or present tense. Rather this grammatical property is expressed by juxtaposing a subject and a predicate:

(9) a. Hi po.
she here
'She [is] here.'

b. Hi hai-ta po.
be.pst-3sg.f
'She was here.'

(10) a. Hu ba-bait.
he loc.def-house
'He [is] at home.'

b. Hu haia ba-bait.
be.pst
'He was at home.'

The (a)-examples have in common the absences of a word that serves as a copula, thus lacking overt tense or finite markers. The (a)-examples are interpreted as present tense. The (b)-examples show that in the past tense a verb specified for tense must appear. In the continuous past tense, and in counterfactual conditionals, gerunds behave like the expressions in (9–10):

(11) Hai-ti *lomed*, keshe-jašan-tem.
was.I study, when-sleep-you.pl
'I had been studying, when you[pl] slept.'

(12) Im hai-ta *m-akšiv*, hai-ta *jodea* ma hu me-daber.
if were.you[m] listen, were.you[m] know what he talk
'If you had listened, you would know what he is talking about.'

The important words are italicized: in (11–12), the verbs *lomed* (Pa'al), *m-akšiv* (Hif'il) and *jodea* (Pa'al) are gerunds. If they were true present tense forms, one would not expect them to be able to appear together with other tensed verbs, namely *hai-ti*, and *hai-ta*.

The assumption that gerunds are not tensed verb forms is also supported by the fact that the former cannot appear with suffixes that are marked for person. Gerunds only appear with number/genus suffixes. The gerund suffixes are shown in Table 2 below:

N/G	m.sg	f.sg	m.pl	f.pl
Gerund		-a / -et	-im	-ot

Table 2: Gerund suffixes

The m.sg in Hebrew is unmarked. The f.sg requires either *-a* or *-et*, depending on the verb class, and on phonological properties of the radical. The plural forms are *-im* (pl) and *-ot* (f.pl). The former also functions as the general plural form, i.e. m+f.pl. Attachment of the plural suffixes causes the elision of /e/, if present in the transfix. In Pa'al 3 verbs, a suppletive transfix is required in the case of suffixes.

The gerund formation depends on the verb class. Pa'al verbs require transfixes, the remaining classes prefixes. The examples below demonstrate gerund formation for each verb class according to the order in Table 1:

(13) _a_ *t* GER/PST
G R *r* 'reside'
GaR 'he resides/resided'

(13) shows the Pa'al 1 verb *G(U)R* 'reside'. Members of this subclass have, for practical purposes, di-consonantal radicals. Their middle consonant is expressed as a vowel in the future tense. They appear with the transfix $\overline{a}$ in their gerund and past tense forms. They do not undergo phonological changes, i.e. *gar-a* 'she resides/resided', *gar-im* 'they reside', *gar-ot* 'they[f] reside'.

(14)

	_o_e_	*t* GER		-ot _o___	pl.f *t* GER
	K T V	*r* 'write'		K TV	*r* 'write'
a.	KoTeV	'he writes'	b.	KoTV-ot	'they[f] write'

(14a) shows the Pa'al 2 verb *KTV* 'write'. Pa'al 2 verbs are the largest class. They build the gerund with the transfix $\overline{o\,e}$. (14b) shows that the attachment of plural suffixes causes /e/ to be elided. The verb then remains bi-syllabic.

(15)

	_a_e_	*t* GER		-a _e_a_	f.sg *t* GER
	J Š N	*r* 'sleep'		J Š N	*r* 'sleep'
a.	JaŠeN	'he sleeps'	b.	JeŠaN-a	'she sleeps'

(15a) shows the Pa'al 3 verb JŠN 'sleep'. This class expresses adjectival process: e.g. *KaRoV* 'near' → *KaReV* 'come near'. (15b) shows the allomorphic transfix ¯e¯a¯ must be used when a suffix attaches.

Nif'al verbs always appear with a prefix:

(16)

	n-	spontaneity		-et n-	sg.f spontaneity
	i___a__	*t* GER/PST		i___e__	*t* GER
	DḤ M	*r* 'astonish'		DḤ M	*r* 'astonish'
a.	n-iDHaM	'he is astonished'	b.	n-iDHeM-et	'she is astonished'

The Nif'al class is difficult to capture in semantic terms. Nif'al verbs have in common that they mark a loss of control over the activity by the subject. Thus, they can express unaccusatives, (medio-)passives, and certain reflexives. If a Nif'al verb has no correspondent in Pa'al, then it is usually an unergative verb. The property of lack of control (spontaneity) is expressed by the prefix *n-*. The transfixes act as the expression of the gerund and the past tense, in conjunction with the required suffixes. Note that the attachment of f.sg *-et* changes the transfix to ¯i¯e¯, while plural suffixes cause the elision of the second transfix vowel.

