Berman, Ruth A.

Derivational Morphology in Hebrew: Insights from Children's Innovations

P A P E R

DERIVATIONAL MORPHOLOGY IN HEBREW: INSIGHTS FROM CHILDREN'S INNOVATIONS

BERMAN, RUTH A. (TEL AVIV UNIVERSITY)

The study concerns lexical innovations by Hebrew-speaking children, focusing on derivational morphology as a means for new-word formation. The principle of transparency, in the sense of one-to-one form/meaning mapping, suggests that Hebrew-acquiring children will prefer to coin new words by linear concatenation, adding an external affix to a stem (as in established *acvut* 'sadness' versus *écev* for 'sorrow', or non-existent *klavon* for established *klavlav* 'doggie' from *kélev* 'dog'). The paper aims to explain, on the basis of findings from innovative forms in spontaneous speech output and structured elicitations, why this is not in fact the case. The answer lies in the interplay between two major forces driving language acquisition and development in general: shared age-related developmental trends and language-specific typological factors, combined with the effect of input frequency in the ambient language.

This study is dedicated in affection and regard to Outi Bat-El, whom I first met as a student of mine at Tel Aviv University, in an undergraduate proseminar on phonology. It is a pleasure to have this opportunity to acknowledge Outi's unique contribution to the domain, in Israeli as in general linguistics, where she has branched out from phonological theory to language acquisition and disorders. She is a model of an involved and caring colleague, supervisor, and teacher.

Acquisition, Children's innovations, Modern Hebrew, Morphology, Templates

1 INTRODUCTION

T he paper addresses the puzzle of why Hebrew-acquiring children prefer to coin new words by the classical means of amalgamating consonantal roots with morphological patterns or prosodic templates rather than by linear stem + affix word-formation. For instance, from the historical consonantal root *ʕ-c-v*, the extant nouns *écev* 'sorrow' and *acv**ut*** 'sadness' (external suffixes are in bold);[1] from the root *p-š-t*, the adjectives *pašut* 'simple', *pastan-**i*** 'simplistic'*;* or established *klavlav* 'doggie, puppy' versus non-existent *klav**on*** from the noun *kélev* 'dog'. Findings of the study, based on children's coinages in their spontaneous speech output and in structured elicitations, are interpreted in light of the interplay between two major forces driving language acquisition and development: typological features of the ambient language (Berman, 2016; Slobin, 1982) and shared age-related developmental trends (Dromi and Berman, 1986; MacWhinney, 1978), together with the factor of frequency of occurrence in language input (Diessel, 2007; Naigles and Hoff-Ginsburg, 1998).

The idea of **innovation** (or coining) refers here to words children use that do not exist in the established lexicon of their language, what Bowerman (1974) characterized as "creative errors".[2] Children produce novel lexical items for one of two reasons:

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1 Hebrew forms are given in broad phonemic transcription to represent current pronunciation of General Israeli Hebrew (Ben-David and Berman, 2007). Abstract consonantal roots are represented by their historical elements, as still reflected in the orthography. For example, the word meaning 'hour' is generally pronounced as bisyllabic *šaa* or reduced to *ša* in rapid speech; it is based on the historical root *š-ʕ-h*, and spelled to this day with the three letters *shin, ayin, heh* (שעה). Stress is marked by an acute accent where it is not word-final.

2 These differ from grammatical errors of young children (e.g., in Hebrew, Preposition + Pronoun inflected forms like *alo* for grammatical *alav* 'on him' - from the preposition *al* 'on' prefixed to the bound form of the pronoun *hu* 'he'; or *miménax* for grammatical *mimex* 'from you.FEM, SG' - from *min~mi-* 'from' and the bound form of *at*, overextended from 1st person *miméni* 'from me' < *mi(n)* 'from' prefixed

Either the word does exist in their language, but they do not know it (e.g., English *caker* for conventional *baker, fastly* for *quickly*) - where the word they coin is "pre-empted" by an established term (Clark, 1993). They may also, less commonly, invent a word to fill a genuine gap in the lexicon (e.g., English *porchy* for an enclosure that looks like a porch, or *to basket* for putting something in a basket).[3] This focus on coinages of young children is motivated by the fact that they innovate unconsciously, not realizing the word as such does not exist in their language, whereas innovations of older speakers and writers are more self-conscious and deliberate. Relatedly, children's coinages reflect an intuitive, untutored perception of the structures of the ambient language, prior to their being exposed to the impact of the written language which, among Hebrew speakers as in other literate cultures, strongly affects how people perceive the words and structures of their native tongue (Olson, 1995).

As we will see later for Hebrew, children's innovative forms are by and large *possible* words in their language (Halle, 1973): That is, even though they do not exist in the conventional lexicon, they are well-formed in terms of the morpho-phonological constraints of the ambient language, based on what Halle (1978) termed "knowledge unlearned and untaught".

The paper starts by reviewing domains that serve as background to the study: Morphology as a domain in linguistic analysis (§2.2), morphological structure of Modern Hebrew (§2.3), and relevant psycholinguistic factors in LANGUAGE acquisition-simplicity, transparency, productivity/frequency, and typology (§2.4). It then outlines the data-base and procedures of the study (§3), as the basis for findings concerning children's lexical coinages in Hebrew (§4). Results are discussed in the conclusion (§5)

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to the pronoun *ani* 'I, me'). Such deviant forms do not constitute lexical innovations; rather, they are transient, *juvenile* forms used in the early stages of grammar acquisition, typically corrected by school age.
3 Morris Halle (1973) early on raised the question posed by "gaps" in the lexicon, noting that these might be filled by *possible* words that accord with the word-formation constraints of a given language, such as *deprival, arrivation* (Kiparsky 2018).

in relation to the interplay between linguistic typology and psycholinguistic factors to explain why children favor root-based "amalgamated" innovations rather than linear concatenation in Hebrew.

2 BACKGROUND DOMAINS

This section briefly addresses two issues of general concern in linguistics (§2.1): One copies the title of Anderson's (1982) paper "Where's Morphology";[4] the other concerns the division between Inflection and Derivation in linguistic theory and description (§2.2). Typological features of Hebrew morphology are considered at some length (§2.3) - divided into inflection (§2.3.1) and derivation (§2.3.2) as specified for verbs (§2.3.2.1), nouns and adjectives (§2.3.2.2), and zero derivation (§2.3.2.3). It then considers major forces driving language acquisition and development: typological features of the ambient language (§2.3) and general psycholinguistic factors of simplicity, transparency, and productivity (§2.4).

2.1 WHERE'S MORPHOLOGY?

In linguistic theory and description, generative accounts, including those of Anderson (1993) and Bat-El (2012a), propose that the basic morpho-lexical unit in Semitic as in other languages is a vowel-containing stem, in keeping with the theory of "prosodic morphology" which views morphological structure as based largely on interdigiting of consonantal root and vowel melody (e.g., McCarthy and Prince, 1990; Watson, 2002). In this view, morphology and phonology are largely intertwined. For example, based in her Optimality-Theory account of the V-Ø alternation in the inflectional paradigms of CVCVC stems, Bat-El (2008) argues that "phonology plays a role in enhancing the distinction among the lexical categories" of verbs, nouns, adjectives, and participles; and in a study of Hebrew language acquisition, Bat-El (2012b) suggests that "it is the

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4 Anderson was Outi's advisor on her UCLA dissertation.

children's phonology that affects their morphological development rather than the other way around". Other generativists treat morphology as part of syntax; for example, Borer (2009: 511) states that "at least for Hebrew compounds, then, there is no need for any recourse to a non-syntactic component of word-formation". In contrast to such approaches, morphology is treated here as a unique area of linguistic structure "by itself" (Aronoff, 1994), which serves as a link between phonology and syntax, grammar and the lexicon: Morphology both feeds into and is fed by the phonological **and** syntactic features of a given language, as I try to show below.

That is not to deny that Hebrew demonstrates a strong connection between phonology and morphology, since similar processes apply across the subdomains of inflectional (grammatical) and derivational (lexical) morphology. Examples abound, as detailed, for example, by Bolozky (1977) for voicing assimilation, avoidance of homogenic consonantal sequences (compare the inflected verb *zalela* 'devoured.3FEM' / the derived noun *zalelan* 'glutton' from *zalal* 'devour'); (ante)pretonic *a/e* deletion e.g., inflected *katva* 'wrote.3FEM' / derived *katvan* 'typist' from *katav* 'wrote'); vowel lowering before historical pharyngeals (e.g., *la-avod* 'to work' / *avoda* 'work, N' from historical ʕ-b-d, cf. *li-lmod* 'to study' / *lmida* 'study(ing), and many others. These parallels do not necessarily apply across-the-board, as suggested by experimental evidence to the effect that Hebrew "allows isolation of morphological and phonological factors in nominal inflection" (Vaknin and Shimron, 2011).

Morphology also plays a powerful role in MH **syntax**. Examples include case-marking by prepositions affixed to personal pronouns except for nominative, of the kind illustrated in fn. 4. (Compare nominative *hu* 'he' / accusative *oto* 'him' fusing accusative *et* and 3rd masculine singular marking / ablative *miménu* 'from him' from *min + hu*). Other morphologically marked syntactic constructions are genitive case in bound possessives and compounds (*séfer* 'book' / *sifro* 'book.POSS.3MASC.SG = his book', *sifrey ha-yeladim* 'book.PL.GEN DEF-children = the children's books') and also abstract

nominalizations like *hores* 'destroy' / *harisa* 'destroying, destruction', which are morphologically largely matched to the set of five *binyan* 'construction, conjugation' verb patterns or prosodic templates.[5] As described in Section 2.3.2.1, these patterns function in syntactic-semantic alternations of voice and valence, marking distinctions of active/passive/middle voice and transitive / intransitive constructions (e.g., from the root *g-d-l* 'grow': Intransitive *li-gdol* 'to-grow in size'; transitive *le-gadel* 'to grow (crops)', Causative *le-hagdil* 'to enlarge, make bigger', Passive *gudal* 'was-raised', *hugdal* 'was enlarged'). In Hebrew, valence is thus typically manifested not only syntactically by verb-argument structure but also morphologically by alternations in the surface form of verbs.

2.2 INFLECTION AND DERIVATION

Morphology is generally viewed as having two main components (Bauer, 2004; Booij, 1996). **Inflection** is associated with the grammar, since (i) it encodes grammatical categories like tense, number, gender, and case; and (ii) in languages where these are marked overtly, they apply largely across-the-board. In contrast, **Derivation** functions primarily for word-formation, often involving a change in word class (e.g., English *long ~ length ~ lengthen; derive ~ derivation ~ derivative*), and applying to sub-classes of the major lexical categories (verbs, nouns, and adjectives). Besides, unlike inflection, derivational morphology does not generally entail one-to-one mappings of form-meaning relations (compare the English Agent nouns *cook ~ baker ~ culinarian,* or the adjectives *considered, considerate, considerable*). There is evidence that the division between the two is not hard-and-fast, but rather takes the form of a continuum, as argued by Bybee (1985) and for Hebrew by Schwarzwald (1991).

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5 Traditional analyses specify 7 different *binyan* patterns, but two of these mark largely predictable alternations between grammatical active and passive (although not necessarily middle) voice, and so are associated with inflectional facets of Hebrew. Focus here is on the five patterns which play a role in lexical derivation and new-word formation processes in the verb system of MH.

The issue of the inflection~derivation dichotomy/continuum is relevant to two main themes of this paper: development and typology. **Developmentally**, children in Hebrew acquire grammatical inflections for tense, number, gender, and case (the latter marked for non-nominative pronouns suffixed to prepositions, as illustrated in fn. 4) well before derivational morphology (Berman, 1985). This reflects a general trend in child language development (Clark and Berman, 2004), in part, at least, because the basic elements of the grammar of the ambient language are mastered by around age 4, whereas lexical knowledge continues to develop well into and beyond school age.[6] Command of a large and varied lexicon is critical for development of derivational morphology, whereas a fairly minimal knowledge of vocabulary is enough to acquire basic inflectional alternations for categories like number, gender, or tense.

