

Linguistic diagnostics of written texts in two school-age populations*

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The paper considers the writing abilities of Hebrew-speaking grade school and middle school students from mid-high compared with low SES backgrounds, as reflected in stories and compositions they wrote on the topic of friendship. A range of linguistic means of expression were employed as diagnostic of school-age written text construction, focusing on the lexicon and including both devices applicable in different languages (overall text length in words and clauses, syntactic clause density, and lexical diversity and density as reflected in proportions of content words) as well as Hebrew-specific features (verb-pattern morphology and construct-state noun compounds). Analyses showed these features to differentiate across the independent variables of the study-age-schooling level, and SES background, and text genre (narrative vs. expository). In terms of genre, expository-type essays usually had denser and more lexically diverse texture than stories. In developmental perspective, lexical diagnostics improved in the texts produced by 13–14 year-olds in comparison with those of 9–10 year-olds. Finally, texts produced by middle-class children attending well-established schools were in general of better lexical quality than those produced by children from disadvantaged backgrounds attending low-achieving schools.

Keywords: linguistic diagnostics; school-age language development; SES background; discourse genre; clause length; text length, lexical quality; Hebrew

1. Introduction

Reading and writing in the school years are of focal interest for research and practice in the domain of developing literacy in general and writing abilities in particular (Olson & Torrance 2009; Ravid & Tolchinsky 2002), with important implications for language-arts curricula, remedial teaching, and clinical diagnosis and intervention (Graesser, McNamara, Louwerse & Cai 2004; McNamara, Crossley & McCarthy 2010; Schlitz 2010). The present study aims to contribute

to these diverse yet inter-connected fields by considering measures which we propose are diagnostic of text-embedded linguistic expression across variables such as age-schooling level, communicative setting, and type of population (Kellogg 2008). To this end, we analyze extended texts elicited in writing from children aged 9 to 10 years compared with 13-to 14-year-olds, in the conviction that the period from middle childhood in grade-school to early adolescence in middle-school is of critical importance for developing the 'language of literacy' (Berman & Ravid 2009), for 'growing into' school-based language usage (Jisa 2004), and for 'meeting the challenges of academic language' (Snow & Uccelli 2009).

The study compares students' linguistic usage in texts written in two different genres: personal-experience narratives and expository essays. Narratives are known to be a universal and early-acquired type of discourse (Berman 2009a; Hickmann 2003). Expository texts represent a more challenging mode of discourse, one that is critical for a range of school-based reading and writing activities and that both requires and evokes a more elevated level of language use than personal-experience narratives (Bar-Ilan & Berman 2007; Berman & Nir-Sagiv 2007; Berman & Nir 2009a; Nippold & Scott 2009; Ravid 2004a; Ravid & Berman 2009).

An additional facet of the present study is that it compares the writing performance of schoolchildren from two backgrounds, from middle-class and low SES families respectively. Proceeding from the assumption that socially-anchored features of home background and school setting play a role in children's realizing their full potential in language-and literacy-related abilities (Arriaga, Fenson, Cronan & Pethick 1998; Hart & Risley 1992, 1995; Hoff 2003; Kishiyama et al. 2009), we query whether and how environmentally-engendered factors weigh against age-appropriate deployment of linguistic means in writing extended texts. Assessments of school-age language abilities in children from different SES backgrounds have typically relied on either standardized tests or on qualitative evaluation of children's writing (Bradley & Corwyn 2002; Duncan et al. 1994; Noble et al. 2005). Our study adds a further psycholinguistic dimension to this domain by means of corpus-based analyses of selected linguistic features.

The study thus involves three independent variables: age-schooling level, population, and text genre. Developmentally, we expected the eighth-graders to score higher on all measures than the younger fourth-grade students. In terms of population, we expected students from higher SES backgrounds to do better than their peers from low SES backgrounds, particularly in the younger age-group (Berman & Ravid 2010). This disparity might not necessarily decrease with age, as indicated by research in other domains of Hebrew-language acquisition and use (Levie, in progress; Ravid & Schiff 2006a). We further expected the expository essays to reveal more advanced use of linguistic forms and structures than the

narratives written by the same participants (Berman & Nir-Sagiv 2007; Berman & Ravid 2009; Ravid 2004a; Ravid & Berman 2010).

2. Text diagnostics

A written text sheds light on numerous facets of the capabilities of schoolchildren – world knowledge, social skills and attitudes, conceptual depth, executive control capacities – all of which are reflected in one way or another in their use of language. Children's writing as a source of information on their linguistic abilities can be assessed from varied perspectives, both top-down in relation to the text as a whole and bottom-up in terms of local linguistic expression in lexicon and syntax. Prior research of the authors and their associates in a range of languages shows that different facets of text-embedded language interface with one another, and that rich content combines with proficient global-level text organization as well as skillful use of local means of linguistic expression to yield a high-quality piece of discourse (Berman 2005, 2008). These different facets of text construction abilities develop in tandem across the school years, and are critically genre-dependent, so that, for example, narrative structure and organization is mastered far earlier than that of abstract expository writing (Berman & Nir-Sagiv 2007; Berman & Nir 2009a). However, to the best of our knowledge, such issues have not been considered in relation to texts produced by children of different SES backgrounds.

The present study aims to demonstrate the diagnostic power of the lexicon as one aspect of the complex cluster of skills involved in schoolchildren's writing of extended texts. Borrowing Perfetti's (2007) apposite term of 'lexical quality' as the basis of reading comprehension, our concern here is with *lexical quality in writing*, on the assumption that text-based deployment of the lexical repertoire is particularly diagnostic of school-age language development. Current research on English-speaking schoolchildren and adolescents of middle-to-high SES backgrounds demonstrates the importance of lexical usage (that is, size and quality of vocabulary) in developing discourse abilities in command of written as compared with spoken discourse (Berman & Nir 2010b; Nir-Sagiv, Bar-Ilan & Berman 2008). Other studies highlight the role of lexical knowledge in later language and literacy development in general (Berman 2007; Dockrell & Messer 2004; Ravid 2004b), as a crucial component in higher-order cognitive activities, critical for academic achievement across the school years (Borovsky, Kutas & Elman 2010; Carlisle 2000; Dockrell, Messer & George 2001, 2004). Moreover, a broad body of research indicates that the lexical repertoire of children of lower SES backgrounds lags significantly behind that of their more advantaged peers in both quantity and quality,

with serious consequences for their academic attainments and school-based success (Hart & Risley 2003; Hoff 2003; Rowe 2008; White, Graves & Slater 1990).