The classes Pi'el, Hif'il, and Hitpa'el require the gerund prefix *m(e)-*. The Pi'el class is the open verb class in MH, e.g. *iRGeN* 'has oRGaNized'. The gerund is expressed by the prefix *me-*:

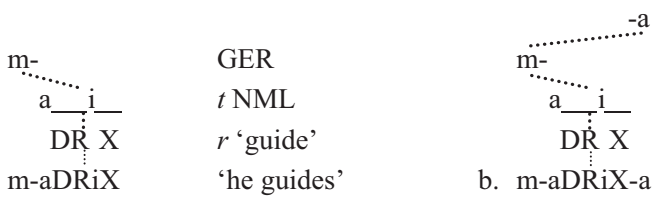
(17)

	me-	GER		-im më-	pl(.m) GER
	_a_e_	*t* BASE		_ä_	*t* BASE
	D B̈ R	*r* 'talk'		D B̈R	*r* 'talk'
a.	me-DaBeR	'he talks'	b.	me-DaBR-im	'they talk'

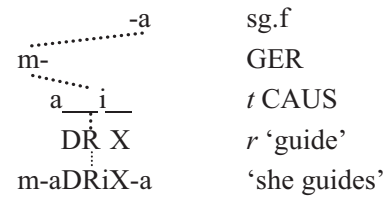
As (17a) shows, Pi'el verbs in the gerund form take the base transfix ¯a¯e¯. The attachment of plural suffixes triggers the loss of /e/, as (17b) shows. Base forms are equivalent with Standard Hebrew imperatives, which have been replaced by future tense forms, and truncated forms thereof. Pi'el verbs mostly include accusative verbs.

The Hif'il class includes accusative and causative verbs. The gerund is expressed by the prefix *m-*.

(18)



a. m-aDRiX 'he guides'

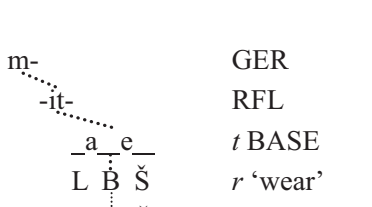


b. m-aDRiX-a 'she guides'

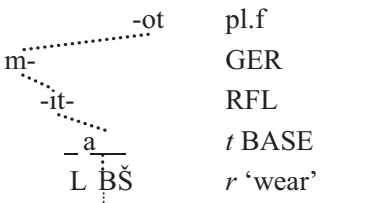
The transfix *a i* that accompanies the gerund prefix *m-* is glossed here as causative. But many Hif'il gerund forms are interpreted as adjectives in MH: *m-aDHiM* 'amazing' < *DHM* 'astound', *m-aRHiV* 'spectacular' < *RHV* 'excite', *m-aGiL* 'disgusting' < *G'L* 'sick', etc. Hif'il gerunds also often act as nominals. (18a–b) could also be translated as '(a) guide'.

Finally, Hitpa'el verbs are also a semantically varied class. While many verbs express reflexivity, depending on the verb's aktionsart, one can also find passives, reciprocals, causatives, unaccusatives, iteratives, change-of-state verbs, and others. Whatever their meaning they must appear with a gerund prefix and a base transfix:

(19)



a. m--it-LaBeŠ 'he dresses'



b. m--it-LaBŠ-ot 'they[f] dress'

The morph *-it-* is an infix. As it expresses the meanings of the Hitpa'el class, which range from valency to aspect, it must sit vertically below the gerund prefix, as in (19a). Again, attachment of plural suffixes causes elision, as shown in (19b).

This section has shown how the gerund is formed for the different verb classes in the most representative fashion. But there are more possibilities. The transfix *o e*, the gerund of Pa'al 2 verbs, also functions as the reduplicative base transfix for several Pi'el and Hitpa'el verbs: *me-ŠoTet* 'stray' < *Š(U)T* 'drift', *h-it-oFef* 'fly around' < *'(U)F* 'fly', etc. In these verbs, the final consonant is a reduplicate. Therefore it is not capitalized. This type of partial reduplication is used in order to intensify the verb meaning.

6 Tense affixes

Hebrew distinguishes only two tenses, namely past tense and future tense. Past tense is usually expressed by a combination of trans- and suffixes, while future tense requires trans- and prefixes. In the past tense and the future tense, the pre- and suffixes are marked for person, number, and genus.