2.3 HEBREW TYPOLOGY

The study aims to provide evidence for the early, and continued, impact of what Slobin (2006) characterized as "typological bootstrapping" (and see, too, Berman's (1986) idea of the "typological imperative"). This section touches briefly on inflectional processes in Modern Hebrew (2.3.1) before moving to derivational morphology as the focus of this study.

2.3.1 Inflection in Hebrew

A less Hebrew-specific interplay between morphology and syntax is that, as in other inflectionally rich languages, features of gender and number agreement (Melnik, 2020) interact with both phonology and syntax. Compare (1a) with (1b) and (1c), with inflectional suffixes bolded:

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6 Some, typically more elevated, inflectional categories are not acquired until well into school age. This applies, for example, to Hebrew morphological categories that have both bound and analytical options, like possessive pronouns and genitive phrases, where the more formal, less frequent bound forms are acquired late. Compare *kadur-**i*** 'ball.1st.sg.poss'~*ha-kadur **šel-i*** 'the-ball of-my' both standing for 'my ball'; *yald-ey ha-kita* 'child-3rd.pl.poss the-class' ~ *ha-yeladim šel ha-kita* 'the children of the class' both meaning the class's students (Cahana-Amitay and Ravid, 2000; Kaplan and Berman, 2015).

(1)

    a.   *ha-oto*   *ha-yarok*   *noséa*   *maher* [7]

            DEF.car.MS   DEF.green.MS.SG   travel.MS.SG quick

            'The green car=[truck] goes fast'

    b.   *ha-mxon**it***   *ha-yeruk**a***   *nosá**at***   *maher*

            DEF-car.FM   DEF-green.FM travel.FM   quick

            'The green car goes fast'

    c.   *ha-mxoniy**ot*** *ha-yeruk**ot***   *nos**ot***   *maher*

            DEF-car.FM.PL DEF-green.FM .PL   travel.FM.PL quick

            'The green cars go fast'

The (constructed) examples in (1) illustrate a key feature of Hebrew inflection: It is largely suffixing and hence concatenating.[8] Suffixes mark the categories of (plural) number, (feminine) gender, and tense, with person marked by suffixes in past tense and prefixes in future, as well as possessives, and pronominal case. Prefixes occur only in infinitives (e.g., ***lirkod*** 'to-dance, ***ledaber*** 'to talk'), present tense in some *binyan* patterns (e.g., ***medaber*** 'talks, is-talking', ***matxil*** 'begins'), and future tense. Compare person marking for past and future tense for the intransitive verb meaning 'grow' based on the root *g-d-l: gadál-ti* 'grew.1SG', *gadál-**ta*** 'grew.2SG.MS','*gadál-**t*** 'grew.2SG.FM', *gadl-**u*** 'grew.3PL'; Future ***e*-*gdal*** '1SG-will-grow' (today largely neutralized to 3rd person marking), ***ti*-*gdal*** '2SG.MS- will-grow', ***yi*-*gdal*** '3SG.MS- will-grow'; Infinitive ***li-gdol*** 'to-grow'. Developmentally, the fact that children acquire future tense marking later than present (unmarked for person) or past is not necessarily due to structural

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7 See fn. 1 for transcription conventions. Grammatical glosses follow the Leipzig conventions.
8 Analysis of word-length in Hebrew texts elicited from schoolchildren, adolescents, and adults indicates that inflectional complexity is a major factor in adding to word-length beyond the favored two-syllable structure of Hebrew words (Nir and Berman, in progress).

complexity plus the typological preference for suffixing. Rather, it can be attributed to semantico-pragmatic factors which underlie later acquisition of future tense as a general feature of child language development.

One instance where inflection is neither suffixal nor prefixal but word-internal is in the so-called *benoni* 'intermediate' forms which function as participles and as markers of present tense, as discussed in Section 2.3.2.3 below (Berman 2014). Compare, in the high-frequency *paal* verb pattern, present tense *kotev* 'write(s), is writing' / past tense *katav* 'wrote', *gomer* 'finish(es), is finishing' / *gamar* 'finished.MS.SG'. These examples show that what Schwarzwald (1996) calls "tense-shifting" is marked by word-internal vowels typically Present CoCeC, Past CaCaC. Yet children acquire Present Tense marking in Hebrew, primarily in the verb-pattern illustrated here, early on, using it as what Lustigman (2013) terms an early "bridging strategy" in moving into verb inflection in general, suggesting that word-internal tense-marking is not an obstacle for them.

These comments are relevant to several facets of the interplay between child language and Hebrew morphological structure. First, the fact that Hebrew-speaking children acquire productive command of inflection prior to derivation, as noted earlier, is shared by children speaking typologically different languages. Second, their early reliance on present tense is also shared by children in other languages, so cannot be attributed to the relative structural simplicity or transparency of external affixation to a stem compared with word-internal marking. And third, the fact that prefixal future tense is a late acquisition is also shared by children in other languages, due to factors of semantic and cognitive complexity rather than the typological preference for suffixal over prefixal marking of grammatical categories. These observations underline a key argument of the present study: *Structural complexity* is only one among a cluster of factors that affect order of acquisition of grammatical categories in Hebrew as in other languages.

The examples in (1) show that inflection in MH is almost entirely concatenating, based mainly on suffixes that are largely unchanged since Biblical Hebrew. From a structuralist perspective, this linearity could account for the fact that inflectional morphology is largely acquired early on, by age 4 in Hebrew. It makes better sense, rather, that the relatively early acquisition of inflectional compared with derivational morphology *across languages* is due to the across-the-board, obligatory nature of grammatical inflection. In contrast, as noted before, command of derivational processes in Hebrew as in other languages depends on a large and relatively sophisticated lexicon. And, as discussed next, it involves considerable variation in connecting the morphological form of words to their semantic content.

2.3.2 Hebrew Derivational Morphology

Unlike inflection, classical Hebrew word-structure favored root + pattern *amalgamation* (Gesenius, 1910).[9] Processes of *agglutination* by linear concatenation of affixes to a stem occurred only occasionally in the Bible (e.g., *malx-ut* 'kingdom' from *mélex* 'king', *rišon* 'first' from *roš* 'head'), and increased markedly in post-Biblical times.[10] This is explained by some as due to contact with Arabic and European languages (Bolozky, 1999; Nir, 1993).[11]

The trend to greater use of agglutinated stem+suffix in MH is testified by Schwarzwald's (2001) corpus-based examination of Hebrew dictionaries and written texts, which found a difference between older, more established words compared with recent innovations: Root+pattern amalgamation accounted for around half the older

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9 The psycholinguistic, usage-based perspective of the present paper (as of its author in general) treats root+pattern amalgamation as a more relevant way of analyzing current Hebrew word-formation processes than the phonologically-motivated structuralist approach of prosodic morphology. Evidence from child language and other sources is presented in an earlier study on the topic (Berman, 2012).
10 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 lexicon (Ravid, 2005).
11 While reluctant to add to the plethora of terms for different linguistic phenomena, I adopt the terms 'amalgamated' and 'agglutinative' to shift focus from strictly Semitic or Hebrew phenomena to more general, cross-linguistic processes of word-formation.

items, and linear stem+affix for under 15%; among newer words, the processes were relatively evenly divided between around one-quarter amalgamated and another quarter agglutinating. In a study of new adjectives and names for commercial brands in MH surveying a dictionary and some written texts, Schwarzwald (2006) found a growing tendency to linear formation, accompanied by a decrease in root+pattern construction. In contrast to the commonly accepted view that agglutinating stem+suffix processes are confined to the nominal system, she suggests that stem+suffix linear formation today "extends to verbs which were traditionally considered as derived discontinuously".[12]

Several pyscholinguistically motivated studies also point to the increase in use of concatenating morphology in Modern Hebrew nouns and adjectives. Ravid (2006) argues for "the key role of nonlinear formation in the organization of the Hebrew lexicon", based on evidence from experimental studies of processing and acquisition. She adds anecdotal examples to argue her case: from a Hebrew-speaking adult on a radio talk show using the innovative (and, to Ravid "ungrammatical") abstract nominals *raut* 'badness' from the adjective *ra* 'bad', and *neimut* 'pleasantness' from *naim* 'pleasant', in place of established, amalgamated *róa* 'evil' and *nóam* respectively (in the segolate patterns CéCeC, CóCec as in words like *rémez* 'hint', *néder* 'oath', *dóxak* 'pressure') with initial vowel lowering before a historical pharyngeal ʕ or ħ). A second example is what Ravid terms "the innovative (and completely unacceptable in her judgment) denominal adjective *hitpazruti*" in the action-noun pattern *hitCaCCut* from the verb *le-hitpazer* 'scatter-INTRANS' (cf. *hitkansut* 'assembling, assembly') plus the adjectival suffix *-i*. Ravid interpreted the young man's usage as meaning something like 'not properly aligned', where she would have used the resultative adjectival participle

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12 I take issue with Schwarzwald's analysis here. As examples, she cites the denominal formation of verbs in the *hifil* conjugation like *hišpric* 'splashed' from the noun *špric* 'jet', or *la-xrop* 'to-snooze' from *xrop* 'a snooze'. But these are few and far between in current Hebrew, they are typically based on loan words like these two examples, and so deviate from what I characterize as "productive" processes of word-formation in current Hebrew usage (Berman, 1987, 1993, 2003), as detailed further below. Besides, these stems alternate in other parts of the verbal paradigm, e.g., past tense 3rd person *hišpric* but 1st person *hišprác-ti, hišprác-nu* 'I splashed, we splashed'.

mefuzar 'scattered, disorderly' in the *meCuCaC* pattern (cf. *medubar* 'spoken') for the same situation.[13] Ravid (2020) provides further evidence from child and adult Hebrew to underscore her conclusion that "in terms of usage, linear derivation in nominals is an advanced, literate device for the expression of complex ideas, mastered by Hebrew-acquiring children years later than command of the Semitic root-and-pattern morpheme-level."

Ben-Zvi and Levie (2016) surveyed over half a dozen published studies along with new data on development of derivational morphology by Hebrew-speaking children from preschool across adolescence. Taking what they term "a structural point of departure", they conclude that findings "support nonlinear morphology as the major tool of Semitic word formation in constructing the core verbal and nominal lexicon of Hebrew."

Interesting light is shed on the issue by Seroussi's (2008, 2011) study of derived nouns in Hebrew. Her analyses cover speaker-ratings and usage distributions for a range of psycholinguistic factors, including familiarity and frequency. Her analysis of 2,400 verb-related nouns compiled from different periods in the history of Hebrew - about half from older, more classical (Biblical or Mishnaic) Hebrew and the other half from Modern Hebrew (since the late 19th century) - found that nearly 20% of the target nouns were formed linearly by adding a suffix to other derived nouns with what she calls "a root-based origin". (e.g., from the historical root *q-l-ṭ* 'take in, absorb', the relatively new noun *taklit* 'a record' in the *taCCiC* pattern, and two even more recent concatenated nouns based on it: *taklit**on** '*diskette', *taklit**or** '*CD disk'). Seroussi's ratings by large numbers of Hebrew-speakers for the variables of Familiarity and

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13 I would not call the two abstract-noun coinages *raut* and *neimut* "ungrammatical" since, following Halle (1973), both are possible Hebrew words that observe what he would have called "the morpheme-structure rules" of the language (cf. *taut* 'error' from *li-tot* 'err', *teimut* 'tastiness' from *taim* 'tasty.Adj'. They are merely not established words in the current lexicon of Hebrew, unlike *hitpazrut,* which was used in an unconventional (not necessarily "unacceptable") sense in the context of the example.

Frequency scored significantly higher for older than for modern nouns and for "root-based" compared with linear stem+suffix derived nouns.

