Derived nouns in Modern Hebrew: Structural and psycholinguistic perspectives

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The article focuses on derived nouns, constructed on the basis of interdigitation of a consonantal root plus one of several dozen prosodic templates or morphological patterns and/or by linear affixation to a word or stem. Structural characteristics of Hebrew nouns are outlined in terms of their inflectional properties (number and gender agreement and bound genitive case marking) followed by specification of different processes of noun-formation in terms of four major morpho-lexical classes. Findings are then reviewed from psycholinguistic and usage-based studies on early and later language acquisition. Such research reveals: (I) children's early mastery of morphological structure as against a lengthy route to command of a mature conventional lexicon; (II) a typological preference for relying on interdigited root plus pattern derivation compared with the seemingly more transparently linear process of concatenation of stem plus external affix; (III) the difference in processing nouns constructed out of canonic triconsonantal roots compared with those based on defective biconsonantals; and (IV) the predominance of morphology over phonology in the mental lexicon of Hebrew speaker-writers.

The article focuses on a subset of Hebrew nouns, termed here "derived nouns", and is based largely on research of the first author on structure and acquisition of Modern Hebrew (Berman 1978; 1985) and of the second author on the morphology/semantics interface in the mental lexicon (Seroussi 2004; 2011). The language under consideration is Modern Hebrew, used as a means of everyday spoken communication since the late 1800s and serving four generations of children born in Israel as their first and major language (Berman 1997, 2003b; Harshav 1993; Rabin 1973; Ravid 1995). The lexicon of contemporary Hebrew is made up of items from different historical periods, approximately as follows: 22% of Biblical origin, 21% Mishnaic, 17% Medieval, and 40% Modern, with nouns accounting for the bulk of the current lexical repertoire of the language (Ravid 2005).The article outlines structural properties of Hebrew nouns (Section 1) as background to findings of psycholinguistic and usage-based research into early and later language acquisition (Section 2).

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1. Nouns in Modern Hebrew

Members of the major lexical categories in Hebrew are typically distinctive in their morphological structure: Verbs are the most constrained category, confined to a small subset of prosodic templates or *binyan* conjugations; Nouns – as further detailed below – are rather less constrained; and Adjectives are structurally the most varied of the three (Berman 1988a; Ravid & Levie 2010). An important typological feature of Hebrew is thus that it has little in the way of **zero derivation** or syntactic conversion: The only exception is use of present-tense verbs used as one (out of many different) means for constructing agent and instrument nouns (e.g., *šofet* 'judging, (he) judges ~ a judge', *me'avrer* 'ventilating, (it) aerates ~ ventilator', *nispax* 'be-attached ~ attaché, appendix' (Berman 1978; Clark & Berman 1984). Hebrew nouns are inflected by suffixes for number and gender, and optionally for genitive case. All nouns are either masculine or feminine in gender, inherent in non-animates (e.g., masculine *šulxan* 'table', feminine *mita* 'bed') and alternating in animate nouns (e.g., *yéled ~ yalda* 'boy ~ girl', *par ~ para* 'bull ~ cow') (Schwarzwald 1982).[1] Count nouns occur in singular or plural number (e.g., *yéled ~ yeladim* 'child ~ children', *par ~ parot* 'cow ~ cows') (Ravid & Schiff 2009; in press); and they may also take a non-productive lexically restricted dual form (e.g., *léxi ~ lexayáyim* 'cheek ~ cheeks', *yom ~ yamim ~ yomáyim* 'day ~ days ~ two-days'). Subject nouns govern agreement of their associated predicates in number and gender and of adjectival and demonstrative modifiers in number, gender, and definiteness, as shown in (1).

(1) a. *ha-xaruz ha-gadol ha-ze nafal*
the-bead.M the-big the-this fell
'this big bead fell'
b. *ha-xaruz**im** ha-gdol**im** ha-éle nafl**u***
the-beads.M.PL the-big.M.PL these fell.PL
= 'these big beads fell'
c. *ha-kubiy**a** ha-gdol**a** ha-**zot** nafl**a***
the-block.F the-big.F the-this.F fell.F
'this big block fell'

Nouns can also be inflected for possessive marking (e.g., *xaruz-**o*** 'bead-his = his bead', *kubiy-ot-**éhem*** 'block-s-their = their blocks') alternating with analytic constructions with the genitive marker *šel* 'of' (e.g., *ha-xaruz šelo* 'the-bead of-him = his bead'), with the latter more typical of everyday usage (Cahana-Amitay & Ravid 2000).

They may also take a genitive form when the initial, head element in compound constructions is morphologically bound to the adjunct noun that follows (e.g., *xaruz-**ey** ha-yeladim* 'bead-s:GEN the-children = the children's beads' vs. the free form *xaruzim* 'beads', *simla-**t** kala* 'dress:GEN bride = (a) bride's dress' vs. the free form *simla* 'dress' (Berman 1988b; 2009; Borer 2009).

Hebrew nouns are a structurally mixed set of forms (Berman 1987; Ravid 1990; 2006a; Schwarzwald 2009), classifiable into four main morphological categories: non-derived, derived by minor morphological processes, by compounding, and by major, canonical morphological processes, as follows.

(I) NON-DERIVED NOUNS – are of two types: (a) "basic" or "primitive" terms, typically referring to animals, plants, and everyday objects, often of Biblical origin (Kautsch 1910; Waltke & O'Connor 1990), e.g., *xamor* 'ass', *ec* 'tree', *xec* 'arrow'; and (b) loan words with non-native stress and syllabic structure (e.g., *rádyo, télefon, ótobus, univérsita*) (Bolozky 1978; Fisherman 1986).

(2) MINOR DERIVATIONAL PROCESSES – are common in contemporary Hebrew nouns, but lexically restricted, by means of (c) acronyms – e.g., *mazkal* for *mazkir klali* 'secretary general', *um* 'the U.N.' for *umot me'uxadot* 'nations united = the United Nations' (Aronoff 1976; Ravid 1990); and (d) blends constructed out of a relatively non-systematic clipping of the stems of two independent nouns, e.g., *katnóa* 'motor scooter' from *katan* 'small' and *nua* 'move', *midrexov* 'pedestrian mall' from *midraxa* 'sidewalk' and *rexov* 'street' (Bat-El 1996; Berman 1989).