Lexical command interacts with grammatical knowledge and depends on semantic and procedural memory – encyclopedic, lexical, and conceptual (Baayen 2007; Engel, Santos & Gathercole 2008; Talmy 2003) – as well as on pragmatic knowledge about language use (Clark 1996; Levinson 1983). Most specifically, knowledge of the lexicon interacts with derivational morphology as a key component of developing lexical knowledge and organization of the mental lexicon – particularly in a language like Hebrew (Clark 1993; Ravid 2004b). A major linguistic means for new-word formation, derivational morphology embodies the form-meaning relations between open class lexical items (nouns, verbs, and adjectives) in different ways in different languages (Aronoff 1976, 1994; Berman 2000; Comrie 1985). This is reflected in English, for example, by the Latinate family of semantically and morphologically related words derived from the stem *mem-* (from Latin *memor-*): *remember*, *memorize*, *commemorate*, *memory*, *memorization*, *memorial*, *memorable*, *memo*, and (a recent coinage) *meme*; and in Hebrew by words based on the Biblical root *z-k-r*, *zaxar* ‘remember’, *nizkar* ‘recall (verb)’, *hizkir* ‘remind’, *zikaron* ‘memory’, *zxira* ‘remembering’, *hizaxrut* ‘recall (noun)’, *azkara* ‘memorial (service)’, *tizkóret* ‘reminder’, *zéxer* ‘memory-trace’, *mazkir* ‘secretary’, *mazkéret* ‘souvenir’, *mizkar* ‘memo’, *zaxur* ‘memorable’. Such morphological connections are particularly relevant in Hebrew as a Semitic language (Bolzky 1999; Schwarzwald 2001, 2009; Velan, Frost, Deutsch & Plaut 2005), where they have been shown to play an important role in Hebrew-speaking children’s developing lexicon (Berman 1997; Berman & Ravid 2009; Ravid 2004b, 2006; Ravid & Berman 2009; Ravid & Schiff 2006b; Seroussi 2004).

2.1 Content words as keys to lexical usage

Our analysis focuses on content words or ‘open-class’ items – nouns, verbs, adjectives – as lexical units that express relatively independent conceptual content, hence conveying the bulk of the informational substance of a given piece of writing. Each of the three major lexical classes plays a distinct yet related role as a prototypical means of realizing one of the key propositional-act functions of reference, predication, and modification (Croft 2000). Thus, *nouns* are critical for making reference to entities in discourse, with the shift to more lexically specific and abstract items indicative of both development and genre, while abstract, typically morphologically derived, nominals are important for constructing expository texts of the kind necessary for school-based literacy (Boscolo 1990; Nippold & Scott 2009; Ravid 2006; Ravid & Berman 2009). *Verbs* are the key to predication, as the pivot around

which the clause as a whole revolves both semantically and syntactically (Berman & Slobin 1994: 26, 257–262; Golinkoff & Hirsh-Pasek 2008; Nir-Sagiv 2008: 48–54). And *adjectives* as optional modifying elements, along with adverbs, lend descriptive, textual, and conceptual richness to any piece of discourse by enhancing nouns and verbs (Dixon & Aikhenvald 2004; Ferris 1993; Ravid & Levie 2010).

The linguistic domains investigated below cover facets of lexical usage that for the most part are shared by speaker-writers of different languages, specifically: lexical diversity and density, nominal abstractness, range and type of adjectives, and number of words per clause. Features confined to Hebrew as the target-language of our study include distribution of noun compound *smixut* constructions and verb morphological *binyan* patterns. To start, we delineate non-Hebrew-specific properties of lexical structure and usage that we analyzed.

Lexical Diversity refers to the proportion of different words in a piece of discourse as measured by Type/Token ratios (Malvern et al. 2004: 19–29). While the total number of words in a text is indicative of overall verbal output, the number of *different* lemmas and word-forms used in a given context is a more sensitive diagnostic of linguistic skills and expressive flexibility, since it reflects the depth and range of the lexical repertoire children can access in the course of ongoing text production and their ability to vary items from this repertoire (Berman & Verhoeven 2002). *Lexical Density* refers to the proportion of content words (nouns, verbs, and adjectives) out of total number of words in a piece of discourse (Halliday 1989; Malvern et al. 2004; Strömquist et al. 2002). This is an important indicator of textual richness since, as noted, these open-class items convey the bulk of the semantic content and propositional information contained in a given text.

Nominal Abstractness, recognized as an important facet of lexical development in general (Golinkoff & Hirsh-Pasek 2008; Halliday 1989; Ravid & Avidor 1998), refers in the present context to an innovative, semantically motivated analysis on a 10-point scale ranging from highly concrete, specific, largely monomorphemic nouns to abstract, generic, and derivationally complex terms. Devised and tested originally for Hebrew (Ravid 2006), a modified 4-point version of this scale has proved diagnostic of lexical usage in English texts produced in writing by schoolchildren, adolescents, and adults (Berman & Nir 2010a; Nir-Sagiv, Bar-Ilan & Berman 2008), and so can be taken as a relatively language-independent measure. Abstract nouns occurring in the present sample include, for example, *bedidut* ‘loneliness’, *mašma’ut* ‘significance’, *sikum* ‘summary’, *tofa’a* ‘phenomenon’, items that are not only semantically abstract and infrequent in everyday spoken usage, they are also, in Hebrew as in other languages, typically morphologically complex. Use of *Adjectives* is also

diagnostic of expressive quality since, as noted, adjectives are optional modifying elements, in contrast to nouns as obligatory referential arguments (different kinds of subjects or objects) and verbs as the core of predications about events and states (Ravid & Levie 2010). Examples in the present sample include *boded* 'lonely', *ayom* 'terrible', *amiti* 'genuine', and the compounded *asir-toda* 'prisoner-of thanks = grateful'.

To illustrate the conceptual framework underlying our analysis of text-based lexical usage in developmental perspective, the texts in (1) and (2) compare the breakdown into open-class lexical items in the expository essays written by a 4th grade and an 8th-grade student of high SES background instructed to write a composition on the topic of friendship. Verbs are underlined (only lexical verbs, excluding copulas and existential operators), nouns are double-underlined, with abstract nouns marked in grey, adjectives are bolded, and explanatory comments in the translation are given in square brackets. The relatively free translations into English do not reflect the exact lexical value of the Hebrew original: For example, the Hebrew noun *nose* serves to translate both 'topic' and 'subject', while Hebrew has two different words for 'friendship' – *xaverut* and *yedidut* – differing in degree of intimacy, both of which were provided in the instructions.