As noted, focus in the present paper is on **amalgamating root+pattern** and **stem+suffix agglutinating** processes in MH word-formation - where the stem+suffix structures may be based on root+pattern forms and iterated, but not vice versa (e.g., *yéled* in the segolate pattern from the root *y-l-d* 'give birth' > *yald-ut* 'childhood' > *yaldut-i* 'childish' > *yald-ut-i-ut* 'childishness'.[14]

This division into two major types of word-formation in MH is by no means generally accepted in contemporary research on Hebrew (Shimron, 2003). Hebraists adopt a traditional "root-based" approach, where the historical consonantal root is taken for granted as a key facet of Hebrew word-structure, from different perspectives: typological (Goldenberg, 1994), structuralist (Schwarzwald, 1996, 2002), experimental (Ephratt, 1997).[15] Contemporary linguists since Aronoff (1976) and, more recently, proponents of "prosodic morphology" noted earlier, generally adopt a "word-based" analysis (e.g., Bat-El, 1986, 1989, 1994; Bolozky 1982, 1986, 2003). For them, derivational processes in Hebrew as in other, non-Semitic languages are based on words or bound word-stems: New words derive from existing lexical items, and the consonantal root is relevant, if at all, only for etymological or historical reasons.

I argue, rather, that in a psycholinguistic rather than strictly structuralist perspective - underlying earlier work of my own (Berman, 2000, 2003, 2012) - Hebrew-acquiring children from a young age relate to a **consonantal skeleton** in order to understand unfamiliar words and to coin new words of their own. That is, they do not necessarily have an idea of the abstract, historical root in the words they encounter. This is especially true of the many high-frequency items based on *defective* roots with weak consonantal elements (glides, historical pharyngeals or glottals) which do not appear on

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14 A further process noted here is **zero derivation** by use of present-tense participial forms of verbs as nouns or adjectives (Section 2.3.2.3).
15 And see, too, experimental, structuralist oriented evidence in Berent and Shimron (1997).

the surface in most or all the words constructed out of them. Even educated but non-expert Hebraist adults have a hard time identifying, say, a word like *esa* 'travel.1ˢᵗ.sg.fut = I'll travel' from historical *n-s-ʕ* or *maaxal* 'food' from historical *ʔ-k-l* for *maaxal* 'food' (Seroussi, 2014). Studies using different methodologies such as priming in the work of Frost and his associates (e.g., Frost, Forster, and Deutsch 1997) and taking into account variables comparing speech and writing, younger and older speakers, and speakers at different levels of literacy all support this view: The ancient Semitic root has not died out in MH, it still has psychological relevance even for less tutored speakers, though the construals of all but language specialists are not necessarily in strict accordance with its historical antecedents. On the other hand, at the core of the present study, is the fact that the role of the consonantal root in word-formation has been increasingly supplemented by linearly concatenated derivation, accounting for around 20% to one-quarter of the current (nominal) vocabulary of MH.

2.3.2.1 MH Verb-formation: The binyan system

Hebrew word-formation to this day reflects the traditional division into verbal and nominal lexical categories, setting verbs apart from nouns and adjectives (Goldenberg, 1995; Ravid, 2020). All, although not only, **verbs** are constructed in one of five so-called *binyan* (literally 'building') categories, labeled variously as conjugations, morphological patterns, and/or prosodic templates.[16] These are illustrated in Table 1, listed by their traditional names from the root *p-a-l* 'act, do' and labeled here P1 to P5 for convenience; examples are given for the two structurally productive roots *k-t-b / x-t-v* and *g-d-l* in the morphologically simplex form of past tense, 3ʳᵈ person masculine singular.[17]

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16 This description excludes two patterns that are largely inflectional, representing grammatical passive versus active *voice*, which are traditionally treated as part of the same morphological system. Besides, these are largely irrelevant to child language, in which passives are rare, and late-developing.

17 All generalizations here need to be hedged, since as in derivational morphology in general, the *binyan* system does not reflect 100% one-to-one form-meaning mappings. The idea of "productivity", as elaborated in Section 2.4, refers here to speaker preferences for particular form-meaning matches in

Table 1. Examples of verbs in five binyan patterns from two different roots

	Pattern	g-d-l	Gloss	k-t-b	Gloss	Transitivity[18]	Currently Preferred Functions[19]
a.	*paal* [p1][20]	*gadal*	grow (up) get big	*katav*	write	+Trans ~ Intrans	Basic, neutral, expresses activities, states, change-of-states, rarely used for innovating verbs, highest frequency
b.	*nifal* [p2]	—		*nixtav*	be-written	Intrans	Passive ~ Middle Voice alternate of P1, occasionally of P3, change-of-state "unaccusative" verbs
c.	*hifil* [p3]	*higdil*	enlarge	*hixtiv*	dictate	Trans	Causative, mainly of P1, also of P2
d.	*piel* [p4]	*gidel*	grow = raise	*kitev*	address as CC	Trans	Action verbs, favored for denominal verb-formation
e.	*hitpael* [p5]	*hitgadel*	aggrandize	*hitkatev*	correspond with=write to	Intrans	Middle voice alternant of P4, morphological reflexives and reciprocals

As the table illustrates, not all the meanings listed in the last column apply directly to the glosses for these two sets of examples, reflecting the non one-to-one mapping of

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current usage.

18 Syntactic *transitivity* is reflected in the fact that verbs in p2 and p4 unlike the other three patterns never take the accusative, direct object marker *et,* although they may take prepositional objects, e.g., p2 *nixnas la-xéder* 'enter (in)to the room', p5 *hitanyen ba-inyan* 'take an interest in the matter'.

19 Functions listed in Table 1 are based on psycholinguistic studies characterizing those *favored* in current Hebrew usage (Berman, 1987, 1993, 1995; Bolozky 1986, 1999; Seroussi 2008).

20 For historical reasons explained in relation to Figure 1, *paal* is also termed *qal* 'light',

form-meaning relations in derivation morphology in general. Interrelations between the five patterns are illustrated in Figure 1, where continuous lines represent most common or productive interrelations, dotted lines ones that are lexically more restricted.

Figure 1: Interconnections between the five binyan patterns
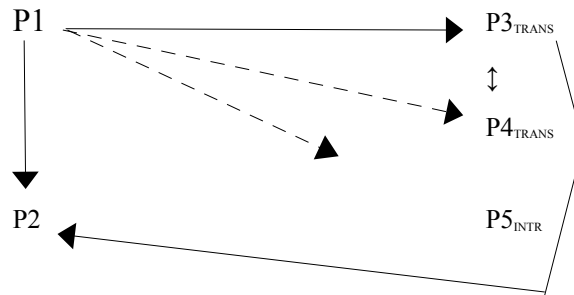
These "two complementary systems" in the verb system of MH (Ravid, 2006)- p1 *paal,* p2 *nifal,* p3 *hifil* / p4 *piel,* p5 *hitpael* - define two relatively productive sets of **form-function interrelations** (in the sense of "productivity" explained in the next section). They were historically distinguished as "light" (*qal*) versus "heavy" (*kaved*) patterns, since the middle of the three radical consonants in the second but not the first set of patterns was geminate (compare p4 *siper* 'told' with p3 *safar* 'counted' both from the root *s-p-r*). Phonological gemination does not apply in Modern Hebrew, but the distinction in Figure 1 remains relevant, since form-meaning mappings and transitivity alternations tend to cluster within the patterns in each of the two groups. This is illustrated by the examples in (2) (Berman, 1993; and see, too Ravid, 2020).

(2) 1. Examples of binyan pattern alternations: p1, p2, p3

    a. *ron* <u>*katav*</u> [p1]   *et*   *ha-pétek*   [Root *k-t-b ~ x-t-v*][21]

    'Ron   wrote   ACC   the-note'

    b. *ha- pétek* <u>*nixtav*</u> [p2] ~ *ha- pétek* <u>*nixtav*</u> [p2]   al ydey   *Ron*

    'The-note is-written' ~ 'The-note   was-written   by   Ron'

    c. *ron* <u>*hixtiv*</u> [p3]   *le-David*   *pétek*   *al*   *ha-nose*

    'Ron dictated   to David   (a) note   on   the topic'

2. Examples of binyan pattern alternations: P4, P5

    a. *ron*   *perek* [p3]   *et*   *ha-migdal*

    'Ron   took-apart   ACC   the-tower (of blocks)'

    b. *ha-migdal*   <u>*hitparek*</u> [p5]

    'The-tower   fell-apart'

In their spontaneous usage, children use verbs in all five *binyan* patterns from an early age, as shown in Table 2 (from two studies reported in Berman, 1982, p. 178).

Table 2: Distribution of verb-patterns in usage of children at play in nursery-school

	Study A	Study B
Age Range	3 - 4	3 years
<u>Total Forms</u>	<u>1,049 [verb tokens]</u>	<u>160 [verb roots]</u>
a. p1 *paal*	66.5%	55.5%
b. p3 *hifil*	13.5%	14.5%
c. p4 *piel*	9.0%	14.5%
d. p5 *hitpael*	6.5%	8.0%
e. p2 *nifal*	3.0%	5.0%

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21 Alternations between the stops *b, p, k* and their spirant version were originally specified by phonological features of gemination and syllable structure, but today are largely lexically determined.

Spoken and written usage of Hebrew-speaking schoolchildren, adolescents, and adults show the same distributional trends - relative predominance of p1 *paal,* favoring of the two typically transitive patterns p3 *hifil* and p4 *piel* compared with less use of intransitive p5 *hitpael* and p2 *nifal.* Older speaker-writers, however, show more variety (less reliance on p1 *paal,* more interrelated forms of the same root in a single piece of discourse) than young children (Berman, 2007).

2.3.2.2 Noun and Adjective Formation in MH

Unlike verbs, Hebrew nouns and adjectives are **structurally mixed**. They include words that are "non-derived", in the sense that they are morphologically unrelated to other words based on the same root. These include (i) basic or primitive items like the nouns *sus* 'horse', *šulxan* 'table' and the adjectives *gas* 'crude', *varod* 'pink'; and (ii) loan words that are phonetically adjusted to Hebrew vowels and consonants (e.g., *rádyo, šókolad* and the Arabic loan adjectives *axla* 'great, cool', *mabsut* 'pleased'). Of concern here are *derived nouns and adjectives,* defined as belonging to a "family of words" with two or more items based on the same consonantal root and having related meanings. Unlike the restricted *binyan* patterns of verbs (which are limited in number; manifest semantic relations between them; and represent syntactic alternations), derived nouns and adjectives may be either (i) amalgamated by interdigited consonantal roots *or* (ii) formed by concatenation of a stem plus suffix.[22] In the former case, these take the shape of so-called *miškal* literally 'weight' patterns, represented here as combinations of consonantal roots plus syllabic affixes - for example, the so-called "segolate" noun pattern CéCeC as in *yéled* 'boy', *kélev* 'dog', *kéšer* 'knot', *séfer* 'book'; or *miCCaC* as in *miklat* 'shelter', *mispar* 'number', *mixtav* 'letter', *migdal* 'high-rise'. As these examples show, nominal patterns stand for a variety of semantic classes, illustrated in

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22 Nouns and adjectives may also be formed linearly with prefixes, but these are largely high-register items often based on Greek or Aramaic prefixes, and so non-occurrent in child language, e.g., *xad-memadi* 'uni-dimensional' *du-sitri* 'two-way', *al-tivi* 'supernatural', *tat-hakara* 'sub-conscious (n.)'.

(3) for the roots *g-d-l* 'grow' and *k-t-b* 'write', with dashes representing accidental gaps in the current lexicon.