In order to facilitate the understanding of the interactions of pre-, trans-, and suffixation, the current account begins with an example of the Pa'al 1 subclass (cf. ex [13]). Since these verbs appear with the transfix $\overline{a}$ in their gerund and past tense forms, pre- and suffixation are best illustrated with these verbs. The most frequent Pa'al 1 verbs are:

(20) a. *gar* - *lagur* 'reside', *zaz* - *lazuz* 'move', *tas* - *latus* 'travel by plane', *met* - *lamut* 'die', *nax* - *lanuax* 'rest', *af* - *lauf* 'fly [like a bird]', *kam* - *lakum* 'get up', *ṣam* - *laṣum* 'fast'

b. *rav* - *lariv* 'quarrel', *raṣ* - *lariṣ* 'run', *sam* - *lasim* 'put', *šar* - *lašir* 'sing'

c. *ba* - *lavo* 'come'

The verbs in (20) are shown in the past tense 3sg.m form (as all Hebrew verbs are usually lemmatized), followed by the infinitive form. In the subclass (20a), the infinitive requires /u/, and in the subclass (20b), /i/. The subclass (20c) contains only one verb, the slightly irregular verb *ba* 'come'. The past tense forms shown in (20) are also used as gerund forms, however with different suffixes in the plural.

Below only the forms for the first verb in (20), *gar*, are given. The past tense suffixes, are the same for all verb classes. They are summarized in Table 3.

P/N/G	1sg	2sg.m	2sg.f	3sg.m	3sg.f	1pl	2pl.m	2pl.f	3pl
Past	-ti	-ti	-t		-a/-ta[5)]	-nu	-tem	-ten	-u

Table 3: Past tense suffixes

The examples below dispense with tree representations, because the issue at hand concerns pre- and suffixation. Only one example is shown as a tree structure. Note that the 3sg forms are equivalent to the gerund forms: *gar* 'he resides/d' (13), *gar-a* 'she resides/d'.

(21)

	-ti	1sg	c.	GaR-t	‘you [sg.f] resided’
	_a_	*t* PST	d.	GaR-nu	‘we resided’
	G R	*r* ‘reside’	e.	GaR-tem	‘you [pl(.m)] resided’
a.	GaR-ti	‘I resided’	f.	GaR-ten	‘you [pl.f] resided’
b.	GaR-ta	‘you [sg.m] resided’	g.	GaR-u	‘they resided’

The future tense requires pre- and transfixes, and suffixes in the 2sg.f/2pl/3pl forms. The future affix system is shown in Table 4.

P/N/G	1sg	1pl	2sg	3sg
future	*v*-	n-	t-	j-
	a-	na-	ta-	ja-
	e-	ni-	ti-	i-
	a-	ne-	te-	je-

Table 4: Future tense affix system

The first row in the *future* cell shows the future tense prefixes across all verb classes. /*v*/ stands for “vowel”. Each prefix beginning with a consonant must be followed by a vowel. In the Pa’al 1 subclass and in the Hif’il class, that vowel is /a/, as shown in the third row. The fourth row shows the standard prefixes for Pa’al, Nif’al, and Hitpa’el verbs. Pi’el verbs behave according to the last row. In order to derive the plural forms of the 2 and 3 persons, the suffix *-u* must be added (*tagur* ‘you[m] will reside’ vs. *tagur-u* ‘you[m/pl] will reside’; *jagur* ‘he will reside’ vs. *jagur-u* ‘they[m.pl] will reside’). If the suffix *-i* is added to a 2sg form, one gains the 2sg.f form: *tagur* ‘you[m] will reside’ vs. *tagur-i* ‘you[f] will reside’.

In the future tense of Pa’al 1 verbs, two transfixes occur: in subclass (20a), i.e. verbs such as *gar*, the transfix is ¯*u*¯. In (20b) verbs, it is ¯*i*¯, and in *ba* (20c), it is ¯*o*¯. I.e. the transfixes correspond to those appearing in the infinitive forms.

The following examples are, apart from the first, again not shown as tree structures:

(22)

	a-	FUT.1sg	c.	ta-GuR-i	‘you [sg.f] will reside’
	_u_	*t* INF	d.	ja-GuR	‘he will reside’
	G R	*r* ‘reside’	e.	na-GuR	‘we will reside’
a.	a- GuR	‘I will reside’	f.	ta-GuR-u	‘you [pl] will reside’
b.	ta- GuR	‘you [sg.m] will reside’; ‘she will reside’	g.	ja-GuR-u	‘they will reside’

Note that the forms for 2sg.m and 3sg.f in (22b) are syncretic. Modern Hebrew is a partial pro-drop language when a tensed verb (not a gerund!) is present. Usually, first and second person pronouns are dropped; third person subject pronouns must remain overt. Hence there is no cause for confusion in verb forms such as (22b).