(1) Expository essay of high SES 4th grade boy [Sean]

ani xoshev še-nose ha-xaverut/yedidut me'od yafe, ki ka'asher yesh xaverim tovim, kax yesh yoter vitaron še-yesh lexa yoter xaverim. kax ata margish yoter mekubal, kefl exa, ata yaxol lesaxek im xaverim ki yesh yeladim še-kol ha-zman nisharim levad ba-kita, menasim še-yihyu lahem xaverim, aval lo ohavim otam.

'I think that the topic of friendship is very nice, because when there are good friends, then there is more advantage so that you have more friends. That way you feel more popular, it's fun for you, you can play with friends, because there are kids that all the time stay alone in class. They try to have friends, but nobody likes them.'

The text has a total of 49 word tokens, of which 19, that is 38.8%, are content words. 10 of the content words (about half) are nouns (4 repeating the same noun), of which 5 are abstract, 6 are verbs, and 3 are adjectives.

(2) Expository essay of high SES 8th grade boy [Or]

ani yodea al xaverut še-ze me'eyn "heskem" be-al pe beyn shtey anashim ha-xolkim mashehu, lefaxot exad, be-meshutaf. ha-"heskem" omer še-shtey ha-xaverim yihyu ne'emanim ve-kenim exad im ha-sheni. le-da'ati ha-xaverut hi davar tov ve-be-ikar ha-uvda še-be-dérex klal ha-xibur hu miyadi beyn shtey anashim.

'I know about friendship that it is a type of "agreement" by mouth [=oral] between two people who share something, at least one, in common. The "agreement" says that the two friends will be loyal and sincere with one another. In my opinion, friendship is a good thing, especially the fact that in general the connection between two people is immediate.'

This text has a total of 43 word tokens, of which 22, that is 51%, are content words. 14 of the content words (about half) are nouns, of which 10 are abstract, 3 are verbs, and 5 are adjectives.

These two (quite typical) texts demonstrate how diagnostic the different lexical measures we adopted prove to be. They reveal greater lexical density, diversity, and higher level of linguistic register in use of nouns and adjectives in the essay written by the older boy, which also demonstrates more sophisticated and original conceptual content and more tightly coherent organization than the text of the younger student.

2.2 Words per clause as a key to syntactic complexity

Lexical items also serve as the building blocks for syntactic constructions, from phrase to clause to sentence. In the present context, concern is with the level of the single clause rather than of clause-combining complex syntax (for the latter, see Berman & Nir 2009a; Nir-Sagiv 2008). The measure of *Words per Clause* (WPC) provides a straightforward and reliable measure of syntactic density by specifying how many lexico-grammatical elements are combined within the boundaries of each clause, hence how much information is packaged within a single clause. This measure, in a way comparable to use of MLU (mean length of utterance) in early child language (Brown 1973; Dromi & Berman 1982) requires (a) agreed definition of what is meant by 'a word' for the particular purpose at hand (Berman 2002) and (b) well-motivated specification of clause boundaries as the basis for dividing each text into clauses.

To this end, each text in the data-base is divided into *clauses*, following the procedure stipulated in Berman and Slobin (1994:660–661), who define a clause as a semantic and grammatical unit that contains "a unified predicate that expresses a single situation (activity, event, state)". The 'clause' has proved to be a reliable means for sub-dividing extended texts as a unit that has the following advantages: It is readily identifiable by researchers with minimal training in linguistics and/or discourse analysis; it is more uniform in structure and content than a 'sentence', as a unit that is often difficult to specify; it is better suited to written language than the basically oral units of 'utterance' in adult-child interactions or 'turn' in conversational analysis; as a single, unified element of

predication, hence of semantic content, a clause is close in spirit to Chafe's (1994) notion of 'idea unit', and so clearer than the rather vague notion of 'proposition'. Importantly, despite cross-linguistic differences in grammatical structure, much the same criteria can be applied to clause-division in both written and spoken language and in languages that use different orthographies (Berman & Slobin 1994; Berman & Verhoeven 2002).

These decisions are illustrated in (3) and (4) below for the two texts given in (1) and (2) above, divided into clauses by carefully pre-specified criteria.

(3) 4th grade essay divided into clauses

1. *ani xoshev*
2. *še-nose ha-xaverut/yedidut me'od yafe,*
3. *ki ka'asher yesh xaverim tovim,*
4. *kax yesh yoter yitaron*
5. *še-yesh lexa yoter xaverim.*
6. *kax ata margish yoter mekubal,*
7. *keflexa,*
8. *ata yaxol lesaxek im xaverim*
9. *ki yesh yeladim*
10. *še-kol ha-zman nisharim levad ba-kita,*
11. *menasim še-yihyu lahem xaverim,*
12. *aval lo ohavim otam.*

(4) 8th grade essay divided into clauses

1. *ani yodea al xaverut*
2. *še-ze me'eyn "heskem" be-al pe beyn shtey anashim*
3. *ha-xolkim mashehu, lefaxot exad, be-meshutaf.*
4. *ha-"heskem" omer*
5. *še-shtey ha-xaverim yihyu ne'manim ve-kenim exad im ha-sheni.*
6. *le-da'ati ha-xaverut hi davar tov ve-be-ikar ha-uvda*
7. *še-be-dérex klal ha-xibur hu miyadi beyn shtey anashim.*

The WPC measure illustrates a major developmental shift from a mean of 4.1 words per clause in the twelve clauses of the 4th-grade text in (3) compared with 6.1 in the shorter 8th grade text, reflecting a finding that recurs across different types of texts and populations (Berman & Ravid 2009; Ravid & Levie 2010). Increased syntactic complexity, hence the amount of information packaged within the boundaries of a single clause, is intimately related to lexical density and diversity: Each clause contains more, and longer phrases (Ravid & Berman 2010); while syntactic connectivity between clauses is marked by lexical means such as coordinating and subordinating conjunctions and sentence modifiers. Taken together, the distribution and deployment of these linguistic

devices signal the consolidation of a more proficient and coherent mode of written expression.

2.3 Hebrew-specific verbal and nominal properties

The measures surveyed thus far, as noted, are applicable across different languages. In addition, we consider two major *Hebrew-specific* lexical constructions: Verb-pattern derivational morphology and noun compound morpho-syntax.