(3) Illustrations of nouns formed by two morphological processes

Interdigited, amalgamated Nouns and Adjectives

CaCaC	—	*katav* 'reporter'
CicuC	***gidul*** 'growth'	*kituv* 'caption'
CoCec[23]	—	***kotev* 'writer'**
CóCeC	*gódel* 'size'	—
CCaC	---	*ktav* '(hand)writing'
CCiC	*gdil* 'tassel'	*ktiv* 'spelling'
CaCaCa	—	*katava* '(news) report'
CaCCan	—	*katvan* 'typist'
CCóvet	—	*któvet* 'address'
CCiCa	*gdila* 'growing (bigger)'	*ktiva* 'writing'
haCCaCa	*hagdala* 'enlargement'	*haxtava* 'dictation'
hiCCaCCut	*hitgadlut* 'aggrandizement'	*hitkatvut* 'correspondence'
meCaCeC	*megadel* 'raiser, farmer'	*mekatev* 'captionizer'
miCCaC	*migdal* 'highrise, tower'	*mixtav* 'letter, missive'
taCCiC	*tagdil* 'enlargement'	*taxtiv* '(a) dictate'
CCuCa	*gdula* 'greatness'	*ktuba* 'marriage-contract'
maCCeCa	*magdela* 'enlarger'	*maxteva* 'writing-desk'
tiCCóCet	—	*tixtóvet* 'correspondence'

Adjectives

CaCVC	*gadol* 'big'	*katuv* 'written'
meCuCaC	*megudal* 'overgrown'	—

Agglutinated Stem + Suffix Forms

+ -ut:	*gadlut* 'grandeur, bigness'	*katvanut* 'typing, stenography

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

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23 The patterns CoCec, meCaCeC, maCCiC, meCuCaC take the form of present-tense verbs serving as nouns or adjectives by zero derivation (see Section 2.3.2.3)

CaCCan (hypothetical 'grower'); and neither *g-d-l* nor k-*t*-*v* occurs in the common, semantically varied *segolate* noun pattern CéCeC noted earlier. Second, typically for derivational processes, 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 *misrad* 'office', *miklat* 'shelter'). 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 the abstract suffix -*ut* in *katvan-ut* 'stenography' from *katvan* 'typist', *gadl-ut* 'greatness' from *gadol* 'big, great' (Bolozky and Schwarzwald, 1992).[24] The most productive means of deriving agglutinative **denominal adjectives** by the suffix -*i* is not represented in (3), for example: *tipeš* 'fool' > *tipši* 'foolish', *cava* 'army' > *cva**i*** 'military', *memšala* > *memšalti* 'government-al' (Ravid and Shlesinger, 1987). These processes can themselves be concatenated, as in *séfer* 'book' > *sifrut* 'literature' > *sifruti* 'literary', *yéled* 'child' > *yaldut* 'childhood' > *yalduti* 'childish' > *yaldutiyut* 'childishness'.

To sum up this section on word-formation in MH, consider the options available to Hebrew speakers from both types of derivation, amalgamated and agglutinating, in words in the established lexicon derived from the historical root *ħ-š-b* in (4), by lexical category.

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24 The same suffixal elements may occur both in what are traditionally viewed as *miškal patterns* as in the agent noun form CaCCan (e.g., *katvan* 'typist' < p1 *kotev* 'write(s)', *saxkan* 'actor' < p3 *mesaxek* 'act, play') compared with noun-based use of the same agentive ending -*an* in words like *psanter* > *psantran* 'pianist', *mizrax* > *mizraxan* 'orientalist'. This is also true of the abstract noun suffix -*ut* as in the verb-derived action nominals *hitkatvut* 'correspondence, corresponding' from p5 *le-hitkatev* 'to-correspond' or *himanut* 'avoidance' from p2 *le-himana* 'to avoid' versus the noun / adjective + suffixal forms *yald-ut* 'childhood', *sifr-ut* 'literature', *gadl-ut* 'greatness', *negiš-ut* 'accessibility'.

(4)

Verbs [In 5 different verb patterns, p1 to p5, as shown in Table 1, in the structurally simplex past, 3rd.masc.sg]

xašav 'think' [P1]

nexšav 'be regarded' [P2]

hixšiv 'regard (as)' [P3]

xišev 'calculate' [P4]

hitxašev 'consider, be considerate of' [P5]

Nouns [In varied semantic categories, linearly added suffixes in **bold**]:

xašiva 'thinking, thought'	DERIVED ACTION NOMINAL [PATTERN 1]
xišuv 'calculation'	DERIVED ACTION NOMINAL [PATTERN 4]
hitxašvut 'considerateness'	DERIVED ACTION NOMINAL [PATTERN 5]
xašav 'actuary, accountant'	AGENT NOUN [CaCaC]
xešbon 'account, receipt'	CONCRETE OBJECT
xašivut 'importance'	ABSTRACT NOUN
xišuviyut 'computation'	ABSTRACT NOUN
maxšava 'thought'	ABSTRACT COUNT NOUN [maCCeCa]
maxšev 'computer'	INSTRUMENT [maCCeC]
maxševon 'pocket calculator'	INSTRUMENT

Adjectives

xašuv 'important'	[CaCuC pattern]
mexušav 'calculated'	[meCuCaC passive participle]
mitxašev 'considerate'	[p5 *benoni* participle]
xišuvi 'computational'	[plus denominal *-i*]
maxšavti 'mental, thinking'	[plus denominal *-i*]

The forms in (4) underline several generalizations relevant to the derivational processes of amalgamation and agglutination in MH. (i) While the root *ħ-š-b* is the basis for numerous words in the lexicon of MH, with a larger than usual "family size" of root-related items (de Prado Martin et al., 2005), it still has gaps. For example, there is no word *xésev in the common segolate C*éCeC* pattern for nouns, nor do current Hebrew dictionaries have an entry for the word *xašiv (theoretically 'thinkable, calculable' from the CaCiC pattern signifying adjectives of potentiality); (ii) the form-meaning relations are not fully predictable: for example, *maxševon* with the diminutive ending *-on* could mean 'laptop = little computer' and not pocket-calculator, and *xasuv* 'important' is in the CaCuC pattern used typically for resultative adjectives like *nahug* 'driven', *banuy* 'built' - justifying the words in (4) as belonging to lexical derivation rather than grammatical inflection; (iii) the same root occurs, atypically, in all five *binyan* verb-patterns, and also in the two passive-voice patterns CuCaC as *xušav* 'be-calculated', huCCaC as *huxšav* 'be considered"; (iv) there are **fewer concatenated forms** (with the suffixes *-ut, -on, -i*) compared with amalgamated derivations; (v) concatenation can be recursive, as in *xišuv + i + ut* 'computing + ADJ + ABS' > 'computationalness' ; (vi) some linearly attached suffixes are multifunctional (for example the suffix *-on* marks Instrument nouns in *maxševon, xešbon,* but it is also used for diminutives as in *xadron* 'little room', *yaldon* 'little boy' or for printed organs like *iton* 'newspaper', *šavuon* 'weekly'. In contrast, some suffixes manifest regular one-to-one form/meaning mappings, as in the case of *-an* for agent/instrument nouns, *-ut* for abstract nouns and *-i* for denominal adjectives.

2.3.2.3 Zero derivation

Given the rich and varied alternatives of derivational structures in Hebrew, it is not surprising that the language allows little in the way of *zero derivation*, a change of lexical class without any morphological marking. In Hebrew, this is confined to cases where verb-forms in the *benoni* 'intermediate' participial/present tense form (and they

alone) may undergo *syntactic conversion* to form nouns or adjectives (Bat El, 2008; Berman 1978: 139-179; Berman, 2017). These possibilities are illustrated in (5).

(5) Examples of *benoni* form verbs functioning as nouns, or adjectives:

p1	*šofet* 'judge(s)' ~ 'a judge'	*bolet* 'stand(s) out' ~ 'conspicuous'
	orex 'edit(s) ~ an editor	*corem* 'grate(s)' ~ 'grating, irritating'
p2	*nispax* 'be attached' ~ 'attaché/ment'	*nimas* 'be ~ is tiring' ~ 'hateful'
	nivdak 'be tested' ~ 'testee'	*nisbal* 'be-suffered' ~ 'sufferable'
p3	*madrix* 'guide(s)' ~ 'a guide ~ manual'	*madhim* 'amaze(s)' ~ 'amazing'
	manhig 'lead(s)' ~ 'a leader'	*mafxid* 'frighten' ~ 'scary'
p4	*meamen* 'train(s)' ~ 'trainer'	*mevader* 'amuse' ~ 'amusing, funny'
	megašer 'bridge(s)' ~ 'a coach'	*mesapek* 'supply' ~ 'sufficient'
p5	*mitamel* 'practice(s)' ~ 'gymnast'	*mitpanek* 'coddles' ~ 'self-indulgent'
	mitbager 'mature(s)' ~ 'adolescent'	*mitnadned* 'wobble' ~ 'wavering'

Zero derivation is morphologically, lexically, and, in the case of nouns, also semantically restricted in Hebrew, since it applies only to agentive or the related inanimate instrument nouns (Clark and Berman, 1984). As such, it contrasts markedly with a language like English (Clark and Clark, 1979), where this is a highly productive process, both syntactically and in the lexicon (e.g., a word like *round* can function as an adjective, a verb, a noun, a particle, or a preposition).

Although restricted in both form and frequency, zero formation is of interest for the conflict it entails between the two psycholinguistic principles noted in the next section: *simplicity* (maximal-due to no change in form to mark a change in lexical category) and *transparency* (minimal-due to no surface marking of differences in lexico-grammatical function).

2.4 PSYCHOLINGUISTIC PRINCIPLES IN LANGUAGE ACQUISITION

This section moves to child language to consider factors underlying *shared developmental trends* in what Pléh (1990) termed "the search for universal operating principles in language acquisition". Three such principles are particularly relevant to acquisition of derivational morphology in Hebrew as in other languages: simplicity (§2.4.1), transparency (§2.4.2), and productivity (§2.4.3), combined with the impact of ambient language typology (§2.4.4) in cross-linguistic perspective.

2.4.1 Simplicity of form

Reference here is to Eve Clark's idea of the role of *simplicity of form* in child language, that is, the degree of change required by a given form, on the assumption that the less a form changes, the simpler it is (1993: 119-122). *Prediction I* for the present study would be that words that do not alternate across lexical classes would dominate in child language, at least in the early stages. For Hebrew, this would mean a favoring in use of *benoni* verbs for innovating nouns and adjectives by zero derivation, as noted in the preceding section.

The factor of simplicity is, however, relatively limited from the perspective of the present study, for two reasons. First, it applies mainly at the initial stages of language acquisition, before age 3, when children begin to work on derivational morphology both in the conventional lexicon and in their innovative usages, as will be seen in Section 4. Second, typologically it is well suited to a language like English, where syntactic conversion plays an important role in word-formation, but less so for Hebrew.

2.4.2 Transparency

This term refers to the one-to-one mapping of form-meaning relations, so that, ideally, each grammatical or semantic element would have its own unique representation in the surface form of words. In processes of word-formation, (Dressler, 1985; Slobin, 1980), "transparency" refers to the *compositional clarity* of morphologically complex words

as affecting the order of lexical acquisition (Berman 1987, 2003; Clark, 2003; Clark and Berman, 2004).

The notion of 'transparency' figures from various perspectives in linguistic and psycholinguistic research, including surface evidence of phonological processes (Kiparsky, 1973, 2000; McCarthy and Prince, 1999), semantic or contextual (dis)ambiguity (Jackendoff, 1983; Keenan and Ebert, 1973), and the structural interpretability of children's productions, in terms of their grammatical target words (Lustigman, 2012, 2016). And in Hebrew research, derivational processes that involve amalgamation are considered more marked than stem plus affix agglutination, in terms of both the changes applied to the word stem and the clarity of stem-affix boundaries in the derived words (Ravid, 2006; Schwartzwald, 2019).

These varying accounts of transparency take into account the clarity of the structural boundaries, of the grammatical components of linguistic constructions, and the ability to interpret evidence of linguistic processes based on examination of linguistic forms. From the point of view of language acquisition, transparency can be seen as a structural feature that facilitates grammatical growth.

This yields *Prediction II,* that agglutination by stem plus external affix would be favored from the start for lexical innovation in Hebrew child language over and above the more intertwined representation of elements of meaning in amalgamation of root - affix associations.

2.4.3 Productivity

The notion of 'productivity' is also used in different senses in (psycho)linguistic research. In linguistics, a 'productive operation' is one that applies with relatively few constraints, to a large number of items, so that productivity represents a structural property of both forms (e.g., affixes) and operations (e.g., affixation) (Aronoff and Schvanefeldt, 1978; Baayen, 1992; Berman, 1987, 1993, 2003). From this perspective, for example, inflection is more productive than derivational morphology, since it

applies with fewer constraints to a larger number of items (Anderson, 1988; Schwarzwald, 1982). In studies that adopt this perspective, productivity is typically viewed as interacting with a range of structural as well as usage-based factors, including lexical compositionality, semantic transparency, and frequency.

