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Hebrew Adjectives in Later Language Text Production

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Abstract

The study investigates the distribution and use of adjectives in 252 texts produced by 63 Hebrew-speaking children, adolescents, and adults who were asked to tell and write a story about a personal fight or a quarrel, and to present a talk and write an expository text on the topic of school violence. All adjective types and tokens in each text were identified, counted, classified, and analyzed using semantic, morphological, and syntactic criteria. Findings show that the adjective class grows larger, richer, and more diverse with age and schooling – in lexicon, morpho-semantics, and syntax. Also, adjectives configure by text genres and modalities in ways that provide independent support for text type classification from spoken narratives, on the one hand, to written expositories, on the other. Finally, gender effects point in the direction of Hebrew-speaking girls and women employing a richer and more diverse adjective lexicon than boys and men in this study.

Keywords

adjectives, expository, Hebrew, later language development, lexicon, morpho-syntax, narrative, speech and writing, text production

Introduction

The category of adjectives provides an interesting window on lexical acquisition in later language development during the school years. Adjectives are a less primary word class than nouns and verbs both typologically and psycholinguistically, and they also emerge later in acquisition. The present study aims to show that investigation of the distribution and use of adjectives in texts produced by Hebrew-speaking children, adolescents, and adults affords rich insights into how adjectives consolidate in the school-age lexicon at the interface of semantic, pragmatic, syntactic, and discursive factors.

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Adjectives constitute a less primary lexical category than either nouns or verbs in several senses. Semantically, nouns are those terms that refer, describe, or designate objects in some way, whereas adjectives denote attributes or properties of nouns (Lyons, 1968; Schachter, 2007). Syntactically, adjectives fulfill two functions, again, in relation to nouns: predicative adjectives have the function of predicate heads (e.g., *Mary is smart*); attributive adjectives have the function of noun phrase (NP) modifiers (e.g., *the smart student*) (Dixon & Aikhenvald, 2004; Ferris, 1993). In many languages (e.g., French, Latin, Hebrew), adjectives agree with the noun they modify in number, gender, and/or definiteness or case. Greenberg (1963) notes that in all languages where the adjective follows the noun, it expresses all the inflectional classes marked by the noun, even in cases where the noun itself may lack overt expression of one or all of these, so implying that while nouns have a fixed form independent of any modifier associated with them, adjectives conceptually presuppose a noun and structurally adjust their form to suit it (Keenan, 1976; Markman, 1989).

Psycholinguistically, the representation of adjectives in the mental lexicon is less richly structured and more arbitrary than that of nouns. Markman's work on categorization indicates that people expect nouns but not adjectives to refer to concepts that have enduring and permanent inferential depth, that provide essential information about the object and its identity, that are more readily placed in a taxonomy, and that are difficult to combine with richly structured categories (Markman, 1989, pp. 116–135). Adjectives, in contrast, are less dense in meaning and have a less correlated structure than nouns, and they are more prone to adjusting not only their form but also their meaning according to the modified noun. Compare, for example, *good person – good knife*; *large house – large mouse*; and even more dramatically, *criminal act* versus *criminal lawyer* (Bolinger, 1967). Both adults and children rely on the contrastive functions of adjectives in the interpretation of NPs (Prasada & Cummins, 2001; Sedivy, Tanenhaus, Chambers, & Carlson, 1999).

Language learning studies further demonstrate the secondary status of adjectives. Polinsky (2004) found that less proficient adult L2 learners of Russian do most poorly on comprehension and translation of adjectives compared with nouns and verbs, leading her to suggest that adjectives are rhetorical devices whose comprehension is not necessary for identifying the referent of a given NP. Extensive work by Waxman and associates on young children demonstrates that adjective learning depends on the nature of the noun they modify or predicate (Hall, Waxman, & Hurwitz, 1993; Mintz & Gleitman, 2002), and that learning adjective meaning is facilitated when adjectives are mapped to basic-level nouns (Klibanoff & Waxman, 2000; Waxman & Klibanoff, 2000; Waxman & Markow, 1998).

In sum, the main function of adjectives is to narrow down the identification of the NP referent by providing additional and adventitious information about the noun. Since adjectives are less robust and canonical than either nouns or verbs, their status and distribution should serve as a window on aspects of lexical acquisition that might be obscured in the speedier developmental paths of the more canonical lexical classes. The size and makeup of the adjective category can thus be taken to constitute a yardstick for language 'richness.' This is especially relevant in later, school-age language development, which manifests an extended repertoire of linguistic items, categories, and constructions as well

as more efficient and explicit modes for representing and thinking about language (Berman, 2004, 2008; Berman & Ravid, 2008; Nippold, 2007; Ravid & Berman, 2009; Ravid & Berman, this issue).

While children are aware of the informative value of adjectives in relation to nouns from early on, a full array of adjectival categories is far from present in 6-year-olds (Blackwell, 2005; Blodgett & Cooper, 1988), suggesting that they coincide with the consolidation of an 'advanced,' high-register, literate lexicon and its cognitive correlates (Dockrell & Messer, 2004). In English, for example, denominal adjectives of Latinate origin such as *informative* or *industrial* are not in productive usage before high school (Bar-Ilan & Berman, 2007). Likewise, Hebrew denominal and reduplicated adjectives (see next subsection) are late-emerging morphological categories with a long developmental route across adolescence (Ravid, 2004b).

Against this background, the current study examines the morpho-semantic and syntactic distribution of adjectives in texts produced in speech and in writing by Hebrew-speaking children, adolescents, and adults – in the conviction that the best way to evaluate later-developing linguistic abilities is in the context of extended discourse (Berman, 2008; Ravid & Zilberbuch, 2003). Two dimensions constraining the kind of language used in texts are *modality* – mode of language production either in speech or in writing – and *genre* – text type defined by function, social-cultural practices, and communicative purpose (Paltridge, 1997); in this case, narrative versus expository texts. Recent studies demonstrate the impact of genre and modality on the selection of expressive devices and grammatical constructions in non-expert text production (Berman, 2005, 2008; Berman & Nir-Sagiv, 2007; Ravid, 2006). Thus the choice of two modalities and two different text genres generates interesting predictions for the text-embedded study of content vocabulary such as adjectives. Regarding modality, written texts are informatively and linguistically denser than spoken texts, with higher proportions of content words and more complex syntax (Chafe, 1994; Ravid & Berman, 2006; Strömqvist, Nordqvist, & Wengelin, 2004) – therefore we can predict that written texts should contain more adjectives than spoken texts.