(III) COMPOUNDING PROCESSES – combine two nouns with the initial head noun morphologically bound to the second, adjunct noun, either as (e) syntactically productive and semantically transparent N+N strings (e.g., *bet-horay* 'house:GEN-parents my = my parents' house', *ba'aleyha-mif'al* 'owners:GEN-the-factory = the factory's owners' or (f) lexicalized, often idiomatic terms (e.g., *bet-xolim* 'house:GEN -sick-Pl = hospital', *bá'aley báyit* 'owners:GEN-home = landlords' (Berman 1988b; 2009; Borer 2009).

(IV) CANONICALLY DERIVED NOUNS – represent two main word-formation processes, both dating back to classical Biblical Hebrew, thus: (g) "interdigited" nouns derived by the non-concatenational processes typical of Semitic, from a consonantal root combined with a set of several dozen affixal patterns, traditionally termed *mišqalim* (literally 'weights'), which are semantically and morphologically related to verbs and/or adjectives with a shared consonantal root, as illustrated by the examples in (2a); and (h) nouns derived by "linear" concatena-

tion formed out of a word-stem plus external (usually suffixal) affix as in the examples in (2b) (Ravid 2006a; Ravid & Malenky 2006; Schwarzwald 2001; 2006b).

a. Interdigited nouns from the root *x-š-b* 'think':
   xašav 'auditor', *xešbon* 'account', *maxšev* 'computer',
   maxšava 'thought', *xašiva* 'thinking', *xišuv* 'calculation',
   taxšiv 'cost-account';
b. Linearly derived nouns from words with the root *x-š-b* 'think':
   xešbonay 'accountant', *xešbona'ut* 'accountancy' from *xešbon* 'account'
   maxševon '(pocket) calculator' from *maxšev* 'computer',
   xašivut 'importance' from *xašuv* 'important'.

Analysis here focuses on the last two types of Hebrew "derived" nouns illustrated in (2), as a subset of the major category of nouns which has the following properties: It includes several thousands of items in the current lexicon of Hebrew; its members are morphologically complex and hence analyzable into structural components; they include large groups of "families of words" (De Jong *et al*. 2000) that share a common consonantal root, often with a shared meaning, and they cover a range of semantic categories as further detailed below.

Derivational patterning of nouns is illustrated in (3), based on the consonantal verb-roots *g-d-l* 'grow' and *k-t-v* 'write' – with dashes representing accidental gaps in the lexicon of current Hebrew.

Agent Nouns:[2]

CaCaC	---	*katav*	'reporter'
CaCCan	---	*katvan*	'typist'
From Present-Tense Verbs:			
megadel 'grower, breeder'		*kotev*	'writer, author'
---		*mexutav*	'addressee'

Action Nouns:[3]

CCiCa	*gdila*	'growing, growth'	*ktiva*	'writing, script'
CiCuC	*gidul*	'growth, tumor'	*kituv*	'caption(izing)'
hitCaCCut	*hitgadlut*	'aggrandizement'	*hitkatvut*	'corresponding/-ence'
hagdala		'enlarging/-ment'	*haxtava*	'dictating/-ion'

Other Noun Patterns:

CóCeC	*gódel*	'size'	---	
CCaC	---		*ktav*	'(hand)writing'
CCiC	*gdil*	'tassel'	*ktiv*	'spelling'
CaCaCa	---		*katava*	'(news) report'

CCuCa	*gdula*	'greatness'	*ktuba*	'marriage-contract'
CaCCanut	---		*katvanut*	'typing, stenography'
CaCCut	*gadlut*	'grandeur'		---
CCóvet	---		*któvet*	'address, inscription'
miCCaC	*migdal*	'tower'	*mixtav*	'letter, missive'
taCCiC	*tagdil*	'enlargement'	*taxtiv*	'(a) dictate'
maCCeCa	*magdela*	'enlarger'	*maxteva*	'writing-desk'
tiCCóCet	---		*tixtóvet*	'correspondence'

The examples in (3) show, first, that while the system is structurally productive, there are many lexical gaps for any one pairing of a given consonantal root plus affixal pattern. For example, the root *g-d-l* has no agent noun in the typically agentive pattern CaCCan (hypothetical 'grower'); and neither *g-d-l* nor *k-t-v* occurs in the extremely common and semantically varied so-called *segolate* noun pattern CéCeC (e.g., *kéšer* 'knot' from the root *k-š-r* 'tie', *séfer* 'book' from the root *s-p-r* 'tell'). Second, the system is not fully regular, since its form-meaning relations are often unpredictable. And while both *g-d-l* and *k-t-v* happen to form nouns in the miCCaC pattern that have a product meaning (*migdal* 'tower' and *mixtav* 'letter'), other nouns in this same pattern may belong to other semantic classes (e.g., place names like *midbar* 'desert', *misrad* 'office' and other nouns like *mispar* 'number' from *s-p-r* '*count*', *mišpat* 'sentence' from *š-p-t* 'judge'). Besides, as noted, nouns (and adjectives) differ from verbs, which must be formed by interdigitation of root plus one of several non-concatenative *binyan* verb templates: Nouns, in contrast, may also be constructed linearly – as in the examples in (3) of *katvan-ut* 'stenography' from *katvan* 'typist', *gadl-ut* 'greatness' from *gadol* 'big, great' (Bolozky & Schwarzwald 1992).[4]

Semantically, the examples in (3) demonstrate that these two types of Hebrew derived nouns range from concrete instrument nouns (e.g., *mazgan* 'air-conditioner' from the verb-root *m-z-g* 'blend') and human agents (e.g., *sapar* 'barber' from *s-p-r* 'cut hair') via place and collective nouns (e.g., *miklat* '(a) shelter' from *q-l-t* 'take-in' and *mištara* 'police-force' from *š-t-r* '(to) patrol') and on to fully abstract nouns like *ma'avak* 'struggle', *heseg* 'achievement', or *ahava* 'love' (Lyons 1977; Ravid 2006b). Derived nouns are also often polysemous, with both concrete and abstract notions represented by a single surface term, e.g., *sidur* 'prayer-book' from the root *s-d-r* in the action nominal pattern *CiCuC,* which can also stand for the abstract nouns 'tidying (of a room, say)' as well as 'arrangement' or the slang term 'fixing (someone)', or *kabala* from the root *k-b-l* which can mean, respectively, 'acceptance', 'reception', 'system of mysticism', or 'receipt'.