Verbs can be analyzed developmentally along similar lines in different languages, for example, by considering range and diversity of cognitive, inner-state verbs as diagnostic of developmental progress (Booth, Hall, Robison & Kim 1997; Fusté-Herrmann et al. 2006). In the present context, however, focus is on the Hebrew-specific facet of derivational morphology in the shape of the *binyan* system of seven verb patterns or conjugations, which organize the Hebrew lexicon semantically and syntactically (Berman 1993, 2003; Berman & Ravid 2009). All verbs in Hebrew are formed from a consonantal root that alternates in one or more of these seven *binyan* conjugations, as prosodic templates or nonlinear morphological patterns combining affixal elements with consonantal roots (Berman 1993, 2003). These reflect a range of syntactic and semantic relations such as causativeness, reflexivity, reciprocity, and voice (Berman 1978; Schwarzwald 2009). For example, the root g-d-l alternates between four different patterns as follows: intransitive *gadal* 'grow (bigger)', transitive *gidel* 'grow (something), raise (crops)', passive *gudal* 'be-raised, be-grown', causative *higdil* 'enlarge, make bigger', *hugdál* 'be-enlarged, be-made-bigger', while the (defective) root r-?-y occurs in five different patterns, thus: transitive *raá* 'see', intransitive *nir'a* 'be-seen, seem', causative *her'a* 'show', reciprocal *hitra'u* 'see each other, meet'.¹ Research shows that (a) verb-pattern alternation is a major indicator of Hebrew child language development, once inflectional morphology marking verb tense and subject-verb agreement is established, from age three to four years on (Berman 1985, 1993); (b) later, school-age development is manifested by increased reliance on intransitive patterns representing a patient-rather than an agent-oriented perspective (Berman & Neeman 1994); and (c) the two strictly passive *binyan* patterns are a very late acquisition, occurring only occasionally even at high-school age (Berman 2004; Jisa et al. 2002; Ravid 2004b). Pattern alternation is shown by the 23 verbs underlined in (5), a story written by an 8th-grade girl of High SES background, Shir, where the five non-passive patterns are specified as Pn, thus: P1 (*Qal*) represents the most basic, high-frequency pattern, P3 (*Pi'el*) and P5 (*Hif'il*) two active, commonly causative, patterns, and P2 (*Nif'al*) and P4 (*Hitpa'el*) the two low-frequency mainly intransitive patterns (Berman & Ravid 2009).

(5) Story written by high SES 8th grade girl [Shir]

yom exad ba-xofeš ha-gadol tsiltse [P3] elay xaverti ve-hitsu [P5] še-nelex [P1] yaxad la-brexa, le-seret, ve-lehistovev [P4] ba-kanyon. na'neti [P2] la be-xiyuv ve-nifgašnu be-ša'a 10:30. txila halaxnu [P1] la-kanyon ve-histovavnu [P4] šam ad ša'a 12:30, ve-az axalnu [P1] aruxat^tsohorayim be-Burger-King. Le-axar miken, halaxnu [P1] lir'ot [P1] et ha-seret "Hari Poter ve-xadar^ha-sodot". ha-seret haya mehane [P3] me'od. le-vasof, be-ša'a 3:20, be-xom^ha-yom, nasanu [P1] levalot [P3] ba-brexa. axar-kax hizmanti [P5] ota elay ha-bayta še-niheye [P1] yaxdav ba-maxšev. sixaknu [P3] ba-maxšev ad ša'a 5:30. liviti [P3] et xaverti ha-bayta. nifradnu [P2] le-šalom ve-kivinu [P3] še-yiheyu [P1] od yamim ke'eylu kefim u-mehanim. be-yom ze nora neheneynu [P2], tsaxaknu [P1] ve haya lanu me'od kef.

'One day in the summer vacation, my friend phoned me and suggested that (we) go to the pool together, to a movie, and to-hang out at the mall. I responded positively and we met at 10.30. First, (we) went to the-mall and hung around there until 12.30, and then (we) had-lunch at Burger King. Afterwards, (we) went to-see the movie "Harry Potter and the Chamber of Secrets". The movie was very enjoyable. Finally, at 3.20, in the heat of the day, we took-a-bus to have-fun at the swimming-pool. Later, (I) invited her to my place to-spend-time together at the computer. (We) played computer games until 5.30. (I) accompanied my friend to her place. (We) parted, hoping to-have more fun, enjoyable days like that. That day (we) enjoyed ourselves. (we) laughed and had lots of fun.²

As expected, around 40% of the verb tokens are in the basic P1 pattern (9 out of 23), in common verbs like those meaning 'go', 'eat', 'see'. The mainly transitive P3 and P5 patterns account for another 8 verbs, with 6 verbs in the two intransitive patterns P2 and P4. Taken together, this reflects a varied patterning of verbs, characteristic of advanced lexical usage in Hebrew.

The second Hebrew-specific construction concerns so-called *smixut* 'construct-state' N-N *noun compounds*, in which the first noun – the head noun – is morphologically bound to the second, modifying noun. These nominal constructions were selected as representing a language-particular juncture of Hebrew lexicon, morphology, and syntax and as a device for expressing complex sub-categorization reflecting a late-developing means of referential elaboration (Berman 2009b; Ravid & Zilberbuch 2003). Examples of this construction include (where the caret mark ^ stands for a bound form), *axsanijat^no'ar* 'hostel^youth = youth hostel', *batey^hamišpaxa* 'houses^the-family = the family(s) homes'. These alternate with more everyday, analytic expressions with the genitive marker *šel* 'of' (e.g. *ha-batim šel ha-mišpaxa* 'the-houses of the-family'), on the one hand, and with the high-register, infrequent so-called 'double compound' (e.g. *bate-ha šel ha-mišpaxa* 'homes-its

of the-family = the family's homes'), on the other. For example, the narrative text of an 8th-grade girl, Keren, included all three types of compound constructions, thus: *tuv^ta'am* 'goodness^taste = in good taste', *mofa šel ha-tsofim* 'concert of the-Scouts = the Scouts' concert', and *sipura šel na'ara* 'tale-her of (a) girl = a girl's tale'.

We assumed that these different measures of text-based linguistic usage would reflect differences in all three independent variables: age-schooling level, SES background of participants, and text-genre.

3. Method

Research population

Participants were children at two levels of age-schooling, grade-school 4th-graders aged 9 to 10 years and middle-school 8th-graders aged 13 to 14, in two groups: mid-high SES (henceforth HI) and low SES (LO) backgrounds. For present purposes, 80 participants were randomly selected out of the population of a large-scale research study (Berman & Ravid 2010; Berman, Nippold & Ravid 2007). Data for the 40 HI group were collected from 4th and 8th grade classes from two well-established schools in central Israel and for the 40 LO group from 4th and 8th grade classes in two schools in disadvantaged neighborhoods in central Israel that meet the criteria of the national Ministry of Education 'Strauss Deprivation Measure' (Olshtain & Zuzovsky 2004). All 80 participants were normally developing monolingual native-speakers of Hebrew.