The distribution of adjectives as predicative or attributive has been shown to be affected by discourse genre (Chafe, 1982; Englebretson, 1997; Thompson, 1988). Content-wise, one might predict that narratives should contain more adjectives than expository texts, since narratives focus on people-related events and motivations (Berman & Slobin, 1994), and thus might necessitate the use of modifying adjectives. However, one might also make the case for having more adjectives in expositories, which focus on ideas and concepts, expressing claims and argumentation in a causal context (Britton, 1994). From a point of view of linguistic complexity (Ravid, 2004a), the interdependence between nouns and adjectives suggests that syntactic and lexical knowledge may pace each other in learning to deploy them in discourse (Ravid & Cahana-Amitay, 2005). Thus, the higher the occurrence of nouns and adjectives in texts, the higher the complexity of the syntactic architecture that frames them (Ravid & Berman, this issue; Ravid, van Hell, Rosado, & Zamora, 2002) – meaning that expository texts, the habitat of complex syntax, should contain more adjectives. Finally, use of high-register adjectives has also been shown to correlate with both genre and modality (Ravid & Berman, 2009; Ravid & Zilberbuch, 2003) and to interact with other constructions expressing a detached and

abstract stance, such as complex syntax, passive voice, nominalizations, impersonal pro-nouns, irrealis, and non-finite constructions (Berman & Nir-Sagiv, 2004). In sum, we expect written texts, and especially written expositories, to contain more, and more diverse, adjectives.

Hebrew Adjectives

Hebrew is an interesting case of a language where child language acquisition mirrors the historical process in which a morphological class has evolved. Biblical Hebrew, although morphologically rich, lacked a morphological class of adjectives (Gai, 1995; Gesenius, 1910). Primary adjectival notions such as *tov* 'good,' *ra* 'bad' were expressed mainly by present-tense participial (*beynoni*) verb forms which share many features with nouns (Berman, 1978). Biblical Hebrew also had a small class of nouns denoting ethnic origin with the suffix -*i*, e.g., *yevusi* 'belonging to the nation of Yevus.' These two classes are at the core of present-day adjectival formation in Hebrew.

Modern Hebrew has four major structural classes of adjectives. The first, an essentially closed class of primary CVC (consonant-vowel-consonant) adjectives originating in Biblical present-tense participials (e.g., *xam* 'hot'), are morphologically simplex words, since despite their verbal origin they are monomorphemic as well as monosyllabic, having lexicalized into a single unit. They typically designate basic semantic relations such as *good*, *bad*, *hot*, *cold* and so are very early acquisitions (Ravid & Nir, 2000). A second class contains a variety of non-linear root + pattern structures (e.g., *mahir* 'quick' from the root *m-h-r*, in the agentive noun pattern *CaCiC*, where Semitic morphological patterns are presented as templates with slots for consonantal root radicals). Except for certain color terms, which are inherently adjectival (e.g., *kaxol* 'blue,' *sagol* 'purple'), almost all of these are appropriated from either verbal or nominal patterns. For example, *mahir* 'quick' and *axil* 'edible' are in the agentive noun pattern *CaCiC* (cf. *pakid* 'clerk'); while *mafxid* 'scary' and *mevušal* 'cooked, not raw' use participial *maC-CiC* and *meCuCaC* verbal patterns. The semantic content of these verbal/nominal adjectives varies across structural categories, covering a range of general and specific properties, attributes, and states. Time of acquisition also varies by semantic content; for example, even though color terms are structurally complex, they are acquired and conjugated correctly early on because of their high frequency in child-directed speech (Ravid, 1995). Resultative adjectives, in contrast, emerge and consolidate later, between ages 4 and 6 (Berman, 1994).

An analysis of Hebrew adjectives used in peer interaction by 50 kibbutz children aged 2;0 to 6;0 (Ravid & Nir, 2000) revealed the following patterns. The number of adjectives produced increased with age from 0.1 per utterance in the youngest group to 0.2 in the oldest. The earliest semantic classes to emerge were color, dimension, and physical property adjectives, as in Blackwell's (2005) developmental study of the semantic properties of adjectives used by Adam and Sarah (Brown, 1973). Later emerging adjectives denoted more abstract and internal states and attributes. Again, as found by Blackwell for English, by age 3 years most – but not all – adjective categories had at least one representative, with semantic and morphological diversity increasing with age. Syntactically, across the board most adjectives were predicative, with 5.5 predicatives for every attributive

adjective in the 2-year-olds, as compared with 1.5 predicatives for every attributive by age 6. Adjective modification also increased both quantitatively and qualitatively from age 2 to 6. Moreover, all three domains in the Ravid and Nir (2000) study – semantics, morphology, and syntax – were highly correlated in all age groups.

Two more adjectival devices belong to later language development. The third, reduplication, used mostly for adjective (and noun) diminutivization (e.g., *vradrad* 'light pink' from *varod* 'pink') is a late-emerging device in Hebrew (Hora, Avivi-Ben Zvi, Levie, & Ravid, 2006). The fourth and most productive class of adjectives in Modern Hebrew is a late historical development deriving from Biblical ethnic nouns, which in Medieval Hebrew evolved into a full-fledged class of denominal adjectives, e.g., *xašmal-i* 'electr-ic,' *cibur-i*[1] 'publ-ic.' Structurally, denominal adjectives are simpler than the root-and-pattern class, since they involve linear formation of a nominal stem and the addition of the adjectival suffix *-i*. However, they are typical of higher register, written Hebrew like literary prose or journalistic and expository texts, and their meaning is quite complex (Ravid, 2004b). About one-third of the adjective types occurring in Hebrew newspapers are denominal (Ravid & Shlesinger, 1987). Apart from lexicalized forms such as *xagigi* 'festive' and the original Biblical ethnic-attributive meaning (e.g., *dati* 'religious,' *rusi* 'Russian'), they are completely absent from peer- and child-directed speech (Ravid, Leibovitch, & Nir-Sagiv, 2009; Ravid & Nir, 2000). Denominal *i*-suffixed adjectives are the latest to emerge in Hebrew child language, from around age 6, and they surface in text production only from high school up (Levin, Ravid, & Rapaport, 2001; Ravid & Zilberbuch, 2003).

Method

The database for this analysis consists of 252 texts produced by 63 Hebrew-speaking children, adolescents, and adults (Berman & Ravid, 1999).

Participants

Participants consisted of 4th graders (aged 9–10), 7th graders (aged 12–13), and 11th graders (aged 16–17), with 16 in each of the three age/grade groups, and 15 adult college graduates ranging between 25 and 35 years. Each group consisted of an equal number of males and females, except for the adult group, which had seven males and eight females. None of the adults majored in a language-related topic such as linguistics, literature, Hebrew language, or foreign languages. All participants were native speakers of Hebrew from middle-to-high SES background.