Nouns such as *sidur, kabala* are derived from two *mišqal* patterns associated with the subset of verb-derived nominals traditionally termed *šmot pe'ula* 'names:GEN action = action nouns' in Hebrew grammars (e.g., Bendavid 1956). Morphologically, these are related to one of the five non-passive *binyan* verb patterns, as shown for the active *pi'el* pattern in the two alternative forms *CiCuC* and *CaCaCa* respectively. Other examples are given in (4), as follows.

(4) CCiCa – from verbs in the basic *pa'al* pattern, e.g.,*šmira* 'guarding', *bniya* 'building, construction'
CiCuc – from verbs in the *pi'el* activity pattern, e.g., *dibur* 'speaking, speech', *nihul* 'management', *irgun* 'organization';
haCCaCa – from verbs in the *hif'il* causative pattern, e.g., *haxlata* 'deciding, decision', *hastara* 'hiding, concealment', *haf'ala* 'activation'

The system manifests numerous irregularities in the morphological relation between the base-verb and its derived action nominal, and the three typically transitive verb patterns allow more than a single action-nominal pattern (Ravid & Avidor 1998; Seroussi 2004). Another facet of these constructions is that while morphologically derived and semantically related to their source verbs, they display typically nominal syntactic properties (Berman 1976; 1978); for example, unlike verbs, they can [1] occur with the genitive marker *šel* (e.g., *ha-haclaxa šel ha-séfer* 'the-success of the-book'; and [2] as both head and modifier in compound constructions (e.g., as a bound initial head noun in *haclaxat ha-sod* 'success~succeeding:GEN the-secret' = 'the success of the secret'; and as a free adjunct noun following the head noun in *sod ha-haclaxa* 'secret:GEN the-success' = 'the secret of success'). On the other hand, traces of their verbal origin are reflected in how they combine syntactically with their associated subject and object nominals (e.g., *ha-haclaxa šel hapalatam et ha-memšala* 'the-success of their-overthrow ACC the-government = their success in overthrowing the government', where the first derived nominal 'success, succeeding' takes the nominal genitive marker *šel* while the second 'overthrow(ing)' takes the accusative marker *et* that is governed here, as across the language, by a transitive verb. As noted earlier, Hebrew action nominals like their counterparts in English, may be semantically ambiguous as between action or manner readings (e.g., *halixato hifti'a otanu* 'his-going ~ departure surprised us' versus *halixato hi mešuna* 'his (way) of walking is weird') and also between denoting abstract activities or states or concrete objects (as in the earlier examples of *sidur* 'arranging ~ prayerbook', *kabala* 'acceptance ~ receipt').

As noted, the two basic processes of derived-noun formation in Modern Hebrew (linear and interdigited) have their origins in earlier periods of the language, preferred form-meaning mappings often shift with time. For example, the nominal pattern CaCiC (with a historically long vowel in the first syllable) served in Biblical Hebrew mainly for agent nouns (e.g., *kacin* 'captain', *nasix* 'prince', *palit* 'fugitive') but today is used productively for constructing adjectives with the sense of possibility (e.g., *raxic* 'washable', *šamiš* 'useful', *axil* 'edible'). Another common process in current Hebrew is expanding the use of the final syllable of interdigited patterns to stem-final derivations, as illustrated in (5)

(5). a. *-an*
- (i) in the verb-derived pattern *CaCCan*, e.g.,
  rakdan 'dancer' from the root *r-k-d* as in *lirkod* 'to-dance',
  mazgan 'air-condition' from the root *m-z-g* as in *lemazeg* 'to moderate'
- (ii) as a word- or stem-based linearly added suffix, e.g.,
  mizraxan 'orientalist' from *mizrax* 'east'
  tvustan 'defeatist' from *tvusa* 'defeat'

b. *-ut*
- (i) in the verb-derived pattern *hitCaCCut,* e.g.,
  hitkatvut 'correspondence' from the root *k-t-v* as in *lehitkatev* 'to-correspond'
  hitbagrut 'maturation' from the root *b-g-r* as in *lehitbager* 'to mature'
- (ii) as a word- or stem-based linearly added suffix, e.g.,
  manhigut 'leadership' from *manhig* 'leader'
  solvanut 'tolerance' from *sovlan* 'tolerant'

c. *-on*
- (i) in the verb-derived pattern *CiCaCon*, e.g.,
  .nicaxon 'victory' from the root *n-c-x* as in *lenaceax* 'to-defeat'
  dika'on 'depression', from the root *d-k-'* as in *ledake* 'to-depress'
- (ii) as a word- or stem-based linearly added suffix, e.g.,
  švu'on 'weekly (paper)' from *šavua* 'week'
  milon 'dictionary' from *mila* 'word'

These examples illustrate the lack of uniform form-meaning mappings between the nouns constructed both with a given suffix as well as in a given surface pattern like *CiCaCon*. For example, the *-on* suffix is used to derived the names of periodicals like *iton* 'newspaper' from *et* 'period', *šnaton* 'annual' from, *šana* 'year'; as a diminutive ending in *yaldon* 'little boy' from *yéled* boy', *dubon* 'teddy bear' from

dov 'bear'; and in collective nouns like *širon* 'songbook' from *šir* 'song'. One-to-one form/meaning relations are thus fairly rare, with the possible exception of the highly productive ending *-ut* which invariably denotes abstract nouns (Bolozky & Schwarzwald 1992). This suffix, too, includes both linear affixation to a stem and interdigited patterns – as illustrated in (6a) and (6b) respectively.

(6) a. Linear affixation adding *-ut* to a word/stem:
   (i) Noun/Adjective > Abstract Noun: *manhigut* 'leader-ship', *sovlanut*
   'tolerance', *me'oravut* 'involve-ment';
   (ii) Noun > Adjective: *mišn-i-ut* 'second-ary-ness', *katn-on-i-ut*
   'small:DIM-y-ness = pettiness', *yald-ut-i-ut* 'child-hood-y-ness = childishness' (Ravid & Shlesinger 1987).

b. Interdigited root plus affixal patterns ending in *-ut*: This applies in action nouns derived from verbs in the two intransitive patterns:
   (i) *hiCaCCut – hipardut* 'separation' from *nifrad* 'part = be-separated',
   himan'ut 'avoidance' from *nimna* 'avoid');
   (ii) *hitCaCCut –: hitragšut* 'excitement' from *hitrageš* 'be-excited', *hitkahalut* 'gathering' from *hitkahel* 'gather together, meet'.