The second person future tense forms also double as imperatives. The Standard Hebrew imperative are only used with a handful of irregular verbs (*lex* 'sit!', *lex-i* 'sit[f]!', *lex-u* 'sit[pl]!'; *ten* 'give!', *kax* 'take!', etc.). The imperatives of *ba* 'come' are *bo*, *bo-i*, and *bo-u*.

The affixes introduced in this section will also appear in the following section. The main distinction rests with the transfixes the major verb classes require.

7 Tense transfixes

Even though tense seems to be sufficiently marked with the affixes introduced in the previous section, it remains a fact that these affixes must co-occur with transfixes specific for each verb class. Even the Pa'al 1 verb *gar* required the transfix ¯a¯ in the past tense (21), and the transfix ¯u¯ in the future tense (22). This section is partitioned into two sections: section 7.1 deals with past tense, and section 7.2 with future tense.

7.1 Past tense

The 3 person form of Hebrew verbs stands out from the other forms. The 3sg.m form is unmarked, but expressed by a specific transfix that not always occurs in other forms. Apart from Hif'il verbs, 3sg.f and 3pl forms are expressed by mono-vocalic, allomorphic transfixes, where the second vowel is elided. 1 and 2 persons must be marked by yet another allomorphic transfix in Pi'el, Hif'il, and Hitpa'el. The situation is summarized in Table 5.

past transfixes	Pa'al 2/3	Nif'al	Pi'el	Hif'il	Hitpa'el
1/2	¯a¯a¯	i¯¯a¯	¯i¯a¯	i¯¯a¯	¯a¯a¯
3sg.m			¯i¯e¯	i¯¯i¯	¯a¯e¯
3sg.f/3pl	¯a¯¯	i¯¯	¯i¯¯		¯a¯¯

Table 5: Past tense transfixes by person

Note that Table 5 does not account for reduplicatives, or for transfix formation by

further subclassification within the respective verb classes.

Pa'al 2/3 verbs require the transfix $\overline{a\,a}$ in the past tense (cf. Table 1). Since in the past tense, Pa'al 3 verbs behave like Pa'al 2 verbs, only one example for a Pa'al 2 verb is shown:

(23)

	_a_a_	*t* PST		-a _a___	f.sg *t* PST
	L M D	*r* 'study'		L MD	*r* 'study'
a.	LaMaD	'he studied'	b.	LaMD-a	'she studied'
	-ti _a_a_	1sg *t* PST		-u _a___	3pl *t* PST
	L M D$_{/e/}$	*r* 'study'		L MD	*r* 'study'
c.	LaMaDe-ti	'I studied'	d.	LaMD-u	'they studied'

Example (23a) shows the 3sg.m of the past tense, which is unmarked. Example (23b) shows that in 3sg.f the allomorphic transfix $\overline{a}$ must appear instead of $\overline{a\,a}$. The allomorph is triggered in the presence of the feminine suffix *-a*. The same holds for (23d). Again, this behavior is consistent cross all verb classes, apart from Hif'il.

(23c) shows the 1sg form. Since the radical ends in, and the suffix begins with a dental, so-called "epenthetic /e/" appears. Even though epenthetic /e/, subscripted in the example, is not part of radical, transfixes, or suffixes, it appears here after the radical. This instance of epenthesis is a phenomenon of the horizontal dimension, and not subject to an analysis of the vertical dimension. Epenthetic /e/ can also appear between the consonants of a radical on certain phonological conditions.

In Nif'al verbs the transfix $i\overline{\ \ a}$ expresses the gerund and the past tense. Hence example (24a) can mean 'he is finished' or 'he was finished'. (24b), however, cannot be understood as being in the past tense. Rather the past tense of (24b) is the form shown in (24c):

(24)

	n- i___a_	spontaneity *t* GER/PST		-et n- i___e_	sg.f spontaneity *t* GER
	GM R	*r* 'finish'		GM R	*r* 'finish'
a.	n-iGMaR	'he is/was finished'	b.	n-iGMeR-et	'she is finished'

	-a	sg.f		-a	sg.f
	n-	spontaneity		n-	spontaneity
	i_____	*t* PST		i_____	*t* PST
	GM$_{/e/}$R	*r* ‘finish’		DH$_{/a/}$M	*r* ‘astonish’
c.	n-iGMeR-a	‘she was finished’	d.	n-iDHaM-a	‘she was astonished’

Example (24a) shows the syncretic 3sg.m form which can denote the gerund or the past tense. Form (24b) is the feminine gerund form, which can never be mistaken for the past tense form, which is shown in (24c). Example (24d) shows the 3sg.f past tense form of example (16b). The second consonant of the radical cannot trigger epenthetic /e/ because /h/ is a guttural. The vowel /a/ appears instead.