Procedure

Participants were asked to tell and write a story about a personal fight or a quarrel, and to present a talk and write an expository text on the topic of school violence. Each participant thus produced four texts – two spoken and two written, in two genres: two personal-experience conflict narratives, and two expository texts discussing violence in schools. The text production tasks were administered orally and individually. Each

participant was met twice, with a week apart between meetings. The four orders in which texts were elicited were balanced, with each session consisting of one written and one spoken task, one narrative and one expository task. Preliminary analyses did not reveal an effect for order as a dependent variable. At the initial meeting, participants were told that the investigators were collecting information on 'why people fight or quarrel.' The precise task orders, the test conditions, and the instructions are described in detail in the Appendix.

Text Analyses

In preparation for adjective analysis, we conducted an analysis of text size and lexical density. The two basic units measuring text size are words and clauses: words were defined for Hebrew as corresponding to graphemic sequences separated by spaces – this was necessary since several function words in Hebrew are written attached to the next word and also interact with it morpho-phonologically (Ravid, 2005). For clauses we followed Berman and Slobin's definition of a clause as 'a unified predication' (1994, pp. 660–664). The following were identified and counted in each text: all clauses, word tokens, content word tokens, and adjective types and tokens. Based on previous analyses, we predicted a rise in all these measures with age and schooling, and in particular in written and expository texts.

Adjective Categories

Adjectives were identified and classified in all the texts constituting this corpus according to the criteria described above. The two authors, both experienced psycholinguists specializing in the morphology and acquisition of Hebrew, coded the adjectives separately, with an inter-coder reliability score of 86%. We repeatedly met to discuss and resolve the differences in coding.

Two different categorizations were applied to the adjectives in our corpus: morpho-semantic and syntactic. For the first analysis, we identified four Hebrew-specific categories of form-meaning adjective pairings, and placed them on a scale running from 1 – most neutral, core adjectives, mostly of Classical extraction – to 4 – high-register, literate adjectives, emerging later in the history of Hebrew (Ravid, 2006; Ravid & Berman, 2009; Ravid & Nir, 2000). Here too, we predicted a higher score on the scale with age and schooling, especially in written expository texts. A fifth category of reduplicated diminutive adjectives (e.g., *šmanman* 'fatso' from *šamen* 'fat') was initially part of this examination, but no such adjective occurred in the texts investigated.

Morpho-semantic Categories

(1) *Core adjectives*: This category is based on the list of adjectives frequently produced by children aged 2–5, documented and compiled by Nir (1997). It contains a list of basic monosyllabic adjectives of the type described earlier (e.g., *kal* 'light'), together with canonical color terms (e.g., *yarok* 'green'), basic dimensional adjectives

(*katan* 'small'), basic evaluative adjectives (*yafe* 'pretty,' *xazak* 'strong'), and some common adjectives with modal functions (*carix* 'necessary').

(2) *Resultative participial adjectives*: This category of root-and-pattern adjectives typically develops in Hebrew-speaking children between the ages of 4 and 6. It contains adjectives that typically have a resultative meaning, based on three different passive participle verb patterns: *CaCuC*, e.g., *tafus* 'taken,' *meCuCaC*, e.g., *mesudar* 'tidy, tidied,' and *muCCaC*, e.g., *muxba* 'hidden.'

(3) *Adjectives with verbal/nominal patterns*: This category contains adjectives that share their forms with nouns and verbs, for example: *CaCiC zahir* 'careful' (cf. *pakid* 'clerk'), *CaCCan bayšan* 'shy' (cf. *rakdan* 'dancer'), *niCCaC nilhav* 'enthusiastic' (cf. verb *nixnas* 'enter'). Categories 2 and 3 together rely on the second structural class of non-linear formation, described earlier.

(4) *Denominal i-suffixed adjectives*: This class of literate, late-emerging adjectives is extremely productive in Modern Hebrew, e.g., *mosad-i* 'institution-al,' *ma'as-i* 'practic-al.'

Syntactic Categories. The following analyses were conducted on the syntactic context of adjectives. First, *syntactic site*, with the expectation that predicative adjectives should decline and the other categories increase with age and schooling, especially in written expositories. The following sites were analyzed: (1) predicative, e.g., *ha-délet*[2] *hayta ne'ula* 'the door was <u>locked</u>' (7th grader, written narrative); (2) attributive (postnominal), e.g., *xadar košer zamin* '(an) <u>accessible</u> fitness room' (adult, written expository); (3) adverbial function, e.g., *hem nehenim lir'ot yeladim axerim sovlim* 'they enjoy watching other kids <u>suffer(ing)</u>' (11th grader, written expository); (4) NP head (noun ellipsis/zero conversion), e.g., *ba-dérex ha-zot eyn mafsidim ve-eyn menacxim* 'this way there are no <u>losing</u> (ones = <u>losers</u>) and no <u>winning</u> (ones = <u>winners</u>)' (7th grader, written expository).

Second, we examined adjective *participation in complex structure*s: (1) adjective conjoining, e.g., *metuxkamot ve-adinot* 'sophisticated and subtle'; (2) adjective stacking, e.g., *hašpa'a xevratit gdola* 'great social influence'; (3) compound head, e.g., *alimut tluyat macav* 'situation-dependent violence.' Finally, we examined the *internal adjective phrase modification*: (1) basic modification, e.g., *haxi gdola* 'most big = biggest,' *ma-ze alimim* 'so violent'; (2) advanced modification, e.g., *yaxasit katan* 'relatively small'; (3) multiple modifications, e.g., *harbe yoter lo ne'imim* 'much more unpleasant.' Again, the prediction was that more adjectives would appear in complex constructions (both external and internal) with age and schooling, especially in written expository texts.

Gender Effects

Ever since Robin Lakoff's (1975) book on women's language, adjectives have loomed large in studies of discourse and gender. As our population was evenly divided between males and females, we decided to carry out some further analyses on our data, focusing on possible differences in adjective distribution between the two genders.

Table 1. Means and Standard Deviations of Number of Words, Number of Clauses, and Mean Clause Length (Words per Clause), by Grade, Genre, and Modality

Grade/Genre	# Words		# Clauses		Mean Clause Length	
	Spoken	Written	Spoken	Written	Spoken	Written
4th Narratives	96.56	74.19	22.44	18.44	4.47	4.25
	(51.36)	(35.59)	(12.47)	(10.3)	(0.83)	(0.75)
Expositories	59.94	48.31	14.56	10.25	4.15	4.68
	25.8)	(28.03)	(6.14)	(5.27)	(0.79)	(1.29)
7th Narratives	118.87	108.00	27.5	24.88	4.37	4.45
	(76.26)	(52.69)	(18.02)	(13.19)	(0.62)	(0.71)
Expositories	99.75	81.5	21.81	16.88	4.81	5.04
	(54.02)	(25.9)	(13.6)	(6.25)	(0.60)	(1.00)
11th Narratives	108.62	104.19	25.00	22.69	4.49	4.55
	(100.85)	(68.48)	(24.48)	(14.85)	(0.61)	(0.65)
Expositories	84.56	78.31	16.13	14.94	5.77	5.64
	(57.19)	(48.93)	(11.74)	(10.25)	(2.16)	(1.64)
Adults' Narratives	218.53	154.13	48.33	32.73	4.64	4.87
	(105.00)	(107.62)	(25.76)	(25.11)	(0.63)	(0.85)
Expositories	199.27	163.33	34.53	26.47	5.67	6.47
	(115.66)	(79.93)	(17.36)	(12.33)	(0.91)	(1.91)

Results

Text Size

As a basis for specifying adjective distribution, we measured text size in terms of words, clauses, and mean clause length (number of words divided by number of clauses). Table 1 presents these measures by age/grade group, genre, and modality.