An important property of Hebrew nouns is the ready accessibility with which they are linked into morphological "word families": [1] by a common root typically with a shared semantic core (as for the roots *g-d-l* and *k-t-b* in (3) above, or the following examples from the root *n-h-l* 'handle, manage': *nihul* 'conducting', *nóhal* 'custom', *menahel* 'principal', *minhal* 'administration', *hanhala* 'management', *hitnahalut* 'behavior, handling oneself'); and [2] by morphological pattern or template, which may but need not have a favored semantic function (as noted earlier for the *miCCaC* pattern – which occurs in numerous place nouns like *mitbax* 'kitchen', *misrad* 'office', *midbar* 'desert', *miklat* 'shelter', *mif'al* 'plant = factory', but also for nouns in sundry other semantic categories, like *minhal* 'administration', *mitrad* 'nuisance', *migvan* 'variety', *mifgan* 'demonstration', *misxak* 'game').

Current research indicates that the consonantal root has more psychological reality and hence more psycholinguistic impact on how the mental lexicon of Hebrew speaker-writers is perceived and organized than the prosodic templates or so-called *mišqalim* (Frost *et al.* 1997; Seroussi 2010).

Note, finally, that all the examples of derived nouns listed so far are formed from full or canonically triconsonantal roots, in which all three radicals of the root appear in the surface form of words constructed out of them.5 Another, relatively large group of so-called "defective" roots typically include weak consonantal elements like glides or pharyngeals, which may fail to appear in the surface form of words constructed from them. As a result, they are phonologically opaque, so that even educated (non-Hebraist expert) speaker-writers of Hebrew find it hard to identify the historical root elements of such words. For example, they often fail to distinguish between the derivational source of the derived nouns *havana* 'understanding' – from the opaque root *b-w-n* – and *havnaya* 'structuring' from the distinct root *b-n-y* (Seroussi 2011). Yet both roots are structurally productive in current Hebrew, as shown by the nouns derived from them:[6] From the abstract historical root *b-w-n* – *havana* 'understanding', *muvan* 'meaning, sense', *mevin* 'someone who understands', *tvuna* 'wisdom', *tovana* 'insight' (with prefixal *t-*), *hitbonenut* 'meditation' (in the action-noun pattern illustrated in (6b-ii); and from *b-n-y* – *havnaya* 'structuring', *bniya* '(process of) building', *binyan* '(product of) building', *banay* 'builder', *mivne* 'structure', *tavnit* 'mold, pattern' respectively.

In sum, the two processes surveyed here for derived noun formation in Modern Hebrew, interdigited and linear, representing key facets of the lexical typology of the language, are strongly entrenched in current usage – as described in the literature in this in this domain on Israeli Hebrew (e.g., Berman, 1987; Ravid 1990; 2006; Schwarzwald 2001) and as demonstrated in psycholinguistic research surveyed in the next section. That is, derivational processes, both interdigital and linear, are not only structurally productive, they are also the means favored by speakers for extending the lexical repertoire of content items in their language. They play a key role in contemporary new-word formation, as reflected both in officially prescribed lexical innovations, and also in speakers' spontaneous coinages, in children's creative usages, and in the mental lexicon of Hebrew speaker-writers, as discussed in the next section.

2. Psycholinguistic Perspectives

Major structural patterns characterizing the category of nouns in Modern Hebrew as surveyed above have also been the topic of extensive psycholinguistic research, demonstrating that Hebrew noun-structure constitutes a fertile ground for processes of new-word forma-

tion among native speakers from an early age. This is shown by the findings reviewed below from empirical research on young children's coinages (Section 2.1) and on the morphology-semantics interface in development of the mental lexicon across adolescence (Section 2.2).

2.1 Children's coinages of derived nouns

In a structured elicitation study, children aged 3 to 7 years old were required to derive novel agent and instrument nouns from familiar input verbs. For example, they were asked to name a person or an instrument whose function is, say, *li-dxof agalot* 'to-push carts', *lefazer kaftorim* 'to-scatter buttons' (Clark & Berman 1984). Children as young as four years of age showed a significant preference for a single derivational process for this purpose, by use of the agentive noun-ending *-an,* as in *daxfan* 'pusher' or *pazran* 'scatterer' for the above examples. Moreover, except for the youngest group of three-year-olds, who often used a *benoni* 'intermediate' verbal form to yield an innovative compound construction (e.g., *doxef-agalot* 'pushes ~ pusher-of carts', *mefaze- kaftorim* 'scatters ~ scatterer-of buttons'), young Hebrew-speaking children relied on compounding far less than their English-speaking peers in a similar task – around 5% from three-year-olds in Hebrew compared with 21% in English (Berman 2009; Clark & Hecht 1982).[7] They also often used the object noun in these constructions as the basis for noun-innovation (e.g., *agala* 'cart', *kaftor* 'button') rather than the input verb, to yield, say, *aglan* 'carter' or *kaftoran* 'buttoner' from the two example stimuli. These results are in line with other studies showing that Hebrew-speaking children frequently rely on interdigited derivational processes as well as linear affixation to a stem when deriving new words in general (Berman 1994; 2003b). These findings are both confirmed and extended by a different study comparing children's verb as well as noun coinages in both structured elicitations and spontaneous speech output (Berman 2000). These two lines of comparison revealed that Hebrew-speaking children as young as age 3 years coin novel nouns both to fill genuine lexical gaps and to replace conventional terms in the adult lexicon. And they construct both interdigited nouns (e.g., *ma'ataf* 'wrapper' for established *neyar atifa* 'paper (for) wrapping') and linear de-adjectival nouns (e.g., *cmi'ut* 'thirstiness' for *cima'on* 'thirst'). On a test devised to elicit novel nouns, children aged 3 to 9 years and adults were required to derive novel words in four target semantic classes – place, instrument, and agent nouns, and resultative adjectives – on the basis of familiar verbs presented to them in the three non-passive, typically transitive

binyan verb-patterns. For example, to elicit place nouns, participants were shown pictures of people in different states and performing different activities in unidentifiable places without any obvious instruments or means, and asked: "What would you call a place which is used for buying, where people buy things [P1 infinitival *li-knot* 'to-buy' *konim* '(they) buy = impersonal plural'], for cooking, where people cook [P3 *le-vashel* 'to-cook', *mevashlim* '(they) cook = impersonal plural']?". Even the youngest group, the 3-year-olds, scored very high (over 80% of their responses) in the amount of total novel nouns that they produced. Yet they sometimes violated structural constraints in doing so, in nearly one-quarter of the innovations from the youngest pre-school age children, in three main ways, as illustrated in (7).