Materials and procedures

Each of the 80 participants in the study wrote two texts, yielding a total of 160 texts for analysis. Children were asked to write a story about an experience they had had with a friend and (at a different session, in balanced order) to write a composition about what they think or know about friendship, without being given any further instructions about length, organization, or quality of the texts they produced. Each handwritten text was entered on computer in conventional Hebrew orthography, representing the exact format of the original, and divided into clauses as specified above.

Analysis

All word tokens and clauses were counted, and all nouns, verbs, and adjectives were tagged, and counted together as content words. Verbs were further subdivided by each of the seven verb-patterns, and the two types of noun compound constructions that are morphologically marked were identified and counted.

4. Results

Analyses were conducted on a data-base of 160 texts ranging in length from or 1–72 clauses, and from 7 to 393 words, with content words ranging from 3 to 227: Of these, nouns ranged from 1 to 127, adjectives from 0–61, and verbs 0–65.

Table 1 presents three measures of text productivity – mean number of words, mean number of clauses, and mean clause length, i.e. number of words per clause.

Table 1. Mean number of words and clauses and mean clause length by Grade, SES, and Genre

Population	# Words		# Clauses		Mean clause length	
	Narr	Expos	Narr	Expos	Narr	Expos
4th Grade High SES	60.35 (41.88)	47.5 (20.94)	14.6 (10.74)	12.1 (6.55)	4.31 (.99)	4.08 (.83)
4th Grade Low SES	41.35 (28.84)	30.55 (20.89)	11.25 (8.76)	8.65 (5.82)	3.9 (.95)	3.55 (.59)
8th Grade High SES	87.9 (45.45)	86.85 (86.57)	21.0 (12.14)	19.25 (15.65)	4.33 (1.0)	4.39 (1.05)
8th Grade Low SES	89.45 (70.99)	82.0 (53.48)	22.75 (16.35)	20.0 (13.46)	3.85 (.43)	4.2 (.48)

We performed three three-way ANOVAs of Grade (2: 4th, 8th) x SES (2: Hi, Lo) x Genre (2: Narrative, Expository) on the data in Table 1 – words, clauses, and mean clause length.

Words. An effect for Grade ($F(1,152) = 26.49$, $p < .001$, $\eta = .15$) emerged, namely that 8th graders wrote longer texts in number of words ($M = 86.55$) than 4th graders (44.94). No other effects or interactions emerged.

Clauses. An effect for Grade emerged ($F(1,152) = 23.88$, $p < .001$, $\eta = .14$), showing that 8th graders wrote text with more clauses ($M = 20.75$) than did 4th graders ($M = 11.65$). No other effects or interactions emerged.

Mean Clause Length. An effect for SES emerged ($F(1,152) = 9.61$, $p < .003$, $\eta = .06$), showing that children from high SES wrote longer clauses ($M = 4.28$) than did children from low SES ($M = 3.88$). No other effects or interactions emerged.

Table 2 presents four measures of lexical density – percentage of Content Words out of total words, and percentage of each of the three content word classes – Nouns, Verbs, and Adjectives – out of total Content Words.

Table 2. Mean percentages of Content Words out of all total words; and Mean percentages of Nouns, Verbs, and Adjectives out of total Content Words, by Grade, SES, and Genre

Population	Content words		Nouns		Verbs		Adjectives	
	Narr	Expos	Narr	Expos	Narr	Expos	Narr	Expos
4th Grade High SES	58.25 (8.62)	53.25 (8.85)	58.8 (13.05)	55.35 (11.96)	32.15 (9.25)	31.0 (15.28)	4.31 (.99)	4.08 (.83)
4th Grade Low SES	60.1 (10.45)	51.45 (8.78)	51.65 (10.84)	47.65 (17.2)	43.05 (10.63)	34.05 (16.07)	3.9 (.95)	3.55 (.59)
8th Grade High SES	57.85 (9.9)	52.9 (7.46)	49.1 (9.06)	55.2 (15.19)	40.55 (11.74)	26.2 (11.69)	4.33 (1.0)	4.39 (1.05)
8th Grade Low SES	59.4 (6.65)	53.45 (7.51)	47.35 (8.46)	53.05 (8.37)	43.45 (9.62)	31.25 (10.77)	3.85 (.43)	4.2 (.48)

We performed four three-way ANOVAs of Grade (2: 4th, 8th) x SES (2: Hi, Lo) x Genre (2: Narrative, Expository) on the data in Table 2 – regarding content words, nouns, verbs, and *binyan* patterns.

% Content Words. An effect for Genre emerged ($F(1,152) = 20.33, p < .001, \eta = .12$), showing that narrative texts have a higher proportion of content words ($M = 58.9\%$) than expository texts ($M = 52.76\%$).

% Nouns. An effect for SES emerged ($F(1,152) = 5.96, p < .02, \eta = .04$), showing that children from high SES produce a higher proportion of nouns out of content words ($M = 54.61\%$) than do children from low SES ($M = 49.93\%$). There were no effects for either Grade or Genre, but there was an interaction of Grade and Genre ($F(1,152) = 6.28, p < .02, \eta = .04$), depicted in Figure 1.

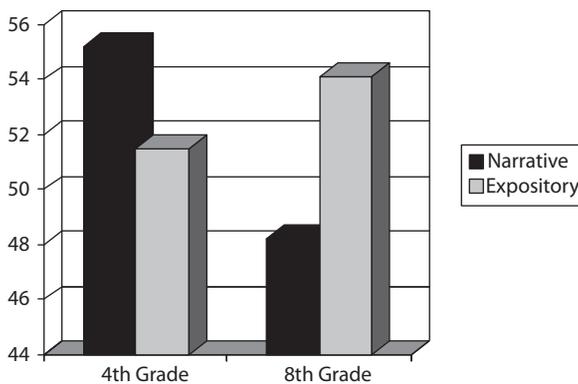


Figure 1. Interaction of Grade and Genre in percentage of Nouns out of total Content Words

A Bonferroni analysis of the sources of this interaction revealed it derives from a difference between genres in 8th but not in 4th grade, and from a difference between narrative but not between expository texts.