We conducted a three-way ANOVA of Group (4 age/grade groups: 4th graders, 7th graders, 11th graders, adults) × Genre (2 genres: narrative, expository) × Modality (2 modalities: spoken, written) on the three variables in Table 1 – number of words, number of clauses, and mean clause length.

Number of Words.   The following effects emerged: first, Age/Grade Group, ($F(3,59) = 16.27$, $p < .001$) indicating increase in number of words. The Bonferroni post-hoc analyses showed that adults had the most words. Second, an effect of Genre ($F(1,59) = 4.58$, $p < .04$ – with narratives having more words ($M = 122.89$, $SD = 77.13$) than expositories ($M = 101.87$, $SD = 70.83$). Third, Modality ($F(1,59) = 10.6$, $p < .003$), with spoken texts having more words ($M = 123.26$, $SD = 77.44$) than written texts ($M = 101.5$, $SD = 59.29$). No significant interactions emerged.

Number of Clauses.   There was an effect of Age/Grade Group ($F(3,59) = 8.99$, $p < .001$), indicating an increase in number of clauses, again with adults having the most clauses. The effect of Genre ($F(1,59) = 17.74$, $p < .001$) showed that narratives had more

Table 2. Mean Number and Standard Deviations of Content Word and Adjective Tokens per Clause, by Grade, Genre, and Modality

Grade/Genre	Content Words per Clause		Adjectives per Clause	
	Spoken	Written	Spoken	Written
4th Narratives	2.07 (0.47)	2.07 (0.54)	0.11 (0.12)	0.12 (0.16)
Expositories	2.01 (0.48)	2.76 (0.9)	0.41 (0.24)	0.49 (0.25)
7th Narratives	1.91 (0.36)	2.01 (0.39)	0.17 (0.11)	0.16 (0.14)
Expositories	2.37 (0.55)	3.05 (0.84)	0.45 (0.34)	0.54 (0.24)
11th Narratives	2.01 (0.36)	2.19 (0.47)	0.22 (0.16)	0.24 (0.2)
Expositories	2.78 (1.26)	3.55 (1.5)	0.44 (0.27)	0.7 (0.61)
Adults' Narratives	2.22 (0.57)	2.26 (0.58)	0.23 (0.19)	0.45 (0.25)
Expositories	3.02 (0.87)	4.26 (1.48)	0.45 (0.19)	0.79 (0.31)

more clauses ($M = 27.75$, $SD = 17.68$) than expositories ($M = 19.45$, $SD = 11.6$). No significant interactions emerged.

Mean Clause Length. The following effects emerged: Age/Grade Group ($F(3,59) = 11.29$, $p < .001$), with clauses getting longer, most particularly in the two older groups. Genre ($F(1,59) = 24.19$, $p < .001$), with expositories having longer clauses ($M = 5.28$, $SD = 1.21$) than narratives ($M = 4.51$, $SD = 0.52$). An Age × Genre interaction ($F(3,59) = 3.58$, $p < .02$) showed that this difference begins only in the 11th grade. There was no Modality effect and no other significant interactions.

Lexical Density

To neutralize the effect of text length, we measured lexical density by number of content words and adjectives per clause (Table 2). All analyses were performed at the token (rather than type) level, since we were interested in actual usage patterns (Bybee, 2006; Elman, 2004).

Content Words. A three-way ANOVA of Group × Genre × Modality showed the following effects. An Age/Grade effect ($F(3,59) = 6.39$, $p < .001$) indicated an increase in number of content words per clause, with the Bonferroni post-hoc analysis showing leaps between 7th and 11th grade. The Genre effect ($F(1,59) = 54.75$, $p < .001$) showed that expositories contained more content words ($M = 2.97$, $SD = 0.95$) than narratives ($M = 2.1$, $SD = 0.36$). The Age × Genre interaction ($F(3,59) = 3.76$, $p < .02$) indicated but this difference emerges only in 7th grade, increasing dramatically in the expositions of the three older groups. Finally, a Modality effect ($F(1,59) = 24.34$, $p < .001$) showed that written texts contained more content words ($M = 2.77$, $SD = 0.68$) than spoken texts ($M = 2.3$, $SD = 0.52$), mitigated by Genre × Modality interaction ($F(1,59) = 17.74$, $p < .001$) showing that this difference stems only from the expository texts. There were no other significant interactions.

Table 3. Mean Score (Maximum Score: 4) and Standard Deviations on the Morpho-semantic Adjective Scale, by Grade, Genre, and Modality

Grade/Genre	Spoken	Written
4th Narratives	0.54 (0.52)	0.39 (0.36)
Expositories	1.06 (0.58)	1.01 (0.75)
7th Narratives	1.05 (1.04)	0.89 (0.79)
Expositories	1.56 (0.84)	1.7 (0.89)
11th Narratives	0.86 (0.91)	0.94 (0.89)
Expositories	1.25 (1.02)	1.55 (0.66)
Adults' Narratives	2.05 (1.15)	2.63 (1.93)
Expositories	2.99 (1.58)	3.93 (2.0)

Table 4. Mean Number and Standard Deviations of Adjective Categories per Text, by Grade, Genre, and Modality

Grade/Genre	Spoken	Written
4th Narratives	1.13 (0.81)	1.19 (1.05)
Expositories	2.06 (0.77)	2.13 (1.15)
7th Narratives	1.75 (1.18)	2.13 (1.59)
Expositories	2.5 (0.82)	2.56 (0.81)
11th Narratives	1.75 (1.06)	2.19 (1.17)
Expositories	2.38 (1.03)	2.75 (0.77)
Adults' Narratives	3.00 (0.85)	3.73 (0.46)
Expositories	3.33 (0.72)	3.47 (0.74)

Adjectives. A three-way Group × Genre × Modality ANOVA yielded the following effects: First, Age/Grade ($F(3,59) = 5.45, p < .003$), showing that the number of adjectives per clause increases, with the largest number in the adults, differing from the two youngest groups. Second, Genre ($F(1,59) = 99.03, p < .001$), with expository texts containing more adjectives ($M = 0.53, SD = 0.29$) than narratives ($M = 0.21, SD = 0.14$). Finally, Modality ($F(1,59) = 15.89, p < .001$), with written texts containing more adjectives ($M = 0.44, SD = 0.25$) than spoken texts ($M = 0.31, SD = 0.15$). Two interactions mitigated the Modality effect. First, Age × Modality ($F(3,59) = 2.95, p < .05$), showing that this difference in found only in the written texts of the two older groups; and second, Genre × Modality ($F(1,59) = 4.91, p < .04$), showing that it stems from a difference between written texts of the two different genres. There were no other significant interactions.