(7) a. (Occasional) deviations from morphophonological constraints on the syllable structure of possible nouns in Hebrew, to yield morphologically non-existent word-forms, e.g., *ritíax* for a person who boils things – *le-hartíax* [boy, Tom, aged 5;11] *ramdedant* for an instrument to put people to sleep – *le-hardim* [girl, Lior, 3;10];

b. Verbal affixes attached to noun-like stems, e.g., with infinitival *le-* 'to' + CaCCon in *lacbon* for an instrument for irritating people from the verb *le-acben* [boy, Omer, 3;10]
+ CaCCéCet in *lehaškétet* for a place for watering from the verb *le-haškot* [boy, Amit, 3;9];

c. Words structurally well-formed as nouns, but inappropriate for a given semantic class, e.g.,
merutax '(that has been) boiled' in the passive participle form meCuCaC in to name a person whose job is to boil things, *le-hartiax* [boy, Tomer, 4;0];
bišlut [girl, Naama, 5;2] and *mevašlan* [boy, Yaniv, 5;5] – possible nouns in Hebrew, but suited to naming an abstract state with the *-ut* suffix or an agent with *-an* respectively, misapplied to name a place where people cook.

Results of a corresponding test requiring children to derive novel verbs from familiar agent, instrument, and place nouns revealed two interesting differences compared with the corresponding test of novel nouns. First, from age three years on, children coined far more novel nouns (83% of their total responses) than verbs (only 55%), but as late as age 7, nearly a quarter of the nouns they innovated were still structurally ill-formed, in marked contrast to the negligible instances of novel verbs that violated morpheme-structure constraints from as young as age 3 years (Berman, 2003b). These findings indicate that the relatively large range of structural options available for new-noun formation in the language facilitates chil-

dren's task in producing novel nouns, although they may find it difficult to meet grammatical constraints on form-meaning relations in Hebrew nominal patterning until school-age. In contrast, the fact that Hebrew verbs can be constructed only by means of a small number of only five (non-passive) interdigited patterns motivates children from the very start to observe language-particular structural constraints when coining new verbs.

These findings are supported by observations of children's naturalistic speech output showing that they find it quite natural to coin new verbs from familiar verbs by moving across and between the five verb-patterns (Berman 1993). The bulk of children's spontaneous noun coinages (Berman 2000), in contrast, fill genuine lexical gaps, naming objects or states that lack conventional labels, rather than replacing established lexical items. Such innovations show considerable variety in form and content, for example, from children aged 3 to 5 years: non-existent *maknéax* 'wiper' from *le-kanéax* 'to-wipe (one's nose)'; *maglexa* 'shaver' from *le-galéax* 'to-shave', *mac'anit* 'finder' from *li-mco* 'to-find' (= someone who is good at finding things), *kavar* 'burier' from *li-kvor* 'to-bury', *negiva* 'wipery' from *le-nagev* 'to-wipe (dishes)', *neginut* 'instrumenting' from *le-nagen* 'to-play (music)'. Semantically, names for objects, particularly instruments, accounted for as high as one-third of the novel nouns documented, followed by agent-nouns, then by abstract or state nominals, with relatively few innovations naming places. Taken together, these studies reveal that by early school-age, Hebrew-acquiring children have command of the structural options available in their language for constructing nouns, and, in the majority of cases, they also know how to map these appropriately in terms of their form-meaning relations.

2.2 Hebrew derived nouns in later language development

Further evidence for how speaker-writers construe the category of nouns in Hebrew is provided from psycholinguistic research on later, school-age language development. The preceding section demonstrated that even young preschool Hebrew-speaking children manifest considerable knowledge of structural options and of conventional form-meaning relations in the lexicon of their language. On the other hand, the path to maturely proficient command of the noun lexicon is protracted, continuing into adolescence and beyond. Two studies conducted in writing are reported here as evidence for the different trajectories of form-meaning mappings in the mental lexicon of school-children and adolescents faced with a range of both transparent and

opaque, both regular and irregular form-function relations of nouns varying in specificity, concreteness, and register.

Seroussi (2002) had Hebrew-speaking 6th graders (aged 11-12 years), 8th graders (13-14 years), 10th graders (15-16 years), and groups of younger (19-20 years) as well as more mature adults provide action nominals for verbs derived from full, triconsonantal roots in each of the five non-passive Hebrew *binyan* patterns. Regular action nominals, related by canonically consistent form-meaning mappings to their associated verb patterns were produced accurately most of the time, scoring around 70% success as early as the 6th and 8th grade, over 80% in the 11th grade and among the young adults, and over 90% in the older adult group. In contrast, two other classes of action nouns yielded a radically different picture both in absolute figures and in developmental curves (see Table 1). Table 1 shows that, in contrast to fully regular action nouns, totally irregular action nouns, which are not formed in any of the five canonical verb-based patterns are produced correctly as low as around 40% at grade-school age, while "quasi-regular" action nouns, which are formed according to one of the five possible verb-based patterns, but not in the pattern canonically required by the relevant verb-form, lie between the fully regular and irregular forms from 6th grade on. The figures in Table 1 reveal two distinct developmental curves: moderate for regular, rule-governed action nominals and steep in the case of irregular rote-learned action nominals, with the starting point of the former significantly higher than the latter, a gap that lessens with age. These findings demonstrate the relative accessibility of canonical form-meaning mappings in the Hebrew noun system, compared to quasi-regular and irregular derived forms, which need to be rote-learned and so require extensive lexical knowledge (see, too, Ravid & Avidor 1998). Further, reliance on the default rule-governed regular canonic action nominals was so strong, that when participants failed to produce the

Table 1. Mean percentage of correct production of three types of Verb-Derived Action Nouns, by age-schooling level (with standard deviations in parentheses).