% *Verbs*. An effect for SES emerged ($F(1,152) = 8.18, p < .006, \eta = .05$), showing that children from low SES produce a higher proportion of verbs out of content words ($M = 37.95\%$) than do children from high SES ($M = 32.48\%$). There was also an effect for Genre ($F(1,152) = 22.96, p < .001, \eta = .13$), showing that narratives elicit a higher proportion of verbs out of content words ($M = 39.8\%$) than expository texts ($M = 32.48\%$) in the study population. There was also an interaction of Grade and Genre ($F(1,152) = 4.59, p < .04, \eta = .03$), depicted in Figure 2.

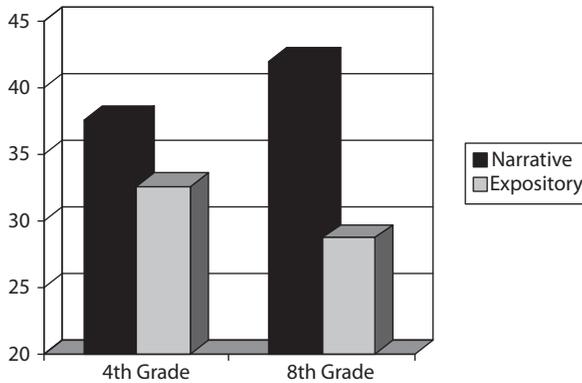


Figure 2. Interaction of Grade and Genre in percentage of Verbs out of total Content Words

A Bonferroni analysis of the sources of this interaction revealed it derives from a difference between genres in 8th but not in 4th grade.

Binyan patterns

Recall that Hebrew verbs occur in one of five morphological *binyan* patterns (excluding two that are strictly passive). Table 3 presents the breakdown of all lexical verbs into the five *binyan* patterns.

We performed a four-way ANOVA of Grade (2: 4th, 8th) x SES (2: Hi, Lo) x Genre (2: Narrative, Expository) x Pattern (5: *Qal*, *Pi'el*, *Hif'il*, *Nif'al*, *Hitpa'el*) on the data in Table 3. The variables of Age, SES, and Genre are irrelevant here as they all balance out to 100%. Thus we focus on the variable of *Binyan* and its interactions with the other variables. There was an effect for *Binyan* ($F(4,604) = 231.49, p < .001, \eta = .61$), showing that *Qal* was by far the most

widely used pattern ($M = 56.36\%$), significantly different from all other patterns, followed by the two basically transitive, active and causative patterns *Pi'el* (15.86%) and *Hif'il* (14.09%), which differed from all other *binyanim* but not from each other, with the two intransitive medial-passive patterns *Nif'al* (6.57%) and *Hitpa'el* (7.12%) being used least of all, differing from all other *binyanim* but not from each other.

Table 3. Distribution of *binyan* patterns by Grade, SES, and Genre (in percentages)

<i>Binyan</i> patterns	<i>Qal</i>		<i>Pi'el</i>		<i>Hif'il</i>		<i>Nif'al</i>		<i>Hitpa'el</i>	
	Narr	Expos	Narr	Expos	Narr	Expos	Narr	Expos	Narr	Expos
4th Grade High SES	59.97 (19.04)	56.89 (12.86)	11.28 (8.68)	19.61 (16.76)	15.04 (15.04)	16.12 (13.41)	8.37 (12.15)	4.0 (9.39)	5.35 (7.95)	3.38 (7.0)
4th Grade Low SES	62.22 (21.14)	58.18 (29.09)	20.08 (18.2)	17.49 (17.08)	9.75 (11.76)	7.65 (10.3)	4.39 (7.09)	1.25 (5.59)	3.55 (7.62)	15.43 (32.74)
8th Grade High SES	57.49 (16.99)	45.82 (26.69)	8.3 (7.82)	17.85 (16.94)	17.58 (11.02)	15.96 (14.01)	12.58 (8.82)	6.62 (9.52)	4.06 (4.72)	13.75 (22.31)
8th Grade Low SES	58.07 (19.47)	52.23 (21.99)	13.85 (9.86)	18.41 (21.54)	16.1 (11.96)	14.52 (16.32)	7.28 (7.76)	8.11 (9.04)	4.7 (6.2)	6.73 (10.08)

The variable of *Binyan* interacted with Grade ($F(4,604) = 2.49$, $p < .05$, $\eta = .016$) and with Genre ($F(4,604) = 3.46$, $p < .009$, $\eta = .022$). These interactions appear in Figures 3 and 4 respectively. No other interactions emerged.

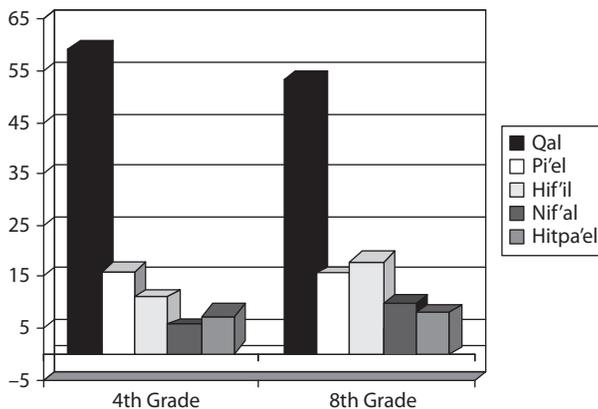


Figure 3. Interaction of Grade and *Binyan* out of total verbs

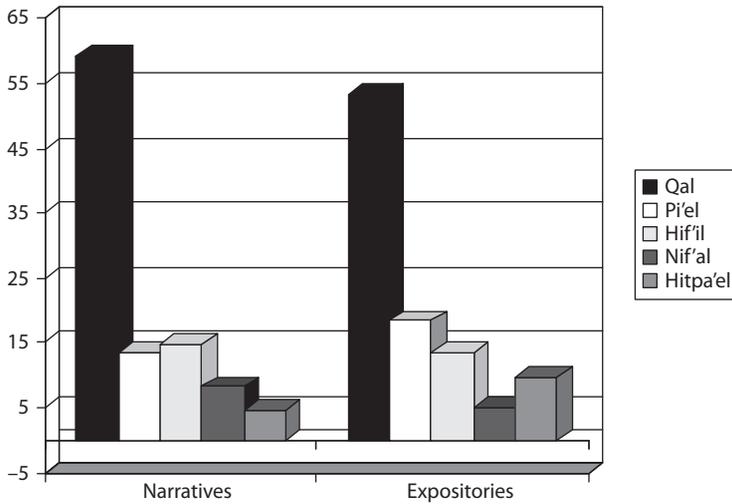


Figure 4. Interaction of Genre and *Binyan* out of total verbs

Binyan and Grade: A Bonferroni analysis of the sources of the interaction depicted in Figure 3 revealed that it derives mainly from a decrease in *Qal* verbs from 4th to 8th grade. *Qal* remains however the most favored of the five *binyan* patterns in both age groups. In both age groups, transitive patterns are used more widely than the intransitives: In 4th grade, there are more *Pi'el* verbs than *Nif'al* and *Hitpa'el*; and in 8th grade *Hif'il* increase in frequency and outnumber *Hitpa'el*.