Morpho-Semantic Analyses

Three analyses were performed on the adjective morpho-semantic categories described in the Method section. First, *mean score on the adjective scale* provided one way of

assessing morpho-semantic development. Table 3 presents the mean scores on the morpho-semantic scale described earlier.

A three-way ANOVA (Group × Genre × Modality) showed an effect of Age/Grade ($F(3,59) = 31.3$, $p < .001$), showing that score on the scale increases, most of all in the adults. There was also a Genre effect ($F(1,59) = 25.27$, $p < .001$), with expository texts having a higher score ($M = 1.88$, $SD = 1.28$) than narratives ($M = 1.17$, $SD = 1.07$). There were no Modality effect or interactions.

The number of *different* adjective categories in a text is another measure of adjective 'richness.' Table 4 shows the number of different adjective categories in the texts analyzed.

A three-way ANOVA (Group × Genre × Modality) showed again an effect of Age/Grade ($F(3,59) = 23.77$, $p < .001$) – the mean number of different adjective categories increases, with two cut-off points – after 4th grade, and after 11th grade. The Genre effect ($F(1,59) = 6.02$, $p < .02$) showed expository texts had a higher number of adjective categories ($M = 2.52$, $SD = 0.79$) than narratives ($M = 2.24$, $SD = 1.14$). Finally, the Modality effect ($F(1,59) = 20.64$, $p < .001$) showed that written texts had more adjective categories ($M = 2.65$, $SD = 1.02$) than spoken texts ($M = 2.11$, $SD = 0.91$). There were no significant interactions.

We performed two analyses to assess the *size of each of the adjective categories* while neutralizing differences in text lengths. One analysis examined the relative proportion of adjectives in each category out of all adjectives, and another looked at the numbers of adjectives in each category per clause. While both analyses reveal similar trends, together they provide a fuller picture of the development of the adjective class.

Number of Category Items per Clause.   Table 5 presents mean number of adjectives per clause from each of the four adjective categories.

Three-way ANOVAs (Group × Genre × Modality) on each of the adjective categories in Table 5 showed the following. *Age/Grade effects*: there was an effect ($F(3,59) = 3.43$, $p < .03$) indicating a decrease in Category 1 core adjective tokens, where 4th graders had the most core adjectives, and 11th graders the fewest; there was also an increase in Category 2 resultative adjectives ($F(3,59) = 5.51$, $p < .003$), with a cut-off point after 7th grade; an increase in Category 3 verbal/nominal adjectives ($F(3,59) = 18.61$, $p < .001$), with cut-off points after 7th and 11th grades; Category 4 showed no effect for group. *Genre effects*: there was no effect in Category 1 and 2; there were more Category 3 adjectives ($F(1,59) = 22.1$, $p < .001$) in expositories ($M = 0.13$, $SD = 0.12$) than in narratives ($M = 0.08$, $SD = 0.5$); and likewise more Category 4 adjectives ($F(1,59) = 7.26$, $p < .01$) in expositories ($M = 0.13$, $SD = 0.2$) than in narratives ($M = 0.06$, $SD = 0.04$). *Modality effects*: Category 1 adjectives ($F(1,59) = 23.37$, $p < .001$) were more numerous in written ($M = 0.18$, $SD = 0.09$) than spoken texts ($M = 0.09$, $SD = 0.09$). An Age × Modality interaction ($F(3,59) = 6.94$, $p < .001$) shows that the number of Category 1 adjectives declined sharply after 4th grade in written texts. There was no effect for Modality in Category 2 resultative adjectives. In Category 3 ($F(1,59) = 72.67$, $p < .001$), written texts had more adjectives ($M = 0.16$, $SD = 0.11$) than spoken texts ($M = 0.05$, $SD = 0.07$). The interaction of Group, Genre, and Modality ($F(3,59) = 2.95$, $p = .04$) shows that Category 3 adjectives increased gradually in spoken texts and exponentially in written expositories. Finally, Category 4 adjectives ($F(1,59) = 23.85$, $p < .001$) were more numerous in written ($M = 0.16$, $SD = 0.17$) than in spoken texts ($M = 0.03$, $SD = 0.1$), with no interactions.

Table 5. Mean Tokens per Clause and Standard Deviations of Adjectives in Different Morpho-semantic Categories, by Grade, Genre, and Modality

Grade/Genre	Category 1 Core Adjectives		Category 2 Resultative Participials		Category 3 Verbal/Nominal Patterns		Category 4 Denominals	
	Spoken	Written	Spoken	Written	Spoken	Written	Spoken	Written
4th Narratives	0.09 (0.11)	0.07 (0.14)	0.02 (0.04)	0.01 (0.02)	0.01 (0.02)	0.03 (0.06)	0.001 (0.005)	0.01 (0.03)
Expositories	0.28 (0.19)	0.29 (0.22)	0.02 (0.04)	0.02 (0.04)	0.07 (0.07)	0.05 (0.07)	0.05 (0.08)	0.13 (0.17)
7th Narratives	0.1 (0.08)	0.08 (0.07)	0.02 (0.04)	0.02 (0.03)	0.02 (0.04)	0.03 (0.03)	0.02 (0.05)	0.04 (0.06)
Expositories	0.18 (0.12)	0.21 (0.14)	0.03 (0.07)	0.02 (0.03)	0.1 (0.11)	0.15 (0.12)	0.14 (0.23)	0.17 (0.23)
11th Narratives	0.08 (0.12)	0.07 (0.08)	0.05 (0.11)	0.06 (0.06)	0.05 (0.08)	0.07 (0.1)	0.04 (0.04)	0.04 (0.08)
Expositories	0.14 (0.16)	0.16 (0.15)	0.03 (0.04)	0.05 (0.09)	0.13 (0.13)	0.24 (0.21)	0.14 (0.25)	0.25 (0.49)
Adults' Narratives	0.1 (0.07)	0.17 (0.13)	0.04 (0.04)	0.06 (0.04)	0.06 (0.04)	0.12 (0.1)	0.03 (0.04)	0.09 (0.08)
Expositories	0.13 (0.09)	0.08 (0.08)	0.04 (0.04)	0.06 (0.06)	0.17 (0.11)	0.37 (0.12)	0.1 (0.12)	0.28 (0.29)

Proportion of Adjective Categories.   Table 6 presents the percentage of adjectives in each of the categories.