	6TH GRADE	8TH GRADE	11TH GRADE	YOUNG ADULTS	MATURE ADULTS
Irregular	41.73 (30.69)	55.0 (23.77)	85.71 (20.26)	90.58 (12.48)	83.33 (28.49)
Quasi- Regular	46.08 (28.56)	60.83 (26.02)	76.42 (19.66)	9.58 (12.48)	84.44 (29.55)
Regular	70.43 (16.91)	70.83 (18.63)	83.57 (15.44)	83.52 (16.17)	91.11 (14.09)

correct action nominal due to inadequate lexico-semantic knowledge, they tended to prefer the regularly derived form as a "cop-out" or default strategy, once again reflecting the discrepancy between overall command of the canonic regular structural options and inadequate mastery of the often idisoycratic form-meaning interrelations in the conventionally established noun lexicon. In contrast to the earlier study, which was based on morphologically transparent triconsonantal roots, Seroussi's (2011) study deliberately addressed the issue of morphological opacity by including both nouns derived from triconsonantal and from morphologically defective biconsonantal roots. Hebrew speaker-writers at three age-schooling levels (6th graders aged 11-12 years, 10th graders aged 15-16 years, and adults in their 20s and 30s), were given a range of different written tasks involving both comprehension and production of nouns derived from both transparent and opaque roots, investigated in tasks of varying levels of difficulty (multiple-choice tasks of relatedness, free associations, interpretation in context, definitions, etc.), requiring them to manipulate derived nouns presented both in isolation and in context.

A major finding of this study were the better results and more appropriate responses to nouns formed out of full roots compared with those formed out of defective or "weak" bi-consonantal roots in the mental lexicon of Hebrew speakers. For example, in a sentence-construction task, balanced for other variables such as familiarity/frequency and semantic concreteness or abstractness, participants produced semantically appropriate sentences significantly more with target nouns derived from full roots compared with those with defective roots. Moreover, this trend was also developmentally significant, since schoolchildren manifested relatively far more difficulty in constructing sentences with nouns from defective roots than did older students and adults. Such contrasts between two main types of Semitic roots in the lexicon of Modern Hebrew is of interest in the context of "nouns crosslinguistically", since the bulk of psycholinguistic studies deal with morphological clues as playing a role in lexical processing from two main, largely English-motivated, perspectives: (I) when encountering unfamiliar/infrequent morphologically complex words which are decomposed into their morphological constituents in order to understand them better (e.g., Anglin 1993; Carlisle 2000; Larsen & Nippold 2007); and (II) in the initial stages of on-line lexical processing (e.g., Diependaele *et al.* 2009; Solomyak & Marantz 2010).

Seroussi's finding for the impact of the Semitic root and the preference for full roots beyond initial stages of processing, even in sen-

tential contexts and even for familiar/frequent words, has not as far as we know been reported in research on the mental lexicon in other languages.

Another unexpected facet of the differential trajectories revealed by this large-scale study on the mental lexicon of Hebrew relating to the distinction between full and defective roots is that full roots manifest a close interface with semantics, whereas the latter interface more markedly with morphology/phonology. This is demonstrated by results on a task requiring participants to select the noun most closely related to the stimulus noun out of four types of relations – morphological, morphological plus semantic, semantic, phonological. For example, for the test noun *xovéret* 'booklet' from the triconsonantal root *ħ-b-r* 'join' (a) Morphological – related by the same root but without a shared meaning (e.g., *xaverut* 'friendship'); (b) Morphological plus Semantic – a shared root and a related meaning, typically by co-hyponymy, that is, a noun in the same category as the stimulus item (e.g., *maxbéret* 'copybook'); (c) Semantic – a different co-hyponym of the test item, related to it by meaning, but unrelated by root – e.g., *pinkas* 'notebook'; (d) Phonological – a noun that rhymes with the test item but is unrelated to it morphologically or semantically – e.g., *gevéret* 'Madam, lady'. Nouns derived from full roots were given as high as 90% semantic and morpho-semantic distracters, with relatively few morphological and almost no phonological distracters selected. In contrast, only around one-third of the distracters selected for nouns with defective roots were morphological and phonological, as compared with around 20% morpho-semantic. Moreover, a developmental interaction emerged in this tendency for relatively greater favoring of semantic distracters for full roots and increased selection of structural (morphological and phonological) distracters for defective roots. With age, there was an increase in semantic and morpho-semantic distracters for nouns with full roots and a concomitant decrease in morphological and phonological distracters – similarly to what was found for the sentence-construction task as well.

A third major finding of this study was the across-the-board preference of Hebrew speakers for relying on morphological rather than phonological clues, the former outscoring the latter on each and every analysis. For example, in the relatedness task reported above, morphological distracters accounted for a total of 8.1% of the distracters selected and for 12.8% of those chosen in the case of unfamiliar/infrequent words, whereas phonological distracters accounted for as low as 5.8% out of the total distracters and for 7% of those given to

unfamiliar/ infrequent words. Space does not allow us to detail here the many, highly consistent and statistically significant findings demonstrating the superiority of morphology over phonology in the mental lexicon of Hebrew speaker-writers. We merely note here that this same trend was revealed across the entire data-base of thousands of responses given on seven different tasks employing derived nouns as a window on the mental lexicon. This finding for 'morphology over phonology' is clearly typologically motivated, and is in marked contrast to what has been reported in a range of psycholinguistic investigations of the mental lexicon in languages like English and Dutch, in which phonological features (like phoneme co-occurrence and rhyming) have been shown to play a critical role in both comprehension (Dell *et al.* 1999) and production (Levelt *et al.* 1999) as well as in development (Reilly *et al.* 2007).

In sum, the two studies reported in this section provide strong evidence for the impact of the Semitic root in the mental lexicon of Hebrew and the powerful role it plays in interaction with factors of morpho-lexical predictability, morphological transparency, and age-related developments.

3. Conclusion

This review of structural and psycholinguistic facets of the domain of Hebrew nouns has focused on the subset of morphologically derived nouns with a Semitic consonantal root formed from processes of interdigitation and prosodic templates in the form of set affixal patterns. The rich array of structural options available to Hebrew speaker-writers provides fruitful grounds for investigating psycholinguistic trends of lexical development and the mental lexicon that are shared across different languages as compared with ones affected by language-specific factors. Major findings of these studies reflect the typological bias for relying on interdigited root plus pattern derivation compared with linear concatenation of stem plus external affix as a seemingly more transparent process; a developmental discrepancy between early mastery of morphological structure but a protracted path to command of a maturely proficient conventional lexicon; psycholinguistic differences between words constructed out of canonic triconsonantal roots compared with those based on defective biconsonantals; and the predominance of morphology over phonology in the mental lexicon of Hebrew speaker-writers.