In child language research, the notion of productivity is used in other senses. Productivity in acquisition of grammar is often identified by children's ability to apply structural operations to a set of items in a meaningful and consistent fashion as opposed to rote-learning of selected items (Berman, 1978; Bowerman, 1990; Lieven et al., 2003; Lustigman, 2013; Tomasello et al., 1997). Productivity in this sense does not characterize either forms or operations *per se*, but rather children's use of linguistic forms, as reflecting their linguistic competence.

From the *usage-based* perspective of the present author, productivity refers to the items and constructions currently favored by educated although non-expert speaker-writers for expression of form-meaning relations in their language. As such, the notion is particularly relevant to the domain of derivational morphology, as shown by studies on word-formation processes preferred by Hebrew-speaking adults (Berman, 1987, 1995). It also suggests that *frequency* of use, including in adult input to children is a factor closely related to productivity (see Section 3.2 below).

Productivity here thus does not mean the same as generally used in relation to child language, as going beyond rote-learned memorized items (Lustigman, 2013; MacWhinney, 1978). Nor does it mean the same as used by linguists, as constrained or across-the-board a given morphological process is in *structural* terms. (For example, English denominal adjective-formation with the orthographic ending *-y* is structurally confined to monosyllabic words of Germanic origin like *dirty, fussy, funny* or children's innovative *jammy, soapy*), whereas suffixes like *ate, able, al, ary* used in adjectives derived from Graeco-Romance-based nouns are structurally and lexically restricted (compare earlier *consider**ate** ~ consider**able**, industri**ous** ~ industri**al**, liter**al**

~ *literary*). Rather, productive word-formation here refers to processes that non-expert speakers, including young children and educated native-speaking adults, *favor* when deriving new lexical items and when interpreting unfamiliar words.

Examples of "productive" word-formation processes in today's Hebrew and based on structured elicitations mentioned earlier in this paper include: (1) **New verbs** are typically denominated in the *piel* verb pattern rather than in the lexically commoner *qal* (*paal)* pattern (e.g., *le-fašel* 'mess up' from Arabic *fášla* 'a mess-up', *le-malcer* 'to-wait (on tables)' from *melcar* 'waiter'); (2) **new resultative, endstate adjectives** are typically innovated in one of the three passive participle forms marked with *u* - CaCuC, meCuCaC, muCCaC (e.g., *haduk* 'closely linked' from *lehadek* 'tie together', *mefušal* 'messed-up, spoilt', *mušmac* 'bad-mouthed, libeled' from *le-hašmic*); and (3) new **potentiality adjectives** are today coined in the CaCiC pattern (used for Agent nouns like *nasix* 'prince*', qacin* 'officer' in Biblical Hebrew), as in *kavis* 'washable', *kavil* 'acceptable', *nagiš* 'accessible'; while (4) **denominal adjective** formation relies almost exclusively on word-stems with the external suffix *-i* (as in *taasiyat-i* 'industrial', *exut-*i 'qualitative', *paštan-i* 'simplistic'), contrasting with verb-based adjectives in passive participial forms with internal *u* or in monosyllabic words like *kal* 'easy', *rek* 'empty' or bisyllables like *nagiš* 'accessible', *yarok* 'green', *tafel* 'tasteless'.

Importantly, as the hedging terms *typically, largely, almost* indicate, *productivity* is a **relative** rather than absolute term, it applies to forms that people largely favor or prefer, typical of lexical usage, as against more obligatory, across-the-board grammatical structures, on the one hand, and well-established terms from earlier in the history of the language, on the other. In fact, for linguists who view grammar as a "dynamical system that is constantly changing by virtue of psychological processes involved in language use" (Diessel, 2007), the impact of *frequency of usage* applies to language in general, both lexicon and grammar. And it underlies this investigation of the relative reliance on amalgamating or agglutinating processes in constructing new words in MH.

From the point of view of language acquisition and development, the principle of productivity in usage yields two related predictions. *Prediction IIIa* - children will rely in their lexical innovations on the most commonly used form-meaning mappings in their language; and *Prediction IIIb* - the impact of frequency of usage in the language in general and in child-directed speech in particular will be so powerful as to outweigh the principles of simplicity and transparency.

2.4.4 Ambient language typology

The fact that children's construal of linguistic structure and language use is critically impacted by dominant typological properties of the ambient language has been demonstrated for various domains in crosslinguistic research, for example: in phonological templates (Lustigman, 2013; Vihman and Croft, 2007), encoding of grammatical categories (Granlund et al., 2019; Slobin, 1997), spatial semantics (Bowerman and Choi, 2001), expression of motion events (Slobin, 2004), word class distinctions (Pfeiler, 2017), and narrative construction (Berman and Slobin, 1994).

A particularly convincing example of the interplay between morphological structure and ambient-language development is provided by Turkish, an agglutinating language, in which suffixal morphemes attach to a word-stem like ''beads-on-a-string''(Oflazer, 2014). Not only do these suffixes occur invariantly in the same order and the same form in all contexts (except for phonetically conditioned vowel harmony), they include both inflection (e.g., for person, number, case, tense, aspect) and derivation (of adjectives and adverbs from nouns and verbs, for example). This consistency and regularity of form-meaning relations in Turkish has the effect of "precocious acquisition of grammatical morphology and lack of overgeneralizations" in Turkish child speech, with the "entire set of noun inflections and much of the verbal paradigm (being) mastered by 24 months of age or earlier" (Aksu-Koç and Slobin, 1985). And it contrasts markedly with the lengthy path to standard usage in both English, as a language with impoverished but

often irregular morphology (de Villiers and de Villiers, 1985), and morphologically rich Hebrew, as noted further below.

Prediction IV suggests that there is a complex interplay between shared, general developmental principles of simplicity, transparency, and productivity with the specifics of a particular ambient language. As I have argued elsewhere, children are from an early age peculiarly attuned to the specific nature of the language they hear around them, This means that they are readily able to process typological peculiarities that may be a formidable challenge to foreign language learners of, say, Turkish grammatical agglutination or Hebrew lexical amalgamation, on the other (Berman, 1986).

3 THE PRESENT STUDY

Given all the prior research on child as well as adult usage in MH word-formation, what does the present investigation hope to add? First, it focuses on a *particular issue* in developmental perspective: children's preference for amalgamated versus agglutinating processes in derivational morphology. Second, except for one description of adult input (§ 3.2), the data-base for this study relies largely on *innovations,* coinages produced either by structured elicitations or in children's spontaneous speech output, rather than established forms in the MH lexicon. Third, the topic at issue is addressed in terms of the interrelations between the psycholinguistic factors of simplicity, transparency, productivity, and ambient language typology outlined in the preceding section.

This section outlines the data-base and procedures used in the present study (3.1) followed by findings for distribution of the two target processes (amalgamation and agglutination) in adult input to children (3.2).

3.1 DATA-BASE

The study relies on both naturalistic and experimental data on young children's innovations of verbs, nouns, and adjectives in MH. The data-base of children's

naturalistic speech output consists of around one thousand innovative and unconventional lexical usages from dozens of different children, ranging in age from 18 months to early school age - all typically developing, from monolingual, mainstream Hebrew-speaking backgrounds in conversational interaction with an adult (occasionally, among the older children in Sample (i) with siblings or peers). These were culled from several sources: (i) parental reports covering novel usages documented in the spontaneous speech output of some four dozen children (Berman and Sagi, 1981); (ii) cross-sectional adult-child interviews consisting of 20 children at each of the four year-groups from 1-2 years, 2-3, 3-4, and 4-5, where either a parent or a speech therapist investigator conducted a conversation with the child, lasting from half an hour to 50 minutes (Dromi and Berman, 1986); and (iii) longitudinal samples of caretaker-child interactions with four children (three girls and a boy) between age 1;6 to 3;0 years recorded in several sessions coming to one hour per week (Lustigman, 2015).

The experimental data are based on a research design first used by Eve Clark and her associates in studies with children speaking different languages, as reviewed in Clark (1993), including Hebrew (Clark and Berman, 1984, 1987, and summed up for Hebrew in Berman, 1995). In the present context, novel forms were taken from those produced by children in different settings. In production tasks, children are given familiar words as source input items, and are required to use them for coining novel output items. Examples are given in (6):

(6) Structured elicitations of lexical innovations in Hebrew

Domain: **Deverbal Noun-Formation:**

Task: Coining novel (agent and instrument) nouns from established verbs

Example: **Source:** "What would you call a person whose job is to jump [=

likpoc], someone who likes to jump?"

Possible Target Coinages: *kofec,*kafcan, *kapac, *mekapcan

Domain: **Denominal Verb-Formation:**

Task: Coining novel verbs from established (place, object, instrument) nouns and adjectives

Example: **Source:** "I'm putting these beads in a box [= *kufsa*], what am I

doing to the beads, what do I do with the beads when I put them in the box?"

Possible Target Coinages: *kofes, *mekafes, *makfis, *makpis

The experimental studies analyzed for the present study required children to coin new words from familiar lexical items, as illustrated in (6), to produce four types of derivations: (i) input Place nouns like *šulxan* 'table', *kise* 'chair' or *sal* 'basket'; (ii) with Instrument nouns as input, the investigator would say "I'm going to give the teddy-bear a hammer = *patiš /* a spoon = *kaf,* an axe = *garzen* to work with, what is the teddy-bear doing?"; (iii) with Object nouns as input, the instruction was "here's a dollhouse for you to fix up, you're going to give the house walls = *kirot /* curtains = *vilonot /* shutters = *trisim,* what am I doing to the house?" ; and (iv) for Causative derivations, children were shown a large pot of soup and asked how they could change the soup by making it pink = *varod,* brown = *xum,* clear = *tsalul* (Berman, 2003).

Tasks using this design have the advantage over most structured elicitations in morphology, since they provide participants with a semantic representation of the required output coinage by giving them genuine (and familiar) words as input. They thus depart from tasks like Berko's (1958) classic "wug-test", as accepted in psycholinguistic research on the lexicon to this day, which use structurally acceptable but semantically opaque *nonce-words* as input items. Yet, importantly, our design also

avoids the effect of rote learning of familiar vocabulary items that may be acquired and stored as unanalyzed items in children's lexical repertoire, in order to tap children's creative knowledge of morphological processes. Our procedure at one and the same time requires innovations rather than rote-learned extant forms, but it also ensures that children's coinages are based on established semantic associations with words that they already know. The results of these studies have been documented in previous contexts, but not from the point of view at issue here, of the contrast between amalgamated versus agglutinating word-formation. Comparison of the results of the structured elicitations with children's innovations in the course of their spontaneous speech output show highly similar trends in terms of both age-related developments and coinage preferences although not necessarily with the same timetable (Berman, 2000). This justifies combining our findings from different procedures and data-bases in the present study.

The experimental elicitations of the data-base for the present study take into account forms innovated by children performing two different tasks: deriving novel nouns from familiar verbs and adjectives and forming novel verbs based on familiar nouns and adjectives. In each case, data are based on forms produced by 60 children, 12 each at five different age groups, three preschool groups and two school-age groups (average ages 3;5, 4;7; 5;6, 7;5, and 9;6).

3.2 NOUN-TYPE FREQUENCY IN CHILD DIRECTED SPEECH

Before proceeding to findings from this data-base, I decided to test the impact of *frequency of usage* (Diessel, 2007; Naigles and Hoff-Ginsburg, 1998) on language acquisition, here, of derivational morphology. I examined the language addressed to children (Child-Directed Speech, CDS) rather than by frequency counts of the established lexicon reported in earlier studies of derivation in MH as occurring in texts or dictionaries. The data-base used for this purpose consists of transcripts of adults in one-on-one conversational interchange with 20 Hebrew-speaking children at each of

five year-groups between age 1;0 to 1;11 and age 4;1 to 5;6 (Dromi and Berman, 1986). I counted the morphological classes of Nouns and Adjectives (types, not tokens) that adults (mothers or outside investigators) addressed to children in each year-group.