Pi’el verbs use the transfix $\overline{\ }i\overline{\ }\overline{e}\overline{\ }$, and the allomorphs $\overline{\ }i\overline{\ }\overline{a}\overline{\ }$ and $\overline{\ }i\overline{\ }\overline{\ }$:

(25)

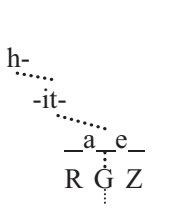
	_i_e_	*t* PST		-a	3sg.f
	S P R	*r* ‘count’		_i_	*t* PST
a.	SiPeR	‘he told’		S PR	*r* ‘count’
			b.	SiPR-a	‘she told’
	-ti	1sg		-tem	2pl.m
	_i_a_	*t* PST		_i_a_	*t* PST
	S P R	*r* ‘count’		S P R	*r* ‘count’
c.	SiPaR-ti	‘I told’	d.	SiPaR-tem	‘you[pl.m] told’

Example (25a) shows the 3sg.m with the transfix $\overline{\ }i\overline{\ }\overline{e}\overline{\ }$, (25b) shows that the 3sg.f form (and as a corollary the 3pl forms) must appear with the transfix $\overline{\ }i\overline{\ }\overline{\ }$. (25c) shows the 1sg with the transfix $\overline{\ }i\overline{\ }\overline{a}\overline{\ }$, which is also required in the 2 persons as in (25d), which shows the 2pl.m form.

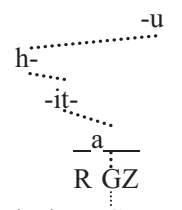
Hif’il and Hitpa’el verbs are marked by yet an additional feature: they must begin with the prefix *h*-. This prefix marks finiteness. It appears in the past tense, in SH imperatives, and hence also in the infinitive, since that is built on the SH imperative. SH imperatives have been displaced by future tense forms or truncated forms thereof.

Hitpa’el verbs require the transfix $\overline{\ }\overline{a}\overline{e}\overline{\ }$, and its allomorphs $\overline{\ }\overline{a}\overline{a}\overline{\ }$ (in persons 1 and 2), and $\overline{\ }\overline{a}\overline{\ }$ (in 3sg.f and 3pl):

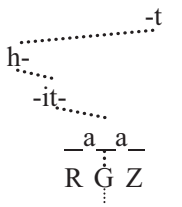
(26)



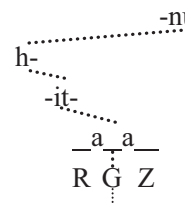
	FIN	
	RFL	
	t PST	
	r ‘angry’	
a.	h--it-RaGeZ	‘he got angry’



	3pl	
	FIN	
	RFL	
	t PST	
	r ‘angry’	
b.	h--it-RaGZ-u	‘they got angry’



	2sg.f	
	FIN	
	RFL	
	t PST	
	r ‘angry’	
c.	h--it-RaGaZ-t	‘you[f] got angry’

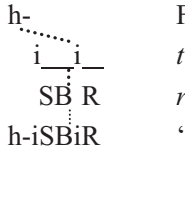


	1pl	
	FIN	
	RFL	
	t PST	
	r ‘angry’	
d.	h--it-RaGaZ-nu	‘we got angry’

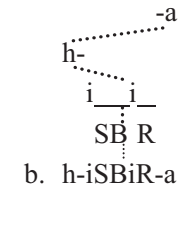
Example (26a) shows the default past tense form, i.e. the 3sg.m with the transfix $\overline{a}\,\overline{e}$. (26b) shows the 3pl form, requiring the allomorph $\overline{a}$. (26c–d) show the 2sg.f and the 1pl respectively, both appearing with the allomorph $\overline{a}\,\overline{a}$.