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Notes

[1] Hebrew forms are represented in broad phonemic transcription representing current General Israeli Hebrew pronunciation (Ben-David & Berman 2007; Blanc 1968), where not otherwise specified. Word-stress is on the final syllable unless marked by an *accent aigu* as (ante)penultimate.
[2] The last three of these agent nouns are derived by zero derivation (also termed syntactic conversion) from verbs in the participial *benoni* form.
[3] These are typically associated with one of the five non-passive *binyan* verb patterns.
[4] Schwarzwald's (2001) examination of Hebrew dictionaries and texts showed that about half of all lexical entries were formed from a root plus pattern, with linear derivation accounting for less than 15%, rising to around one-quarter in the case of recent coinages.
[5] So-called "quadrilaterals" consisting of four or even more radical elements are increasingly common in current Hebrew (Yannai 1974; Berman 2003).
[6] The term "productive" is used here in a deliberately vague and general sense, in order to avoid the constraints involved, both in principle and in practice, of adopting one or another perspective on this controversial issue (as discussed, for example, by Aronoff 1976; Bauer 2001; and Plag 2006; and in Hebrew-specific terms by Berman 1987; Bolozky 1999).
[7] The *benoni* 'intermediate' form serves both as a participial and present-tense form of verbs, and is the only set of forms in Hebrew which allows zero derivation or syntactic conversion from one lexical category to another, e.g., the form *šofet* can stand either for the present-tense verb 'judge(s)' or for the noun '(a) judge' and the *benoni* form *nispax* can stand either for the passive verb 'is-attached' or for the nouns '(an) attaché', 'attachment'.

Bibliographical References

Anglin Jeremy M. 1993. Vocabulary development: a morphological analysis. [Monographs of the Society Research in Child Development. 58, 10]. Chicago: University of Chicago Press.
Aronoff Mark 1976. Word formation in generative grammar. Cambridge, Ma: MIT Press. Bat-El Outi 1994. The optimal acronym word in Hebrew. In Koskinen Paul (ed.). Proceedings of the 1994 Annual Conference of the Canadian Linguistics Association. 23-37.
Bat-El Outi 1996. Phonologically-based word formation: Modern Hebrew blends. In Kleinhenz Ursula (ed.). Interfaces in Phonology. Berlin: Akademie Verlag. 231-250.

Bat-El Outi 2006. Selecting the best of the worst: The grammar of Hebrew blends. Phonology 13. 293-328.
Bauer Laurie 2001. Morphological productivity. Cambridge: Cambridge University Press.
Bendavid Abba 1956. The action noun and its meanings. Leshonenu La'Am VI, VII.
Ben-David Avivit & Ruth A. Berman 2007. Hebrew. In McLeod Sharynne (ed.). The international perspective on speech acquisition. Clifton Park, NY: Thomas Delmar Learning. 437-456.
Berman Ruth A. 1976. On derived and deriving nominals in Modern Hebrew. In Cole Peter (ed.). Studies in Modern Hebrew syntax and semantics. Amsterdam: North-Holland. 57-98.
Berman Ruth A. 1978. Modern Hebrew structure. Tel Aviv: Universities. Publishing.
Berman Ruth A. 1985. Acquisition of Hebrew. Hillsdale, NJ: Lawrence Erlbaum. [Also in Slobin Dan I. (ed.) 1985. The cross-Linguistic study of language aquisition Vol. 1. 255-371].
Berman Ruth A. 1987. Productivity in the lexicon: New-word formation in Modern Hebrew. Folia Linguistica 21. 425-461.
Berman Ruth A. 1988a. Word-class distinctions in developing grammars. In Levy Yonata, Isaac M. Shlesinger & Martin D.S. Braine (eds.). Categories and processes in language acquisition. Hillsdale, NJ: Lawrence Erlbaum. 45-72.
Berman Ruth A. 1988b. Language knowledge and language use: Binominal constructions in Modern Hebrew. General Linguistics 28. 261-285.
Berman Ruth A. 1989. The role of blends in Modern Hebrew word-formation. In Wexler Paul, Alexander Borg & Sasson Somekh (eds.). Studia linguistica et orientalia memoriae Haim Blanc dedicata. Wiesbaden: Harrassowitz. 45-61.
Berman Ruth A. 1993. Developmental perspectives on transitivity: A confluence of cues. In Levy Yonata (ed.). Other Children, Other Languages: Issues in the Theory of Acquisition. Hillsdale, NJ: Erlbaum. 189-241.
Berman Ruth A. 1994. Formal, lexical, and semantic factors in the acquisition of Hebrew resultative participles. In Gahl Susan, Andy Dolbey & Christopher Johnson (eds.). Berkeley Linguistic Society 20. 82-92.
Berman Ruth A. 1997. Israeli Hebrew. In Hetzron Robert (ed.). The Semitic languages. London: Routledge. 312-333.
Berman Ruth A. 2000. Children's innovative verbs vs nouns: Structured elicitations and spontaneous coinages. In Menn Lise & Nan Bernstein-Ratner (eds.). Methods for studying language production. Mahwah, NJ: Lawrence Erlbaum. 69-93.
Berman Ruth A. 2003a. Modern Hebrew. In Comrie Bernard (ed.). Languages of the world. (Oxford International Encyclopedia of Linguistics, rev. edn.) Clarendon: Oxford University Press. 118-123.
Berman Ruth A. 2003b. Children's lexical innovations: developmental perspectives on Hebrew verb-structure. In Shimron Joseph (ed.). Language