Findings were as follows: Among words used with the youngest children, **aged 1;3 to 1;11** years, the vast bulk of items were "basic" or underived terms for food, toys, animals, body-parts, etc. (e.g., *sus* 'horse', *buba* 'doll', *óto* 'car')'; these were followed by amalgamated nouns (e.g., *mivréšet* 'hairbrush' - cf p3 *le-havri*š *'to-brush hair'*, *nešika* '(a) kiss' < p4 *le-na*šek *'to kiss'*, *galgal* 'wheel' < p4 *le-galgel* 'to-roll'); and there were relatively few adjectives (e.g., *katan* 'small', *kaxol* 'blue', *yafe* 'pretty'). Only **three** linearly suffixed nouns occurred in the adults' speech: *avir-on* 'airplane' from *avir* 'air', *tinok-i* 'baby-DIMINUTIVE', *kap-it* 'teaspoon' from *kaf* 'spoon', as compared with dozens of amalgamated nouns.

Child-directed speech (CDS) with **two-year-olds,** aged 2;0 to 2;11, shows much the same trends, but with different proportions in the breakdown of nominal vocabulary items in adults' usage: The proportion of basic or non-derived nouns (including more specific, less frequent terms like *karbólet* 'crest of a hen', *nocot* 'feathers', and loan words like *telefon, rádyo*) decreases, though they are still considerably more frequent than other relevant categories. The latter included (i) derived nouns (e.g., *meluna* 'kennel' < *la-lun* 'to sleep', *mitpaxat* 'handkerchief', *migdal* 'tower'); (ii) more sophisticated adjectives (e.g., *maher* 'quickly', zero-derived *meanyen* 'interest(ing)' and, (iii) occasional stem+suffix forms (*ug-**iya*** 'cookie' < *uga* 'cake', *ša-**on*** 'watch, clock' < *šaa* 'hour').

The same trends were observed in the language addressed to **3- and 4-year-olds**, the bulk of nouns were "basic", non-derived (e.g., *xalon* 'window', *arnav* 'hare', *xol* 'sand'); a small percentage (between one-fifth to a quarter of the nouns) were verb-derived (e.g., *avoda* 'work, job' from *la-avod* 'to work', *mekarer* 'refrigerator' from *le-karer* 'to-cool', *maclema* 'camera' from *le-calem* 'to-photograph'); and, again,

concatenated forms were rare (e.g., *pil-on* 'little elephant', *dub-i* 'teddy-bear' from *dov* 'bear').

In sum, across a large corpus of child-addressed speech, (i) "basic" non-derived nouns like *šulxan* "table', *balon* 'balloon', *arye* 'lion' predominated (Berman and Seroussi, 2011) - although, with the older children, these included relatively more abstract terms like ones relating to time (*maxar* 'tomorrow', *ha-sof* 'the-end', *šana* 'year'); (ii) derived nouns constituted a relatively small part of the input across age-groups, less than one-quarter of the nouns used by adults in talking to children aged one to five years; these, too, were almost entirely of the amalgamated kind (e.g., *nešika* 'a kiss' from *le-našek* 'to give a kiss', *ciyur* 'a drawing' from *le-cayer* 'to draw', *prusa* 'a slice' relating to the verb *li-fros* 'to slice (a cake)' - again, referring mainly to concrete rather than abstract entities or states, with a few exceptions, addressed to the older children, like *šena* 'sleep' from *li-šon* 'to sleep', *hatxala* 'beginning', *tafkid* 'role, function'; (iii) concatenated forms of stem + suffix (e.g., *pil-on* 'a little elephant', *sukar-ya* 'candy' from *sukar* 'sugar') were few and far between, less than a dozen words across the entire sample; and (iv) adjectives increased in both number and sophistication with age (including less basic terms like *sagol* 'purple', *xadaš* 'new', *saméax* 'pleased, happy'), but formed only a small part of the input lexicon across age-groups, as attested for child language for Hebrew as well as other languages. In Hebrew-specific terms, adult input did not contain a single denominal adjective formed linearly with the suffix *-i,* earlier noted as typical of an advanced, more literate vocabulary like *abah-i* 'paternal' from *aba* 'father' or *yaldut-i* 'childish'.

4 FINDINGS

Results of comparisons of children's innovations by amalgamating root + pattern versus agglutinating stem + suffix are presented separately for verbs (4.1) and nouns (4.2), followed by a few comments on adjectives (4.3).

4.1 VERBS

In order to succeed at the task illustrated in (3.1), children needed to produce novel items that were well-formed not just as possible words in Hebrew, but also as possible verbs in the language. This means they must be based on one of the small number of *binyan* conjugation patterns that specify the morphophonological shape of all verbs in Hebrew. Starting with the structured elicitations, very few of the children's novel verbs deviated from these patterns. Across tasks, from age 4;1 up, children produced **over 90%** innovative verb forms, the vast majority of which were possible, though non-extant verbs. Less than 5% of the verbs innovated by the youngest children aged 3 and 4 years (29 out of 667 innovations on one test) were ill-formed as verbs, and only 22 took the form of nouns with diminutive or other suffixes - e.g., *madaf-it* `shelfie' from *madaf* `shelf', the innovative diminutive form *siróni* from *sir* `pot' [Hila, 3;8], or the diminutive-like noun coinage *maxteron* from *máxat* `needle' [Rotem, 4;4] -- and nine of these were given by one child, Ya'ara, aged 4;11.

On another test, the 3-year-olds also encountered difficulties with the task, coining relevant verbs only around half the time. A few of these were ill-formed as Hebrew verbs, e.g., from the adjective *muzar* 'strange', a child produced the verb *memazrir* [Omer, 3;10] for required p4 *memazer* or p3 *mamzir* 'makes strange', and another gave the form *mafsal* for putting beads on a bench *safsal* [Tomer 4;0] in place of possible P4 *mefasel,* the extant verb meaning 'sculpt' from *pasal* 'sculptor', *mesafsel* 'to bench (in sports)' or non-occurrent P3 *mafsil* 'to put on a bench'. But such errors were occasional, and confined to younger children. None of their coinages took the form of stem + suffix, and only three out of nearly 500 required innovations (12 participants in each age-group X 40 input items) took the form of prefix + stem, with the infinitival *le-* in *le-aron* 'to closet' from the noun *aron* 'closet' [Michael 4;3] (cf. *le-amen* 'to-train'); the tense marker *me-* in *mekise* 'to chair' from *kise* 'chair' [Tal 5;1] (cf. *me-xase* 'to-cover'; and

metaim 'to give taste to' from *taim* 'tasty' [Tally, 5;0] (cf. P3 *metaem* 'coordinate', P5 *matim* 'suit').

Similar findings emerged from over 200 non-conventional verbs that children innovated in their spontaneous speech output (corpus (i) of those described in Section 3.1). Here, too, they coined verbs in one of the five *binyan* patterns constructed out of traditional root + pattern amalgamation. Before age 5, children often substitute one pattern for a verb that exists in a different pattern: e.g. *lo **bihálti*** [p4] *me-hacfira* 'I didn't affright from the-siren' for established p2 *lo **nivhálti*** [Keren, aged 3;3]; *ha-mocec **hitabed*** [p5] *li* 'the pacifier got-lost [conventional 'killed itself'!] to-me' [Meital, 3;10] in place of conventional ***neebad*** [p2], normative *neevad*; or, on another occasion, the same child answered her mother's query about where her pacifier was by saying *axota* p3 ***ibída** li oto* 'Her sister lost it to me' [Meital, 3;11] in place of p4 ***ibda -*** all four possible Hebrew verbs based on the historical root *ʔ-b-d*.

Other novel verbs produced by 3- to 5-year-olds, in the P4 *piel* pattern favored for denominal verb-formation in current Hebrew, were: *le-karem* from 'krem', to smear with cream, *te-kafkef-i* 'IMP.2nd-spoon-2nd.FEM' from *kaf* 'spoon' asking his mother to give him the icecream on a spoon, *le-raket* from *rakéta* 'tennis racquet' for playing tennis, *smirtate-ti* 'rag.PST.1SG' from *smartut* 'rag' = 'I wiped with a rag', *mexalel* 'travel in space' from *xalal* 'space', or *mekarkér-et* 'cracker-FEM' from *kreker* 'a cracker', 'to put cheese on her cracker'. These examples show, besides their preference for the productive p4 as a means of denominating verbs, that children treat loan words like *krem, smartut,* and *kreker* (all of which violate accepted morpheme structure constraints on possible Hebrew nouns) as native items, by incorporating them into the verb system as well.

Coinages in other binyan patterns also attest to these two trends (replacing established verbs by ones in a different verb pattern or treating loan words as a source

for native-like denomination), These include: p3 *le-sarex* 'to tie shoelaces' from *srox* 'a lace' (cf. conventional p1 *li-srox),* p3 *maftiax* 'opens (with a key)' from *maftéax* 'key' (cf. conventional p1 *potéax* 'open, undo'), p1 *la-cun* 'put the sheep = *con* in their pen', *šofer* 'blow the *šofar',* *satáp-ti* 'I stopped = pressed on the **stop** button'.

These data again show that children's departures from conventional form-meaning pairings of *binyan* pattern / verb-type are by no means occasional: They occur across large numbers of children and apply to numerous different lexemes.[25] Importantly, such unconventional forms are all *possible* words in Hebrew: Compare innovative *bihálti* with conventional *pihákti* 'yawn, PST.1ST.SG = I yawned'; *hitabed* is an occurrent word the child is not familiar with; *ibída* has the same surface form as a verb like *icíka* 'bother, PST.3RD.SG.FEM = she bothered (someone)'. That is, children may not have command of form-meaning mappings in the established lexicon, but when they innovate, they adhere strongly to the typological requirement limiting the form of possible verbs in their language. They simply do not resort to other structural options. And when they do innovate to fill genuine gaps in the lexicon, they observe the pattern-based constraints on possible verb forms in their language.

In sum, both in their spontaneous coinages and in the more demanding task of coining novel verbs from familiar nouns and adjectives in structured elicitations, Hebrew-speaking children from a young age produce well-formed, possible verbs, in one of the five morphological verb-patterns (prosodic templates) available to them in the grammar of their language. This represents a formidable structural achievement, which provides young children with a powerful mechanism compensating for their as yet inadequate lack of a mature lexical repertoire.

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25 Earlier studies of this author provide relevant details on children's acquisition of the Hebrew *binyan* system (e.g., Berman, 1993), so these issues are not further expanded, as marginal to the topic at issue here.

4.2 NOUNS

A very different situation applies to nouns which, as noted, can take varied forms in MH, including non-derived basic words, loan words on the whole adjusted to Hebrew phonology but not morphology, and several dozen derived-noun patterns (Berman and Seroussi, 2011). This wide array of options available to Hebrew speakers for filling gaps in their lexicon may be bewildering to learners. To address speaker preferences, the following observations are, as for verbs, based on findings for innovations of Hebrew nouns from both structured elicitations and from spontaneous coinages. The survey starts with tasks where children aged 3 to 9 and adults were asked to coin nouns from input verbs in different semantic categories.

The study reviewed here was conducted with 72 participants (12 in each age group of 3-, 4-, 5-, 7-, and 9-year-olds - three pre-school groups and two grade-school age-groups - compared with 12 university-educated but non-Hebrew-specialist adults. They were given familiar verbs as input and required to produce novel target nouns and adjectives. The input verbs were alternated across three variables: (i) *binyan* pattern (words in the three typically active, transitive patterns, *qal, piel, hifil* (e.g., *li-rkom* 'to-embroider'. *le-taken* 'to-fix, repair', *le-hafxid* 'to-frighten' respectively, and also in the two intransitive, change-of-state patterns, e.g., *le-heradem* 'to-fall asleep', *le-hitlaxlex* 'to-get-dirty'); [26] (ii) root-transparency, comparing "full roots" like those in the preceding examples with "defective" roots containing historical glides or glottal or pharyngeal back consonants (e.g., *la-uf* 'to fly' from abstract ʕ-w-p, *li-cok* 'to shout' from historical c-ʕ-q to *la-riv* 'to quarrel' from historical *r-w-b);* and (iii) semantic class - Place nouns asking what would you call a place where people do things, perform actions like, say, cook; Instrument nouns - what would you call a thing, an object you use for cooking; Agent nouns - what would you call a person whose job is to fix, who likes fixing things.