Hif’il transfixes are always bi-vocalic. Apart from expressing the past tense, the transfixes also express some form of causation. In this class, one transfix, i.e. $i\overline{\ }\,i$, appears with all 3 person forms. The allomorph $i\overline{\ }\,a$ appears with 1 and 2 persons:

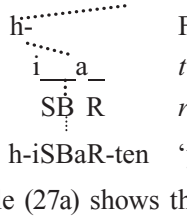
(27)



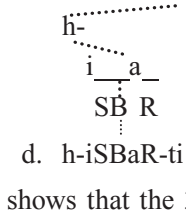
	FIN	
	t CAUS.PST	
	r ‘think’	
a.	h-iSBiR	‘he explained’



	3sg.f	
	FIN	
	t CAUS.PST	
	r ‘think’	
b.	h-iSBiR-a	‘she explained’



	2pl.f	
	FIN	
	t CAUS.PST	
	r ‘think’	
c.	h-iSBaR-ten	‘you [pl.f] explained’



	1sg	
	FIN	
	t CAUS.PST	
	r ‘think’	
d.	h-iSBaR-ti	‘I explained’

Example (27a) shows the 3sg.m form, and (27b) shows that the 3sg.f is marked by the same transfix. (27c–d) show that the allomorphic transfix $i\overline{\ }\,a$ is required in the 1 and 2 persons.

7.2 Future tense

The future tense is formed by verb class specific transfixes and by the set of prefixes discussed in section 6. Table 6 gives an overview over the situation in the future tense.

The row ¯t¯ shows the transfix, and row -s shows the allomorphic transfix required in the presence of suffixes. In the classes Pa'al 1 and Hif'il, allomorphy is absent. Pa'al 2/3 verbs however require the allomorphic transfix ¯¯e¯, and Nif'al, Pi'el, and Hitpa'el verbs require the allomorph ¯a¯¯.

The lower part of Table 6 shows which vowels the future prefixes require in each class.

Class	Pa'al 1	Hif'il	Pa'al 2	Pa'al 3	Nif'al	Hitpa'el	Pi'el
¯t¯	¯u¯ ¯i¯	—i¯	¯¯o¯	—a¯	¯a¯e¯		
-s			—e¯		¯a¯¯		
1sg	/a/		/e/				/a/
rest			/i/				/e/

Table 6: Future transfix distribution and prefix vocalization

Again Pa'al 1 and Hif'il verbs group together, only requiring the vowel /a/, e.g. Pa'al 1 *a-GuR* 'I will reside' (1sg), *na-GuR* 'we will reside' (rest), or *a-SiM* 'I will put' (1sg), *ta-SiM* 'you[m]/she will put' (rest), and Hif'il *a-ZMiN* 'I will order" (1sg), *ta-ZMiN-i* 'you[f] will order' (rest).

Pa'al 2/3, Nif'al, and Hitpa'el verbs require that the 1sg prefix be /e/, and the remaining prefixes be /i/, e.g. Pa'al 2 *e-XToV* 'I will write' (1sg), *ni-XToV* 'we will write' (rest), or *eKRa* 'I will call' (1sg), *ti-KRa* 'you[m]/she will call' (rest); Pa'al 3 *e-ZKaN* 'I will grow old' (1sg), *ni-ZKaN* 'we will grow old' (rest); Nif'al *e-DaHeM* 'I will be surprised' (1sg), *ti-DaHeM* 'you[m]/she will be surprised' (rest); Hitpa'el *e-t-RaGeZ* 'I will get angry' (1sg), *ni-t-RaGeZ* 'we will get angry' (rest).

In the Pi'el class, /a/ is required for the 1sg, while /e/ is required for the remaining prefixes, e.g. *a-LaMeD* 'I will teach' (1sg), *ne-LaMeD* 'we will teach' (rest).

Note that allomorphic transfixes are triggered in the presence of suffixes: in Pa'al 2/3 verbs ¯¯e¯ instead of ¯¯o¯ or ¯¯a¯, e.g. Pa'al 2 *ti-XToV* 'you[m]/she will write' vs. *ti-XTeV-i* 'you[f] will write' (allomorph); Pa'al 3 *ti-ZKaN* 'you[m]/she will grow old' vs. *ti-ZKeN-i* 'you[f] will grow old' (allomorph); in Nif'al, Hitpa'el and Pi'el verbs ¯a¯¯ instead of ¯a¯e¯, e.g. Nif'al *ti-GaMeR* 'you[m]/she will be finished' vs. *ti-GaMR-i* 'you[f] will be

finished' (allomorph); Hitpa'el *ti-t-RaGeZ* 'you[m]/she will get angry' vs. *ti-t-RaGZ-i* 'you[f] will get angry' (allomorph); Pi'el *te-PaReT* 'you[m]/she will specify' vs. *te-PaRT-i* 'you[f] will specify' (allomorph).