Three-way ANOVAs (Group × Genre × Modality) on the data in Table 6 showed the following effects. *Age/Grade effects*: we saw a decrease in Category 1 adjectives ($F(3,41) = 19.55, p < .001$), with cut-off points after 4th grade and 7th grade; an increase in Category 2 adjectives ($F(3,41) = 3.26, p < .04$), with a cut-off point after 7th grade; an increase in Category 3 adjectives ($F(3,41) = 4.83, p < .007$), with cut-off points after 4th and 11th grades. Category 4 showed no effect for group. *Genre effects*: more Category 1 adjectives ($F(1,41) = 7.78, p < .009$) occurred in narratives ($M = 48.87\%, SD = 22.62$) than in expositories ($M = 38.91\%, SD = 24.45$); more Category 3 adjectives ($F(1,41) = 4.15, p < .05$) occurred in expositories ($M = 32.08\%, SD = 18.74$) than in narratives ($M = 21.57\%, SD = 16.52$); and no genre effects emerged in Categories 2 and 4. *Modality effects*: Category 1 ($F(1,41) = 5.09, p < .04$) adjectives were more numerous in spoken ($M = 49.84\%, SD = 20.72$) than in written texts ($M = 37.93\%, SD = 19.7$), and likewise Category 2 ($F(1,41) = 9.96, p < .004$) was larger in spoken ($M = 16.75\%, SD = 14.54$) than in written texts ($M = 7.12\%, SD = 10.43$). In the opposite direction, Category 3 adjectives ($F(1,41) = 8.02, p < .008$) took up a larger proportion of written ($M = 32.08\%, SD = 16.23$) than spoken texts ($M = 21.57\%, SD = 16.86$), and the same is true of Category 4 adjectives ($F(1,41) = 7.54, p < .01$) in written ($M = 22.87\%, SD = 15.43$) versus spoken texts ($M = 11.85\%, SD = 15.73$). No interactions emerged in this analysis.

Table 6. Mean Percentages and Standard Deviations of the Different Adjective Categories out of All Adjective Tokens, by Grade, Genre, and Modality

Grade/Genre	Category 1 Core Adjectives		Category 2 Resultative Participials		Category 3 Verbal/Nominal Patterns		Category 4 Denominals	
	Spoken	Written	Spoken	Written	Spoken	Written	Spoken	Written
4th Narratives	79.44	58.13	9.72	11.25	8.33	28.13	2.5	2.5
	(20.3)	(33.16)	(18.25)	(16.2)	(17.82)	(36.44)	(7.07)	(7.07)
Expositories	63.61	51.7	6.25	5.12	19.72	18.04	10.42	25.15
	(21.09)	(30.35)	(12.4)	(7.92)	(19.05)	(16.41)	(17.68)	(34.3)
7th Narratives	59.29	50.01	10.37	10.06	19.71	16.35	10.63	23.57
	(33.61)	(32.28)	(18.77)	(11.47)	(30.6)	(12.77)	(18.44)	(24.61)
Expositories	50.11	35.99	7.22	5.91	22.53	38.62	20.16	19.48
	(54.02)	(23.98)	(13.8)	(14.94)	(14.23)	(24.1)	(26.77)	(24.68)
11th Narratives	32.74	39.85	31.57	26.06	18.6	24.85	17.09	9.24
	(40.53)	(34.16)	(39.67)	(23.13)	(32.5)	(23.63)	(25.79)	(14.01)
Expositories	32.49	27.68	4.07	10.88	32.67	36.09	30.77	25.36
	(24.15)	(20.77)	(9.97)	(15.12)	(26.59)	(23.98)	(31.12)	(29.09)
Adults' Narratives	42.72	36.51	18.83	16.12	27.51	29.09	10.93	18.28
	(20.46)	(18.37)	(23.34)	(11.28)	(16.39)	(14.81)	(17.92)	(11.01)
Expositories	30.52	11.38	10.14	7.34	38.95	50.03	20.39	31.25
	(17.13)	(10.82)	(9.7)	(7.12)	(16.19)	(13.75)	(20.07)	(18.05)

Syntactic Analyses

We analyzed the syntactic context of adjectives by syntactic site, participation in complex structures, and internal adjective phrase modification

Syntactic Site. Two analyses of different syntactic positions (predicative, attributive, compound head) that adjectives can take in Hebrew are presented here. First, *adjectives per clause by syntactic site.* Table 7 presents the mean number of adjectives per clause by syntactic position, age/grade, genre, and modality.

Three-way ANOVAs (Group × Genre × Modality) on the data in Table 7 showed the following effects: *Age/Grade effects*: no effect emerged in predicative, adverbial, and NP head adjectives; there was an increase in number of attributive adjectives per clause ($F(3,59) = 6.09$, $p < .001$), with cut-off between oldest and youngest groups. *Genre effects*: no effect emerged in predicative, adverbial, and NP head adjectives, but attributive adjectives ($F(1,59) = 25.98$, $p < .001$) were more numerous in expository ($M = 0.26$, $SD = 0.2$) than in narrative texts ($M = 0.15$, $SD = 0.11$). The Group, Genre, and Modality interaction ($F(3,59) = 3.34$, $p < .03$) shows that attributive adjectives leveled off in narratives from 7th grade, while continuing to increase in expositories. *Modality effects*: predicative adjectives ($F(1,59) = 63.49$, $p < .001$) occurred more in written ($M = 0.23$, $SD = 0.2$) than in spoken texts ($M = 0.07$, $SD = 0.1$); and likewise more attributive adjectives ($F(1,59) = 38.37$,

Table 7. Mean Tokens per Clause and Standard Deviations of Adjectives in the Four Syntactic Sites, by Grade, Genre, and Modality