Binyan and Genre: A Bonferroni analysis of the sources of the interaction depicted in Figure 4 revealed that it derives mainly from a favoring of *Qal* verbs in narrative compared with expository texts. *Qal* remains the most favored of the five *binyan* patterns in both of the two genres. In both genres, transitive patterns are used more widely than the intransitives: In narratives, there are more *Pi'el* and *Hif'il* than *Hitpa'el* verbs; and expositories contain more *Pi'el* than either *Nif'al* or *Hitpa'el* verbs.

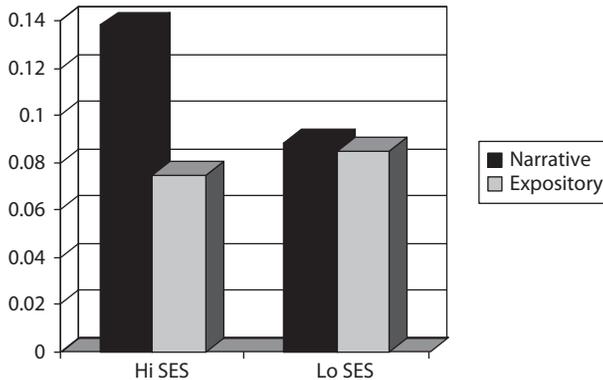
We performed two more *binyan*-related analyses: Number of *Qal* verbs per clause and number of *Nif'al* + *Hitpa'el* verbs per clause. Table 4 presents the data.

We performed a three-way ANOVA of Grade (2: 4th, 8th) x SES (2: Hi, Lo) x Genre (2: Narrative, Expository) on the two analyses depicted in Table 4. *Qal* verbs per clause showed an effect for SES ($F(1,152) = 4.56, p < .04, \eta = .03$), with low SES students relying more on this pattern ($M = .47$) than their high SES counterparts ($M = .41$). There was also an effect for Genre ($F(1,152) = 43.29, p < .001, \eta = .22$): Narratives use more *Qal* verbs ($M = .55$) than expository texts ($M = .33$). There were no other effects or interactions.

Table 4. Number of *Qal* and *Nif'al + Hitpa'el* verbs per clause, by Grade, SES, and Genre

Binyan patterns	<i>Qal</i>		<i>Nif'al+Hitpa'el</i>	
	Narr	Expos	Narr	Expos
4th Grade High SES	0.45 (0.17)	0.35 (0.18)	0.12 (0.17)	0.04 (0.58)
4th Grade Low SES	0.60 (0.24)	0.35 (0.18)	0.07 (0.09)	0.06 (0.11)
8th Grade High SES	0.56 (0.22)	0.26 (0.18)	0.16 (0.1)	0.11 (0.1)
8th Grade Low SES	0.58 (0.25)	0.38 (0.21)	0.11 (0.09)	0.11 (0.1)

Nif'al + Hitpa'el verbs per clause showed an effect for Grade ($F(1,152) = 9.6$, $p < .003$, $\eta = .06$), with 8th grade students having more verbs in this pattern ($M = .12$) than 4th graders ($M = .07$). There was also an effect for Genre ($F(1,152) = 4.46$, $p < .04$, $\eta = .03$): Narratives use more *Nif'al + Hitpa'el* verbs ($M = .11$) than expository texts ($M = .08$). A close-to-significant interaction of SES and Genre emerged ($F(1,152) = 3.81$, $p < .053$, $\eta = .02$), shown in Figure 5.

Figure 5. Interaction of Grade and *Binyan* (*Nif'al + Hitpa'el* per clause)

A Bonferroni analysis of the sources of this interaction revealed that it derives from the fact that genres do not differ in the low SES population, whereas narratives have more *Nif'al + Hitpa'el* verbs than expositives in the high SES population.

Noun compounds (bound smixut constructions)

The last analysis concerns the distribution of the two kinds of morphologically bound noun compounds: construct state and double compounds, as described

in an earlier section. Table 5 presents the numbers of the two compound types per clause.

Table 5. Number of construct-state and ‘double’ compounds per clause, by Grade, SES, and Genre

<i>Binyan</i> patterns Genre →	Construct state compounds		Double compounds	
	Narr	Expos	Narr	Expos
4th Grade High SES	0.14 (0.14)	0.05 (0.07)	0	0
4th Grade Low SES	0.06 (0.08)	0.01 (0.04)	0	0
8th Grade High SES	0.12 (0.14)	0.06 (0.07)	0.007 (0.03)	0.004 (0.01)
8th Grade Low SES	0.06 (0.06)	0.05 (0.07)	0.01 (0.03)	0

We performed a three-way ANOVA of Grade (2: 4th, 8th) x SES (2: Hi, Lo) x Genre (2: Narrative, Expository) on the two analyses depicted in Table 5. *Construct state* compounds per clause showed an effect for SES ($F(1,152) = 10.47$, $p < .002$, $\eta = .06$), with high SES students producing more of these constructions ($M = .09$) than their low SES counterparts ($M = .05$). There was also an effect for Genre ($F(1,152) = 13.68$, $p < .001$, $\eta = .08$): Narratives use more *Construct state* compounds per clause ($M = .1$) than expository texts ($M = .04$). There were no other effects or interactions. ‘Double’ compounds per clause showed an effect for Grade ($F(1,152) = 5.23$, $p < .03$, $\eta = .03$), with only 8th grade students producing such constructions ($M = .006$). There were no other effects or interactions.

5. Discussion

The study employed a range of linguistic diagnostics to evaluate written text construction in middle childhood and early adolescence. Some of these measures have been applied in other contexts, in several languages besides Hebrew, in earlier studies conducted by the authors and their associates (as delineated in Berman 2008; Berman & Ravid 2009). In this connection, we employed the by now well-established methodological design of having the same participant produce different texts, balanced for order, so allowing for direct comparison across genres within and across age-groups. We also added two Hebrew-specific measures in verb-based and noun-based constructions, not formerly analyzed in the framework of written texts and later language development. Most measures were analyzed in relation to both

number of words and number of clauses per text, making it possible to examine each category both in paradigmatic alternations and in syntagmatic combinations. In terms of independent variables, alongside of age and genre, the domain of SES background provides fresh insights from hitherto largely uncharted perspectives on developing writing abilities in middle and later childhood. Prior research on school-age SES has focused largely on general cognitive development or on school-oriented skills in the areas of reading, language arts and literacy skills rather than on writing as a distinct domain of developing linguistic literacy (Blachman et al. 1999; Farah et al. 2006; Qi, Kaiser, Milan & Hancock 2006).