The future tense of the Pa'al 1 verb *gar* has been shown in (22). The forms of the other Pa'al 1a verbs are built accordingly. Since Hif'il verbs pattern like Pa'al 1, more specifically like verbs of the subclass Pa'al 1b (cf. ex [20b]), they are illustrated immediately below:

(28)

	a-	FUT.1.sg		na-	FUT.1.sg
	___i__	*t* IRR		___i__	*t* IRR
	ZM N	*r* 'order'		ZM N	*r* 'order'
a.	a-ZMiN	'I will order'	b.	na-ZMiN	'we will order'
	-i	2sg.f		-u	pl
	ta-	FUT.2		ta-	FUT.2
	___i__	*t* IRR		___i__	*t* IRR
	ZM N	*r* 'order'		ZM N	*r* 'order'
c.	ta-ZMiN-i	'you[f] will order'	d.	ta-ZMiN-u	'you[pl] will order'

(28a) shows the 1sg form, (28b) the 1pl form, (28c) the 2sg.f form, and (28d) the 2pl form. Compare this to the Pa'al 1b verb *sam* 'put': *a-SiM* 'I will put', *na-SiM* 'we will put', *ta-SiM-i* 'you[f] will put', *ta-SiM-u* 'you[pl] will put'. (28c–d) also act as imperatives: *ta-ZMiN-i* 'order! [2sg.f]', and *ta-ZMiN-u* 'order! [2pl]'.

The transfix above, and those below as well, are glossed as IRRealis, because they appear in verbs expressing the imperfective or the irrealis. A gloss such as "SH IMPerative" is also possible.

Depending on subclass, Pa'al 2 verbs require the transfixes $\overline{\ }o\overline{\ }$ or $\overline{\ }a\overline{\ }$, while Pa'al 3 verbs must use $\overline{\ }a\overline{\ }$. Both verb classes require the allomorphic transfix $\overline{\ }e\overline{\ }$, whenever a suffix appears:

(29)

	e-	FUT.1sg		ni-	FUT.1pl
	___o__	*t* IRR		___o__	*t* IRR
	GM R	*r* 'end'		GM R	*r* 'end'
a.	e-GMoR	'I will end'	b.	ni-GMoR	'we will end'

	-i	2sg.f		-u	pl
	ti-	FUT.2		ji-	FUT.3
	_e_	*t* IRR		_e_	*t* IRR
	GM R	*r* ‘end’		GM R	*r* ‘end’
c.	ti-GMeR-i	‘you[f] will end’	d.	ji-GMeR-u	‘they will end’

(29a) shows the 1sg of *GMR* ‘end’ in the future tense, and (29b) shows the 1pl. (29c–d) show that the appearance of the suffixes *-i* [2sg.f] and *-u* [pl] trigger the appearance of the transfix $\overline{\overline{\ }}\,\bar{e}$. Pa’al 3 verbs behave accordingly; other than Pa’al 2 verbs, which can take $\overline{\overline{\ }}\,\bar{o}$ or $\overline{\overline{\ }}\,\bar{a}$, Pa’al 3 verbs always take the default transfix $\overline{\overline{\ }}\,\bar{a}$.

Nif’al, Pi’el, and Hitpa’el verbs form their future tense forms with the base transfix $\bar{a}\,\bar{\bar{e}}$. Nif’al and Hitpa’el future tense forms have in common that their prefixes are formed by /e/ for 1sg, and /i/ for the rest (cf. row 3 in Table 4, right hand side of Table 6). Pi’el verbs require /a/ for 1sg, and /e/ for the rest (cf. row 4 of Table 4, right hand side of Table 6). The transfix $\bar{a}\,\bar{\bar{e}}$ requires the allomorph $\bar{a}\,\overline{\overline{\ }}$ in case suffixes appear.

(30)

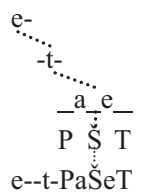
	e-	FUT.1sg		ji-	FUT.3
	_a_e_	*t* BASE		_a_e_	*t* BASE
	K N S	*r* ‘enter’		K N S	*r* ‘enter’
a.	e-KaNeS	‘I will enter’	b.	ji-KaNeS	‘he will enter’

	-u	pl		-u	pl
	ti-	FUT.2		ji-	FUT.3
	_a___	*t* BASE		_a___	*t* BASE
	K NS	*r* ‘enter’		K NS	*r* ‘enter’
c.	ti-KaNS-u	‘you [pl] will enter’	d.	ji-KaNS-u	‘they will enter’

(30a) shows the 1sg of the Nif’al verb *KNS* ‘enter’. (30b) shows the 3sg.m form. (30c–d) show the allomorphic transfixes in the presence of the plural suffix *-u* (and also of the feminine suffix *-i*).