Grade/Genre	Predicative		Attributive		Adverbial		NP Head	
	Spoken	Written	Spoken	Written	Spoken	Written	Spoken	Written
4th Narratives	0.06 (0.07)	0.03 (0.04)	0.04 (0.05)	0.07 (0.14)	0	0.01 (0.01)	0.16 (0.58)	0.18 (0.63)
Expositories	0.28 (0.21)	0.28 (0.17)	0.13 (0.07)	0.21 (0.19)	0	0	0	0
7th Narratives	0.09 (0.06)	0.04 (0.05)	0.08 (0.08)	0.12 (0.12)	0	0.002 (0.01)	0.002 (0.01)	0.01 (0.02)
Expositories	0.16 (0.1)	0.16 (0.1)	0.28 (0.29)	0.34 (0.23)	0	0.003 (0.01)	0.01 (0.28)	0.39 (0.84)
11th Narratives	0.1 (0.09)	0.06 (0.06)	0.1 (0.11)	0.16 (0.17)	0.01 (0.02)	0	0.02 (0.05)	0.02 (0.03)
Expositories	0.21 (0.17)	0.25 (0.2)	0.21 (0.25)	0.4 (0.46)	0.01 (0.03)	0.01 (0.03)	0.01 (0.03)	0.03 (0.13)
Adults' Narratives	0.1 (0.05)	0.1 (0.06)	0.11 (0.07)	0.32 (0.2)	0.01 (0.02)	0.01 (0.02)	0.004 (0.01)	0.01 (0.03)
Expositories	0.19 (0.14)	0.29 (0.35)	0.24 (0.16)	0.49 (0.25)	0.01 (0.02)	0	0.01 (0.02)	0.01 (0.02)

$p < .001$) occurred in written ($M = 0.29$, $SD = 0.2$) than in spoken texts ($M = 0.13$, $SD = 0.11$). There were no modality effects in adverbial and NP head adjectives.

The second analysis of syntactic position examined *proportions of adjectives by syntactic site*. Table 8 presents the percentages of adjectives out of all adjectives by site, age/grade, genre, and modality.

Three-way ANOVAs (Group × Genre × Modality) on the data in Table 8 showed the following. *Age/Grade effects*: predicative adjectives ($F(3,41) = 2.91$, $p < .05$) decreased, but no specific differences were detected among groups. In contrast, attributive adjectives increased ($F(3,41) = 2.95$, $p < .05$), but again no specific differences were detected among groups. No effects were found in adverbial and NP head adjectives. *Genre effects*: more predicative adjectives ($F(1,41) = 5.55$, $p < .03$) were found in narratives ($M = 48.5\%$, $SD = 19.81$) than in expositories ($M = 39.99\%$, $SD = 21.73$). More attributive adjectives ($F(1,41) = 3.97$, $p = .05$) occurred in expositories ($M = 54.32\%$, $SD = 21.26$) than in narratives ($M = 47.25\%$, $SD = 21.04$). No genre differences were detected in the other two syntactic positions. *Modality effects*: no effects emerged in predicative, attributive, and adverbial adjectives. More NP head adjectives ($F(1,41) = 6.74$, $p < .02$) were found in spoken ($M = 5.57\%$, $SD = 6.46$) than written texts ($M = 2.03\%$, $SD = 7.64$). The interaction of age group and modality ($F(3,41) = 5.16$, $p < .005$) shows this difference comes mainly from the teenage groups.

Participation in Complex Structures.   We proceeded next to analyze adjective participation in complex adjectival structures including adjective conjoining, stacking, and serving as compound heads. Since complex structures involve more than one adjective,

Table 8. Mean Percentages and Standard Deviations of Adjectives in the Four Syntactic Sites, by Grade, Genre, and Modality

Grade/Genre	Predicative		Attributive		Adverbial		NP Head	
	Spoken	Written	Spoken	Written	Spoken	Written	Spoken	Written
4th Narratives	42.22 (30.03)	51.25 (30.09)	54.65 (32.18)	39.34 (32.34)	0	3.13 (8.84)	3.13 (8.84)	6.25 (17.68)
Expositories	63.61 (24.71)	57.74 (32.82)	36.39 (21.71)	42.26 (32.82)	0	0	0	0
7th Narratives	52.71 (32.6)	27.86 (33.68)	45.83 (32.69)	65.16 (32.29)	0	1.3 (4.31)	1.47 (3.53)	5.68 (10.25)
Expositories	35.59 (26.57)	40.26 (28.72)	62.76 (25.29)	48.17 (25.89)	0	1.3 (4.31)	1.65 (5.48)	10.27 (6.67)
11th Narratives	53.13 (27.55)	33.94 (28.59)	28.13 (24.36)	57.27 (28.32)	4.55 (15.08)	0	14.2 (21.75)	8.79 (17.15)
Expositories	52.67 (27.83)	50.51 (32.47)	47.33 (27.83)	47.97 (32.83)	0	1.52 (5.03)	0	0
Adults' Narratives	46.92 (21.01)	25.59 (13.2)	48.44 (22.3)	68.85 (16.05)	3.24 (9.9)	1.9 (4.37)	1.4 (3.7)	3.65 (7.17)
Expositories	41.13 (27.16)	32.79 (23.73)	54.51 (26.88)	65.48 (24.08)	1.81 (4.17)	0	2.55 (6.83)	1.74 (2.72)

we calculated this measure per clause rather than as a proportion out of all adjectives. Table 9 presents the mean number of adjectives per clause by complex structure type, age, genre, and modality.

Three-way ANOVAs (Group × Genre × Modality) on the data in Table 9 showed the following effects. *Age/Grade effects*: no effect emerged in conjoined and stacked adjectives; the number of adjectives as compound heads ($F(3,59) = 3.25, p < .03$) increased, with a significant difference between 4th graders and adults. *Genre effects*: conjoined adjectives ($F(1,59) = 7.98, p < .007$) were more numerous in expository ($M = 0.019, SD = 0.03$) than in narrative texts ($M = 0.008, SD = 0.02$). No other effects or interactions emerged in the other complex categories. *Modality effects*: again, more conjoined adjectives ($F(1,59) = 9.14, p < .005$) occurred in written ($M = 0.02, SD = 0.03$) than in spoken texts ($M = 0.007, SD = 0.02$). No other effects or interactions emerged in the other complex categories.

Internal Adjective Phrase Modification. Our last analysis focused on three categories of internal adjective phrase modifications – basic, advanced, and multiple modifications. Since this analysis always involves a single adjective, we were able to examine both percentages and numbers per clause.

Adjectives with internal modification per clause: Table 10 presents the mean number of adjectives per clause by internal AP modification category, age, genre, and modality.