processing and language acquisition in a root-based morphology. Amsterdam: John Benjamins. 243-291.
Berman Ruth A. 2009. Acquisition of compound constructions. In Lieber Rochelle & Pavel Stekauer (eds.). Handbook of compounding. Oxford: Oxford University Press. 298-322.
Blanc Haim 1968. The Israeli koiné as an emergent national standard. In Fishman Joshua A. (ed.). Language problems in developing nations. New York: Wiley and sons. 237-252.
Bolozky Shmuel 1978. Some aspects of Modern Hebrew phonology. In Berman 1978. 11-138.
Bolozky Shmuel 1999. Measuring productivity in word-formation: The case of Israeli Hebrew. Leiden: Brill.
Bolozky Shmuel & Ora R. Schwarzwald 1992. On the derivation of Hebrew forms with the -ut suffix. Hebrew Studies 33. 51-69.
Borer Hagit 2009. Afro-Asiatic, Semitic: Hebrew. In Lieber Rochelle & Pavol Štekauer (eds.). Handbook of compounding. Oxford: Oxford University Press. 491-511.
Cahana-Amitay Dalia & Dorit Ravid 2000. Optional bound morphology in the development of text production. In Howell Catherine S., Sarah A. Fish, Thea Keith-Lucas (eds.). Proceedings of the 24th Annual Boston University Conference on Language Development, Vol. I. Somerville, MA: Cascadilla Press. 176-184.
Carlisle Joanne F. 2000. Awareness of the structure and meaning of morphologically complex words: impact on reading. Reading and Writing 12. 169-190.
Clark Eve V. & Ruth A. Berman 1984. Structure and use in acquisition of word-formation. Language 60. 542-590.
Clark Eve V. & Barbara F. Hecht 1982. Learning to coin agent and instrument nouns. Cognition 12. 1-24.
Dell Gary S., Franklin Chang & Zenzi M. Griffin 1999. Connectionist models of language production: lexical access and grammatical encoding. Cognitive Science 23. 517-542.
Diependaele Kevin, Dominiek Sandra & Jonathan Grainger 2009. Semantic transparency and masked morphological priming: The case of prefixed words. Memory & Cognition 37. 895-908.
Fisherman Haya 1986. Foreign words in contemporary Hebrew: Structural, developmental, and social perspectives. Jerusalem: Hebrew University dissertation. [in Hebrew]
Frost Ram, Ken Forster & Avital Deutsch (1997). What can we learn from the morphology of Hebrew? A masked-priming investigation of morphological representation. Journal of Experimental Psychology, Learning, Memory, and Cognition 23. 829-856.
Harshav Benjamin 1993. Language in the time of revolution. Berkeley: University of California Press.
de Jong Nivja, Harald Baayen & Robert Schreuder 2000. The morphological family size effect and morphology. Language and Cognitive Processes 15. 329-365.

KAUTSCH E. 1910. Gesenius' Hebrew grammar, 2nd English edn. Oxford: The Clarendon Press.
LARSEN Jennifer A. & Marylin A. NIPPOLD 2007. Morphological analysis in school-age children: Dynamic assessment of a word learning strategy. Language, Speech and Hearing Services in Schools 38. 201-212.
LEVELT Willem J.M., Ardi ROELOFS & Antje S. MEYER 1999. A theory of lexical access in speech production. Behavioral and Brain Sciences 22. 1-75.
LYONS John 1977. Semantics. Cambridge: Cambridge University Press.
PLAG Ingo 2006. Productivity. In AARTS Bas & April MCMAHON (eds.). The handbook of English Linguistics. London: Blackwell Publishing. 537-556.
RABIN Chaim 1973. A short history of the Hebrew language. Jerusalem: Alpha Publications. RAVID Dorit 1990. Internal structure constraints on new-word formation devices in Modern Hebrew. Folia Linguistica 24. 289-346.
RAVID Dorit 1995. Language change in child and adult Hebrew: Psycholinguistic perspectives. Oxford: Oxford University Press.
RAVID Dorit 2005. An old-new Language: Hebrew from saba to sababa. Talk given to Internationale Francqui-leerstoel. Belgium: University of Antwerpen, October.
RAVID Dorit 2006a. Word-level morphology: A psycholinguistic perspective on linear formation in Hebrew nominals. Morphology 16. 127-148.
RAVID Dorit 2006b. Semantic development in textual contexts during the school years: Noun Scale analyses. Journal of Child Language 33. 791-821.
RAVID Dorit & Avraham AVIDOR 1998. Acquisition of derived nominals in Hebrew: Developmental and linguistic principles. Journal of Child Language 25. 229-266.
RAVID Dorit & Ronit LEVIE 2010. Adjectives in the development of text production: Lexical, morphological and syntactic analyses. First Language 30. 27-55.
RAVID Dorit & Adina MALENKY 2006. Awareness of linear and nonlinear morphology in Hebrew: A developmental study. First Language 21. 25-56.
RAVID Dorit & Rachel SCHIFF 2009. Morpho-phonological categories of noun plurals in Hebrew: A developmental study. Linguistics 47. 45-63.
RAVID Dorit & Rachel SCHIFF In press. From dichotomy to divergence: Number/gender marking on Hebrew nouns and adjectives across schoolage. Language Learning.
RAVID Dorit & Yitzchak SHLESINGER 1987. On the classification and structure of -i suffixed adjectives. Hebrew Linguistics 25. 59-70. [in Hebrew]
REILLY Jamie, Evangelia G. CHRYSIKOU & Christopher H. RAMEY 2007. Support of hybrid models of the age of acquisition of English nouns. Psychonomic Bulletin and Review 14. 1164-1170.
SCHWARZWALD Ora R. 1982. Feminine formation in Modern Hebrew. Hebrew Annual Review 6. 153-178.
SCHWARZWALD Ora R. 2001. Derivation and innovation in Hebrew: Quantitative aspects. In SCHWARZWALD Ora R. & Raphael NIR (eds.). Studies in Hebrew and language teaching in honor of Ben Zion Fischler. Even Yehuda: Reches. 265-275. [in Hebrew]

Schwarzwald Ora R. 2006a. Three related analyses in Modern Hebrew morphology. In Goldenberg Gideon (ed.). Ancient Egyptian, Neo-Semitic, methods in linguistics in memory of H. J. Polotsky. Jerusalem: The National Academy of Sciences. 277-301.

Schwarzwald Ora R. 2006b. From discontinuous to linear word formation in Modern Hebrew. SKASE Journal of Theoretical Linguistics (http://www.skase.sk) 3. 1-11.

Schwarzwald Ora R. 2009. Three related analyses in Modern Hebrew morphology. In Goldenberg Gideon, Ariel Shisha-Halevy (eds.). Egyptian, Semitic and general grammar: Studies in memory of H. J. Polotsky. Jerusalem: Israel Academy of Sciences and Humanities, 277-301.

Seroussi Batia 2002. Derived nominals and their occurrence in the mental lexicon: A developmental perspective. Tel Aviv: Tel Aviv University thesis. [in Hebrew]

Seroussi Batia 2004. Hebrew derived nouns in context: A developmental perspective. Folia Phoniatrica et Logopaedica 56. 273-290.

Seroussi Batia 2011. The morphology-semantics interface in the mental lexicon: The case of Hebrew. Tel Aviv: Tel Aviv University dissertation.

Solomyak Olla & Alec Marantz 2010. Evidence for early morphological decomposition in visual word recognition. Journal of Cognitive Neuroscience 22. 2042-2057.

Waltke Bruce K. & Michael O'Connor 1990. An introduction to Biblical Hebrew syntax. Winona Lake, Ind: Eisenbrauns.Yannai Yigael 1974. Quadriconsonantal verbs in Hebrew. Leshonenu 35. 119-194. [in Hebrew]