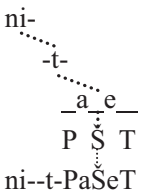
Hitpa’el verbs behave like Nif’al verbs. The reflexive infix is preceded by the gerund prefix *m-* (cf. ex [19]), or by the finite prefix *h-* (cf. ex. [26]) in the past tense. In the future tense, which is expressed by prefixes, the infix appears only as the consonant /t/:

(31)



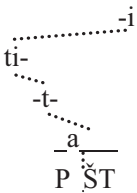
FUT.1sg
RFL
t BASE
r ‘remove’

a. e--t-PaŠeT ‘I will undress’



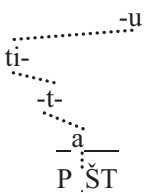
FUT.1pl
RFL
t BASE
r ‘remove’

b. ni--t-PaŠeT ‘we will undress’



2sg.f
FUT.2
RFL
t BASE
r ‘remove’

c. ti--t-PaŠT-i ‘you[f] will undress’



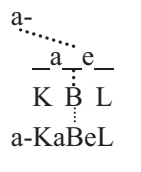
pl
FUT.2
RFL
t BASE
r ‘remove’

d. ti--t-PaŠT-u ‘you[pl] will undress’

(31a) shows the 1sg of the reflexive verb *PŠT* ‘remove’. (31b) shows the plural form thereof. In (31c–d), the presence of the suffix *-i* in (31c), and of the suffix *-u* in (31d) requires the allomorphic transfix.

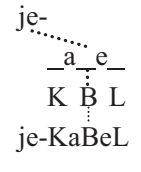
While Pi’el verbs use the base transfix in their future tense, the prefix vowels are different (cf. lower right hand side of Table 6). Since the base transfix is required, one can expect that an allomorph becomes necessary whenever suffixes appear:

(32)



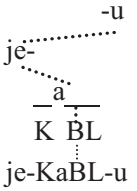
FUT.1sg
t BASE
r ‘receive’

a. a-KaBeL ‘I will receive’



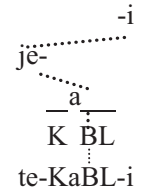
FUT.3
t BASE
r ‘receive’

b. je-KaBeL ‘he will receive’



pl
FUT.3
t BASE
r ‘receive’

c. je-KaBL-u ‘they will receive’



2sg.f
FUT.3
t BASE
r ‘receive’

d. te-KaBL-i ‘you [f] will receive’

(32a) again shows the 1sg of the verb *KBL* ‘receive’. (32b) shows the 3sg.m, and (32c) the plural thereof, which requires the allomorphic transfix. (32d) shows the 2sg.f form, which is marked by the suffix *-i*, and hence also requires the allomorphic transfix.

The future tense is required in desiderative constructions (Groß 2014b), and it is also used as the imperative mood.

8 Conclusion

This paper has demonstrated that a piece- and dependency-based account of root-and-pattern morphology is possible. It was shown that radicals (=roots) convey relatively consistent, if abstract, meaning across very different word-forms (Sec. 2). Transfixes (=patterns) also consistently mark specific grammatical functions, such as gerund (Sec. 5), past (Sec 7.1), and future tense (Sec. 7.2), as well as other derivational word-forms. In some verb classes, transfixation is accompanied by further affixation. In addition to verb-class specific transfixes, past tense forms require suffixes, while future tense forms require prefixes (Sec. 6). A brief proposal concerning verb classification was also provided (Sec. 4). A brief outline of the system employed here to analyze MH verb forms was given in Section 3.

One important research result is that an approach to morphology is possible that acknowledges pieces, i.e. meaning-bearing parts of words, and dependency relationships between these pieces, based on extant research.

Notes

1) The references concern only Hebrew. There are more contributions about Arabic.
2) Again, the references only concern Hebrew.
3) Some dictionaries (Bolozky 2008) lemmatize (1k) as MSFR, i.e. they assume a tetra-consonantal radical.
4) Every single instance named in the main text has been shown to work within dependency morphology (Groß 2011a).
5) Concerning *-ta* see the discussion surrounding (7–8).

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