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26 All input (source) verbs across the different tests were given in the infinitive form, with a prefixal *lV-* to ensure that they were not in the form of possible nouns or adjectives.

From age 4 on, participants were able to derive novel nouns around 90% of the time. However, in contrast to the verbs they innovated, which took the form of possible if non-occurrent verbs in Hebrew (less than 10% ill-formed at ages 3 and 4 years, and under 5% among older children), coining **nouns** involved relatively more ill-formed outputs, in the sense of words that do not conform to the morpheme-structure rules of MH. These deviations peaked among the 4- to 5-year-olds, reaching nearly one-third (32%) of their innovations (e.g., *nevazbezon* from the verb *le-vazbez* 'to waste' for a place where people waste things, spend their time wasting; *mamxabe* from the verb *le-hitxabot* 'to hide (oneself) for an instrument used to help a person hide).[27] Such ungrammatical output forms went down to less than 20% at ages 5 and 7 years, and were negligible among 9-year-olds, showing that command of form-meaning matches in the noun system of Hebrew is a school-age achievement.

Taking into account both well-formed and structurally deviant output novel output nouns in the structured elicitations, in response to the question at issue in the present study, the bulk of the novel nouns children produced from familiar source verbs (69% = over two-thirds of their total output items) were in the amalgamated form of root + affixal pattern. These took a variety of possible forms, including: maCCeC(a) or miCCaCa for Instruments and Places (cf. extant *macber* 'battery', *makdexa* 'drill', *misada* 'restaurant'); CaCaC or CaCCan for Agents (cf. extant *tabax* 'cook', *rakdan* 'dancer'); and CiCuC, CóCeC, or CCiCa, haCCaCa for abstract action or state nominals

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27 These took different forms, as described in Berman (2000): (i) Violations of Hebrew-specific morpheme-structure constraints: e.g., *ritíax* [Tom, 5;11] for a person whose job is to boil things from the causative verb *le-hartíax* 'to boil'; *ramdedant* [Lior, 3;10] for an instrument used for putting people to sleep - *le-hardim;* (ii) use of verbal affixes with nominal stems (e.g., the infinitival prefix *le-* in *la-cbon* [Omer, 3;10], for an instrument used for irritating people from the verb *le-acben; le-haškeket* [Amit, 3;9] for a place for watering from the verb *le-hashkot;* and (iii) words that are structurally well-formed as nouns, but inappropriate for a given semantic class, as in the passive participle form *merutax* [Tomer, 4;0] '(that has been) boiled' to name a person whose job is to boil things, *le-hartiax;* or the coinages *bišlut* [Naama, 5;2] and *mevašlan* [Yaniv, 5;5]*,* both possible nouns in Hebrew, but suited to naming an abstract state with the *-ut* suffix or an agent with *-an* respectively, both misapplied here to name a place where people perform the activity of *le-vašel* 'cooking'.

(as in extant *sipuk* 'satisfaction', *ómek* 'depth', *lemida* 'learning', *hafsaka* 'pause, pausing'). The innovations in these patterns were nearly always well-formed, even if not always conforming to their accepted form-meaning matchings.

Concatenated stem + suffix combinations came to less than one-third (31%) of the output forms in structured elicitations of novel nouns. Among the younger children these were pretty much all over the place in terms of their surface structure. Older, school-age children and adults, in contrast, tended to use endings like *-iya* for Place nouns (cf. established *maafiya* 'bakery') and *-ay* for Agent nouns (cf. *itonay* 'journalist').

The following observations emerge from agglutinated (stem + suffix) novel nouns based on familiar input verbs and adjectives in the elicitation tasks. Across the sample of children's responses, the single most favored suffix for nouns was *-an,* as found in our earliest study in this area (Berman, Hecht, and Clark, 1982; Clark and Berman, 1984). This raises a psycholinguistic question as to how children perceive this ending. It can be interpreted structurally as representing the accepted amalgamated pattern CaCCan as in Agent nouns like *rakdan* 'dancer' from p1 *li-rkod* 'to dance' and also *saxkan* 'player' from P4 *le-saxek* 'to-play' as well as children's *(mi)staklan* 'somebody who looks, peerer' from P5 *le-histakel* 'to look (at)', or Instrument nouns like *mazgan* 'air conditioner', *potxan* '(bottle)opener'. And it also can be a strictly purely linear derivation, as in *psantr-an* 'pianist', *harpatk-an* 'adventurer', *mizrax-an* 'orientalist'. However interpreted, it was used widely, in both the CaCCan pattern and the word + *-an* form in children's innovations. This is not surprising, since it is phonologically salient, and exclusively used for *concrete* Agent and Instrument nouns. In this, it differs from the more lexically sophisticated abstract noun ending *-ut* as in *re-ut* 'friendship', *dabran-ut* 'talkative-ness', *nediv-ut* 'polite-ness' (Bolozky and Schwarzald, 1992) and the denominal adjective ending *i-* , as in *xaver-i* 'friend-ly', *mamlaxt-i* 'nation-al', *sifrut-i* 'liter-ary' (Ravid and Shlesinger, 1987). The only instances where children used

(unstressed) *-i* was to mark diminutives, as in accepted *dúb-i* 'teddy-bear', *xatúl-i* 'kitty', and unconventional *pil-ón-i* 'elephant-DIM.DIM', *tinók-i* 'baby. DIM'. Moreover, **zero derivations** in the form of verbs innovated as nouns were, again, few and far between (e.g., P3 *metaken* for 'fixer', P4 *mitxabe* 'hider'), used mainly by the youngest 3- to 4-year-old children (Berman, Hecht, and Clark, 1982).

In sum, in the structured tests, the bulk of the nouns children coined on the basis of familiar input verbs were in the shape of a possible amalgamation of consonantal skeleton and affixal patterns. Only around 30% took agglutinative stem + suffix forms, and even fewer resorted to zero derivation by *benoni* forms of the corresponding verb in agent and instrument noun coinages.

Similar trends emerged for the sample of over 300 innovative or nonconventional nouns children produced in their spontaneous speech output (Corpus (i) of the data-base described in Section 3.1). Of these, three-quarters were in amalgamated forms of skeletal consonantal root plus affixal noun patterns. These favored *m-* initial patterns for Instruments, like miCCaC (e.g., *miklaf* for an instrument for peeling from p4 *le-kalef*, in place of the conventional *benoni* form *kolef* 'peeler', *midbak* for something used to stick things, from p3 *le-hadbik);* or else they coined nouns in the mi/maCCeC patterns with a feminine ending *-a, -it* (e.g., *maškela* 'weigher' for conventional *moznáyim* 'scales' from *li-škol* 'to weigh', *makšévet* 'listener' from *le-hakšiv* 'to listen' for established *stetoskop*). In contrast, marking children's sensitivity to form-meaning matchings, the Agent nouns they innovated favored external suffixes like *-an, -ay* (e.g., *taknan, taknay* from the p4 verb *le-taken* 'to fix = repairman'). Again, such stem plus suffixal forms accounted for only around one-quarter of children's novel nouns. Most of these were in the form of feminine inflections like *-a, -it, -et*, or else -agentive suffixal *-an, -ay,* with occasional use of *-ut* for abstract nouns (e.g., *nixut* 'resting' from *la-nuax* 'to rest' for established *menuxa* 'state of rest', *neginut* 'playing a musical instrument' for established

negina.[28] And, here too, *benoni* zero-derived coinages were rare (e.g., *tole* 'hangs, hanger' for clothes-pin, established *atav, bonim* 'build(ers)' for *levenim* 'bricks').

The picture for innovative nouns in the free speech output of children (including even younger 2- to 3-year-olds) is largely consistent with the findings from the structured elicitation tasks. Of over 300 spontaneous innovations: (i) none involved prefix + stem concatenation; (ii) around 35 (15%) took the form of stem + suffix, divided by semantic class as follows: 9 Agent nouns with -*an* (e.g., *šar-an* for *mšorer, kotev širim* 'poet, writer of poems, from *la-šir* 'to sing', *šir* 'a song, poem' [Matan, 4;1], *mamci-an* 'invent-or' from the verb *le-hamci* [Shelli, 5;2]); another 7 Agent nouns with -*ay* (e.g., *xaf-ay* 'hairwasher' from *la-xfof* 'wash hair', *takn-ay* 'fix-er' from *le-taken* 'to-fix' (both from Sivan, aged 4;4). Interestingly, these Agent nouns were coined in cases of accidental lexical gaps. In contrast, the ending -*ut* occurred in 14 abstract nouns innovated in place of extant terms (e.g., *cme-ut* 'thirsti-ness' [Gili, 4;9], for occurrent *cimaon* or *cama* 'thirst', *reev-ut* 'hungriness' for extant *raav* 'hunger' [Shay, 5;1].

Another finding for spontaneous noun coinages was, again, that *benoni* zero-formation was infrequent, found in 16 cases, half for Agent and half for Instrument nouns (e.g., *menagév-et* 'wiper.FEM' for *magévet* 'towel' [Leor 2;9], *okc-im* 'sting.pl' for *nemalim* 'ants' [Dor, 2;4]). Use of a verb in present-tense/participial form in place of a noun by zero derivation occurred mainly among the younger children, confirming an earlier finding noted for a structured test deriving Agent and Instrument nouns in Hebrew (Clark and Berman, 1984). The rest of the coinages documented took the form of varied *miškal* nominal patterns, for example: *matbe-ot* = established 'coin-s' for *taba-ot* 'ring-s' [Hagar, 3;3], *maharog* from *la-harog* 'to-kill' for *ekdax* 'pistol' [Ori

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28 Understandably, given the numerous options for noun-formation in Hebrew, the children's coinages included far more ill-formed outputs than for verbs, e.g., **hasbira* for *hesber, hasbara* 'explaining, explanation', **mearbólet* and **mearbeva* for *irbuviya* 'mix-up, confusion'. These were particularly evident in the 4-year-olds, who are at a transitional stage between the difficulty of innovating nouns in general found at ages 2 or 3 years and the older 5- and 6-year-olds who have a larger lexical repertoire to rely on.

2;6]; *hizuy* 'perspiring' in place of *hazaa* [Sivan 4;11], *rixuc* 'washing (oneself)' for *raxaca, hitraxacut* [Asaf, 3;5], *hašlata* for *šlita* 'control, Noun' [Omri, 3;11]. And these included the relatively few innovative Place nouns in the sample, e.g., *kavéret* 'beehive' for established *bet-kvarot* 'place-of graves = graveyard' [Tom, 4;5], *mafrexa* from *praxim* 'flowers' for *maštela* 'plant nursery' [Matan, 3;4].

Until as late as age 7, nearly a quarter of the novel output nouns produced in response to familiar input verbs on the test and some 15% of those novel nouns in the children's spontaneous usages, could be characterized as ill-formed - as illustrated in fns. 28 and 29. Apparently, children find it hard to coin novel nouns which meet the structural and semantic constraints on form-meaning relations in Hebrew nominal patterning. And it contrasts markedly with the performance of these same children in producing novel verbs, where from age 3 they only occasionally, and from age 5 almost never, violated constraints on semantically and structurally appropriate verb-formation in their language.

4.3 ADJECTIVES

In general, children coined relatively few adjectives in their spontaneous usage. These mainly took the form of endstate resultative passive participles marked by a stem-internal *u,* as in the established CaCuC *katuv* 'written', meCuCaC *medubar* 'spoken', muCCaC *mustar* 'hidden', a type of derivation familiar to children by age 3 years (Berman, 1994). These three patterns occurred in coinages like: *kasuy* 'covered' (cf. established *mexuse*), *aluv ~ meulav* 'insulted' (cf. *neelav*), *mešuél-et* 'coughing.FEM' from *le-hištael* 'to-cough to have a cough (= *šiul*)', cf. established *mecunan, menuzal* 'having a cold, sniffly'. This is a remarkable early ability, contrasting with the more transparent stem + suffix forms of past participles used to express similar notions in English and Romance languages (Clark, 2005). Less than a dozen of young children's nominal coinages took the external suffixal *-i,* the means par excellence for constructing

denominal adjectives in Hebrew, e.g., *madbeka bul-it* 'a stamp-y sticker' from *bul* 'stamp', for accepted meCuCaC *mevuyal; rove barzel-i* 'an iron-y gun' for a gun made of iron; *óto sport-i* (cf. the accepted compound noun *mxonit sport* 'car.GEN sport = sports car').[29]

5 DISCUSSION

This study was motivated by a **usage-based** view of linguistic description (Berman and Dattner, 2020), based on evidence from young Hebrew speakers' construal of word-formation processes in their language. Pre-literate children use a variety of word-formation strategies in their novel lexical usages, predominantly in the form of possible Hebrew words, which they coin as replacing extant words they do not know or to fill a gap in the established lexicon. All verbs, and most of the nouns and adjectives they produce turn out to be amalgamated forms of root + noun pattern rather than attaching an external suffix to a familiar word or stem, while the default option of zero-derivation is relatively rare, confined to younger children. The proportion of around a quarter to one-third agglutinating stem plus suffix forms they coin across the data-base closely reflects what has been documented for current Hebrew usage in general. This justifies using untutored children's texts as evidence for general processes in the language.