As expected, clear *developmental* findings emerged across the population along various dimensions. First, overall text length as measured in both words and clauses doubles from one age-schooling level to the other, confirming independent studies showing that the ability to produce longer texts, hence provide additional content, is a clear hallmark of development from early to later childhood (Berman & Slobin 1994). In writing, specifically, longer texts are indicative of greater experience with the written modality and increased ability to sustain off-line verbal production (Malvern et al. 2004).

Next, distribution of content words in the texts emerges as a function of both age-schooling level and of discourse genre: Expository texts alone show an age-related increase in proportion of nouns out of total content words, whereas only narratives employ use more verbs with age. This clear linguistic reflection of inter-genre distinctiveness is attributable to increased familiarity with the highly nominal nature of expository texts compared with the dynamic event-based character of narratives (Berman & Nir-Sagiv 2007; Ravid 2006; Ravid & Berman 2010).

A third developmental finding concerns the two-language specific measures. In the verb system, an age-schooling related decrease in reliance on the basic, unmarked *binyan* pattern, *Qal*, is balanced, with age, by a concomitant rise in use of the two less frequent and less salient patterns, *Nif'al* and *Hitpa'el* – indicative both of a greater morpho-lexical variety with age and the ability to take a non-agent oriented perspective on situations (as illustrated, for example, by the 8th-grader's narrative in (5) above). In nominal constructions, the high-register double compounding construction occurred in 8th grade, and only there. In spite of the small number of such occurrences, this measure – not attested to statistically in prior research on language development in Hebrew – is thus clearly indicative of later-developing Hebrew morpho-syntax and written language usage.

Comparison between narrative and expository texts provide independent support for earlier findings on linguistic facets of *genre-distinctiveness*. Our findings show that Hebrew-speaking schoolchildren are well able to give appropriate verbal expression when writing a story as against when discussing an abstract topic like friendship. Across the population, narratives contained relatively more content words than the expository essays, a finding that can be explained both

by the rise in lexical verbs in narratives and the fact that narratives in general are more accessible and familiar to schoolchildren, especially considering that half the participants were of low SES background. The basic, unmarked verb pattern *Qal* has highest frequency compared with the other six patterns in both narrative and expository texts produced by both populations. The fact that the two low-frequency intransitive patterns were more prevalent in the narratives of high-SES participants show that these children are able to deploy varied linguistic resources in order to write more fully elaborated stories. Finally in this connection, narratives contain relatively more construct-state bound noun compounds than expository texts, reflecting base-line literate Hebrew usage and a 'school-register', of the kind that emerges first in writing the more familiar and earlier-acquired narrative genre (Berman 2009a).

With respect to the variable of *SES background*, the criterion of text length failed to distinguish between the two populations, suggesting that this is more a measure of overall verbal output than of linguistic or discursive quality (Berman & Nir 2009b). In contrast, mean clause length, as measured by words per clause, differentiated clearly between children of high and low SES background, indicating higher syntactic density and more packaging of information within a single clause in the more advantaged groups. Two findings point to a relationship between SES and genre. Recall that our inter-genre analyses revealed, as is to be expected, more nouns in expository texts and more verbs in narratives: The current SES-based analysis further shows that high SES children produce more nouns in general, while low SES children produce more verbs in general. This suggests that the narrative mode of thought remains in some sense more accessible to school-age children from disadvantaged backgrounds compared with the difficulty they may experience with the logico-scientific mode of expression (Bruner 1986) demanded by expository writing. Two language-specific findings distinguish the low SES from the other groups of students: They tended to use the basic, high-frequency verb-pattern more extensively, and they used the construct state construction less than did their high SES peers. This reflects the less sophisticated linguistic means exploited by students of disadvantaged backgrounds in both lexicon and syntax, on the one hand, and in the peculiarly Hebrew interface between morphological and syntactic structure, on the other. Our findings thus indicate that low SES students have less ready access to the type of high-register means of linguistic expression typical of literate, school-type language use.

In conclusion, the range and type of linguistically motivated measures applied as 'text diagnostics' in this study indicates that they are well suited to distinguishing between different genres as well as different populations in terms both of age-schooling level and SES background. Unlike much research on writing development, the study is anchored in the domain of psycholinguistics, rather than

motivated primarily by pedagogical or clinical concerns. As such, our findings re-confirm the nature of written language as a special style of discourse, beyond acquisition and processing of different orthographies that relate mainly to writing as a notational system (Biber & Vásquez 2008; Halliday 1978; Ravid & Tolchinsky 2002). In terms of age-schooling levels, the study contributes to the recently burgeoning domain of 'later language development' from middle childhood into adolescence (Berman 2004, 2007; Nippold 2007; Tolchinsky 2004). Here, we recommend that future research along these lines be continued into and possibly beyond high-school age. Further, by going beyond English as the most highly studied language in this connection, we were able to distinguish explicitly between shared, general devices of text-embedded language use as against linguistic means of expression specific to a given target language (in this case, Hebrew). This, in turn, made it possible to shed further light on the close interconnection between lexicon and syntax in later language development, beyond early acquisition (Bates & Goodman 1997; Marchman & Thal 2005). Finally, the between-population discrepancies revealed in this study provide a fresh perspective on the impact of SES background on development of writing abilities across the school years.

Notes

* Data for the study were collected in the framework of a project on 'Developing Language and Discourse Abilities in Pre-Adolescence: A Cross-linguistic Study of Different Populations' conducted by Ruth Berman and Dorit Ravid in cooperation with Marilyn Nippold, University of Oregon, and funded by the United States-Israel Binational Science Foundation (BSF, research grant No. 2003-044). Analyses are based in part on work done in the framework of the Masters' thesis of the second author (Berman, Nippold & Ravid 2007; Nayditz 2009).

1. Examples of verbs in isolation are given in the morphologically simplest form of past tense, 3rd person masculine singular, since Hebrew verbs lack a single unequivocal 'basic' form.
2. The rather free translation into English indicates the fact that Hebrew subject pronouns like *I* and *we* may be omitted with verbs inflected for person, and Hebrew verbs often take the form of single lexemes, where English may use multi-lexemic expressions, such as *hang out*, *take a bus*, *enjoy oneself*.

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