Children almost *never* produced verb-forms outside of the restricted set of *binyan* patterns. In this, their perception of verbs shows sophisticated attention to the process of consonantal **root extraction**, increasingly from age 4 years on. This is demonstrated in (4) by comments of two kindergarteners, Matan, aged 4;3, and Ben, aged 5;1 in (7a) and (7b) and by a 2nd-grade boy in (8), with historical (orthographic) roots in brackets.

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29 The children's coinages also include around a dozen novel compounds, formed in Hebrew by attaching the modifying noun to a preceding, morphologically bound head noun, e.g., *xotex iparon* 'cut(ter) pencil = pencil cutter', cf. established *mexaded* 'sharpener'; *zvuv-ey káyic* 'flies-of summer = flies that appear in summer', *aron ha-pijamot* 'closet the-pyjamas = the pyjama closet'.

(7)

    a. *hayu šam anašim še-garim ba-**maarav**, anašim še-dibru **aravit*** [root ʕ-r-b]
       'There were there people that live in-the-**west**, people who spoke **Arabic**'

    b. *ani yodéa lama korim lo šatiax **parsi**, ki **porsim** oto,* [root p-r-s]
       'I know why it's called (a) **Persian** carpet, because people spread it out
       *ve bécem ze šatiax **buxári**, ki **boxarim** oto* [root b-ħ-r]
       'and in fact it's (a) **Bukharian** carpet, because people choose it'

(8)

    ADULT: *lama korim le-géšem géšem?*

    'Why (do people) call rain rain?'

    CHILD: *ki Adonay hivtíax latet matar be-ito, yore ve malkoš*

    'Because God promised to give showers in time, first and last rain

    *ve hu kiyem et ha-dvarim, ve hem **mitgašm-im***

    'And he kept his words, and they are-realized [P5, plural, root g-š-m]

    *efšar li-kro le-ze **géšem***

    'You can call it rain'.

Clearly, not all children have such an equally sophisticated metalinguistic skill in overtly spelling out the morpho-semantic relations between words. Yet the ability to extract a consonantal skeleton (like *p-r-s, b-x-r* in (7) and *g-š-m* in (8), based on semantically unrelated words in their lexicon, was evident across the non-conventional verbs documented for this study in both naturalistic and the elicited samples of Hebrew-speaking preschoolers. The metalinguistic comments in (7) and (8) together with the findings for children's innovations surveyed in Section 4 shed light on language acquisition and use from the psycholinguistic perspective of what Halle called

"knowledge unlearned and untaught". Importantly, young preschool children are not as yet "contaminated" by input from the written language, which is known to have a powerful impact on how people perceive and process the segments in their language (Olson, 1994; Seroussi, 2014).

On both the tests and in their spontaneous output, children demonstrated sensitivity to the traditional Semitic division between formation of *verbs* and *nominals* (nouns and adjectives) in their language. The verbs they coined were overwhelmingly "well-formed", in the sense that they conformed to the morphophonological constraints not merely of new-word formation in Hebrew, but also on the form of a possible *verb* in the language. This highly language-particular type of knowledge is not obvious in any *a priori* sense. In order to produce a novel form which is in some way morphologically related to the source noun or adjective, children could in principle have relied on several non-Semitic strategies. (i) They could have opted for *zero derivation*, treating the source noun as a verb, without any change in form (cf. English *to fax, to wallpaper*). (ii) They could have resorted to *suppletive root change*, producing a novel, possibly semantically related, verb with different consonants than those of the source noun or adjective (e.g., for putting things on a table *šulxan,* they could have said *la-sim* 'to-put', *le-sader* 'to-tidy', *le-haniax* 'to-place', and so on). Or (iii) at issue here, they could have applied *external affixation*, either (a) by adding a prefix to the input noun, e.g., present-tense *me-, ma-* or infinitival *le-, li-,* or (b) by adding a noun suffix to the input noun, e.g., feminine *-a* or diminutive *-it.* Affixation to a stem appears a particularly attractive option, since children were asked questions which encouraged them to use the present-tense of verbs, marked by prefixal *m-* in three of the five *binyan* conjugations, and in cases where a female investigator asked "What am I doing?", responses would typically be elicited with the feminine endings *-a* or *-et.* Yet, as noted repeatedly (possibly *ad nauseum*), children chose one of the five *binyan* templates dedicated to (non-passive) verbs in their language. This, too, seems a remarkable achievement.

To return to the question raised at the outset, of why children prefer amalgamating roots plus patterns over adding an external affix to a word-stem (option iii): The findings of this study confirm Slobin's (1996) insight that from early on, *children's language is closer to that of adult speakers* of the ambient language than to their peers from typologically different backgrounds. The breakdown of preschoolers' innovated forms closely mirrors the distribution of amalgamated versus concatenated word-formation in general Hebrew usage, from around one-fifth to one-third, as documented in studies reported in Section 2.3.2 of this paper. That is, the impact of ambient language *typology* is critical from the moment children start talking. This is evident from the very beginning of Hebrew-acquiring children's use of verbs. Initially, at the one-word, "pre-grammatical" stage of their language development, they rely on "bare stems" (Berman and Armon-Lotem, 1996) that conform to the different *binyan* patterns without being inflected - e.g., *fal* for p1 *nafal* 'fell, has fallen', *fox* for p1 *taafox* 'turn-around!', *laafox* 'to-turn around', *xek* for p4 *mesaxek* 'plays, is playing', *lesaxek* 'to-play', *yesaxek* 'will-play'. Characterized as revealing "morphological knowledge without morphological structure" by Adam and Bat-El (2008) and as representing structural opacity by Lustigman (2016), these ubiquitous forms of verbs in children's early Hebrew show early on sensitivity to what constitutes a possible, if partially realized, verb in their language. This way of breaking into the Hebrew verb system forms a sound foundation for children's subsequent mastering of grammar, including inflectional markings, and somewhat later (increasingly from age 3 on) in expanding their lexicon by coining new words.

Yet the forces of development and typology are not necessarily in conflict in this as in other domains of language acquisition. Rather than viewing them as competing factors, developmental principles are embedded in and constrained by typological considerations, so that there is an interplay between the two. Clearly, general developmental principles play a role in acquisition (saliency of consonants compared

with vowels, more so in Hebrew than, say, Spanish; inflection preceding derivation in some but not all domains; preference for concrete versus semantically abstract items, and ones common rather than occasional in the input. Yet, *at the same time,* as argued across this study, the developmental routes of lexical and grammatical knowledge are also shaped by features of the ambient language typology.

This means, among other things, that in the domain in question, the Hebrew-specific input to which children are exposed exerts a strong influence from early on in acquisition. Rather than being geared to surface simplicity (by zero derivation) or transparency of one-to-one form-meaning mappings, when it comes to covering gaps in their lexicon, as in other domains, children are sensitive to the particular demands of the language they hear around them (see, too, Slobin, 2004, in this respect). The single exception we noted here is the earlier emergence of productive marking of inflectional, typically concatenating categories compared with derivational morphology. But, as pointed out before, this is due to the general, cross-language acquisition of across-the-board grammatical categories, which are mastered earlier than the highly variable and often arbitrary form-meaning mappings involved in acquisition of the lexicon.

Results of this analysis show that typology interacts with the factor of *frequency of usage* in the input language (Bybee and Hopper, 2001; Diessel, 2007) in derivational morphology as well as in grammar. As has been shown for other languages, too, the bulk of children's innovative nouns in Hebrew referred to concrete entities like Agents and Instruments and the few adjectives they coined were typically based on verbs (marked by an internal *u,* such as *kasuy* 'coverned' for established *mexuse* 'covered', *mukfe* 'freezened' for established *kafu* 'frozen'). They rarely used the two highly *productive* (in the sense used earlier, of favored by non-expert, but educated speakers for new-word formation) concatenating devices: deverbal or deadjectival *-ut* to form abstract state nouns (cf. established *ayef**ut*** 'tiredness', *meurav**ut*** ' involvedness'), or the ending *-i* to form denominal adjectives (as in *sifrut**i*** 'liter-ary', *xišuv**i*** 'computational').

As analyzed in the literature (by Bolozky and Schwarzald, 1992 and by Ravid and Shlesinger, 1987; Ravid and Zilberbuch, 2003, respectively), these suffixes are productive and widespread in Modern Hebrew. But they typically occur in the higher register confined to a literate lexicon, of the kind that only emerges at advanced school age. True, *binyan*-related, verb-based Derived Action Nominals ending in *-ut* (e.g., p2 *hibahal-ut* 'being alarmed' from P2 *le-hibahel* 'to-be-scared', p5 *hitkansut* 'assemblage, assembly' from *le-hitkanes* 'to-be-assembled) are quite regularly derived from their source verbs (Berman, 2020), but these are typically high-register abstract terms (Comrie and Thmpson, 2007), and as such are not accessible to young children in Hebrew as in other languages. The same is true of adjectives ending in *-i,* which in translation are rendered variously by, say, English *literary, computational, demonic, demonstrative,* etc. These two endings are interesting because they represent what are largely one-to-one form-function mappings of, respectively, abstract nouns and denominal adjective marking in Modern Hebrew. In this, they contrast with derivation of other semantic categories in MH, which are characterized by varied form-meaning mappings. For example, concrete, everyday Agent nouns have established words like Biblical *tabax* 'cook' in the pattern CaCaC, *ofe* 'baker' by zero-derivation from the present tense of the verb *le-efot* 'to-bake', with more recent words like *mevašél-et* 'cook.FEM' by zero derivation from the present tense of the verb *le-vašél* 'to cook'; and *bašlan* 'an expert cook, gourmet', from the same root, in the Agent pattern CaCCan; to which can be added loan nouns like higher register loan words like *šef, gastronom.* And diminutive adjectives typical of nursery usage may take a final, unstressed *-i* as in the earlier examples of *xatúli* 'kitty', *dúbi* 'teddy-bear', as well as with *-on* in *pilóni* 'little elephant' , *siflon* 'little cup', and also by reduplication as in *kofif* 'little monkey' (Ravid, 2020). That is, in derivational morphology in Hebrew as in other languages, different word-structures can apply to a single semantic category. And MH has other options for expressing abstract states as well (e.g., CiCCaCon as in *cimaon* 'thirst(iness)', or

CóCeC as *xóšex* 'darkness'). The *-ut* suffix has a special status as uniquely dedicated to only (although not all) abstract nouns in current Hebrew.

This means that external affixes like MH *-ut* and *-i* manifest a conflict between their form, which appears both simple and transparent, and their usage, which is typically high-register and so infrequent, certainly in young children's linguistic experience. This observation leads to two conclusions: As I have argued elsewhere (for example, in regard to acquisition of *binyan* verb alternations and endstate resultative adjectives, Berman, 1993, 1994), children's construals, in this case of how words are derived and formed in their language, are affected by a "**confluence of cues**". That is, different factors like structural simplicity, semantic transparency, frequency of usage, and typological imperatives all play a role. Which wins out is developmentally determined: Simplicity may be important in the very early stages of acquisition, but it is soon taken over by typological bootstrapping, and this will eventually give way to usage-based preferences under the impact of later school-age literacy and an expanding mental lexicon.

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