Three-way ANOVAs (Group × Genre × Modality) showed the following. *Age/Grade and Genre effects*: no effect was found in any of the adjective modification categories, nor any interaction. *Modality effects*: adjectives with advanced modification ($F(1,59) =$

Table 9. Mean Tokens per Clause and Standard Deviations of Adjectives in Three Different Complex Structures, by Grade, Genre, and Modality

Grade/Genre	Conjoining		Stacking		Compound Head	
	Spoken	Written	Spoken	Written	Spoken	Written
4th Narratives	0	0	0	0	0	0
Expositories	0	0	0	0.004 (0.01)	0	0
7th Narratives	0.005 (0.01)	0.002 (0.007)	0	0	0	0
Expositories	0.02 (0.07)	0.02 (0.03)	0.01 (0.03)	0.005 (0.03)	0.003 (0.08)	0.002 (0.008)
11th Narratives	0.008 (0.02)	0.02 (0.06)	0	0.007 (0.02)	0.003 (0.01)	0
Expositories	0.008 (0.02)	0.01 (0.03)	0	0.02 (0.06)	0	0
Adults' Narratives	0.004 (0.009)	0.02 (0.02)	0	0.006 (0.02)	0.004 (0.01)	0.008 (0.02)
Expositories	0.01 (0.03)	0.05 (0.05)	0.007 (0.02)	0.01 (0.03)	0.01 (0.04)	0.004 (0.01)

30.2, $p < .001$) were more numerous in written ($M = 0.04$, $SD = 0.04$) than spoken texts ($M = 0.002$, $SD = 0.03$); in addition, more adjectives with multiple modifications ($F(1,59) = 68.85$, $p < .001$) occurred in written ($M = 0.09$, $SD = 0.05$) than spoken texts ($M = 0.001$, $SD = 0.05$). No other effects or interactions emerged in the other categories.

Proportion of adjectives with internal modification: Table 11 presents the mean number of adjectives by three internal AP modification categories, age/grade, genre, and modality.

Three-way ANOVAs (Group × Genre × Modality) showed the following. *Age/Grade effects*: no effect was found in any of the adjective modification categories. *Genre effects*: more adjectives with basic modification ($F(1,41) = 7.64$, $p < .01$) occurred in narrative ($M = 17.89\%$, $SD = 16.22$) than in expository texts ($M = 12.47\%$, $SD = 11.79$). There were no effects in the other modification categories. *Modality effects*: adjectives with basic modification ($F(1,41) = 8.81$, $p < .006$) occurred more in spoken ($M = 19.22\%$, $SD = 12.68$) than in written texts ($M = 11.13\%$, $SD = 12.05$). In contrast, more adjectives with advanced modification ($F(1,41) = 16.72$, $p < .001$) were found in written ($M = 5.76\%$, $SD = 4.54$) than in spoken texts ($M = 0.77\%$, $SD = 5.98$), and likewise there were more adjectives with multiple modifications ($F(1,41) = 68.4$, $p < .001$) in written ($M = 16.89\%$, $SD = 6.94$) than in spoken texts ($M = 0.47\%$, $SD = 9.85$). No other effects or interactions emerged in the other complex categories.

Gender Effects

We repeated all of the analyses described above, adding the gender variable. In this sub-section, we report only those effects and interactions where participant gender was found to be significant.

Table 10. Mean Tokens per Clause and Standard Deviations of Adjectives by AP Modification Type, Grade, Genre, and Modality

Grade/Genre	Basic		Advanced		Multiple	
	Spoken	Written	Spoken	Written	Spoken	Written
4th Narratives	0.03 (0.04)	0.03 (0.07)	0	0	0.004 (0.06)	0
Expositories	0.04 (0.08)	0.04 (0.07)	0.03 (0.06)	0.03 (0.08)	0.07 (0.11)	0.07 (0.1)
7th Narratives	0.04 (0.04)	0.03 (0.04)	0.002 (0.09)	0	0.003 (0.01)	0
Expositories	0.04 (0.07)	0.06 (0.09)	0.01 (0.04)	0.04 (0.08)	0.06 (0.07)	0.11 (0.12)
11th Narratives	0.06 (0.06)	0.02 (0.03)	0	0.003 (0.01)	0.001 (0.003)	0
Expositories	0.04 (0.08)	0.06 (0.1)	0.02 (0.04)	0.04 (0.06)	0.06 (0.1)	0.09 (0.11)
Adults' Narratives	0.05 (0.06)	0.03 (0.05)	0.002 (0.004)	0.009 (0.02)	0	0
Expositories	0.06 (0.04)	0.05 (0.05)	0.05 (0.06)	0.07 (0.06)	0.12 (0.09)	0.11 (0.09)

Adjective Density. We found a gender effect in adjective density ($F(1,55) = 5.879$, $p < .02$), measured as the percentage of adjectives out of content words. It showed that girls had a higher proportion of adjectives ($M = 14.92\%$, $SD = 4.05$) than boys ($M = 12.55\%$, $SD = 3.68$).

Adjective Categories. A close-to-significant gender effect on the adjective scale ($F(1,55) = 3.86$, $p = .055$) emerged: girls scored higher on the scale ($M = 1.4$, $SD = 0.96$) than did boys ($M = 1.12$, $SD = 0.93$). A gender effect was also found for number of adjective categories per text ($F(1,55) = 9.78$, $p < .004$): girls had more adjective categories ($M = 2.59$, $SD = 0.80$) than did boys ($M = 2.16$, $SD = 0.85$). When measured as a percentage of all adjectives in the text, we found an interaction of gender and modality ($F(1,37) = 4.87$, $p < .04$) in Category 3 adjectives. It showed that while males had the same proportion of Category 3 adjectives in both modalities, females had more such adjectives in writing than in speech. When measured as the number of category items per clause, we found a gender effect for Category 2 adjectives ($F(1,55) = 5.09$, $p < .004$): girls had more Category 2 adjectives per clause ($M = 0.042$, $SD = 0.04$) than boys ($M = 0.026$, $SD = 0.02$). In addition, we found an interaction of gender and modality ($F(1,55) = 5.92$, $p < .02$), showing that while males and females produced the same number of Category 2 adjectives in written texts, in spoken texts males had fewer such adjectives, and females produced more.

Adjectives in Different Syntactic Sites. In analyzing the proportion of attributive adjectives in our database, we found a gender effect ($F(1,37) = 5.34$, $p < .03$), showing

Table 11. Mean Percentages and Standard Deviations of Adjectives by AP Modification Type, Grade, Genre, and Modality

Grade/Genre	Basic		Advanced		Multiple	
	Spoken	Written	Spoken	Written	Spoken	Written
4th Narratives	26.6 (27.42)	27.5 (21.04)	0	0	2.78 (7.86)	0
Expositories	14.38 (19.98)	15.86 (20.61)	0	0	23.06 (24.85)	17.95 (19.59)
7th Narratives	26.1 (18.95)	20.18 (28.68)	8.68 (17.28)	2.08 (5.89)	0.46 (1.51)	0
Expositories	8.92 (8.72)	9.27 (11.9)	1.82 (6.03)	3.55 (6.66)	11.95 (10.85)	12.83 (13.04)
11th Narratives	22.51 (18.11)	3.64 (6.9)	0	1.51 (5.03)	0.51 (1.68)	0
Expositories	11.23 (15.08)	9.27 (12.06)	3.28 (7.94)	6.6 (10.34)	14.51 (17.92)	15.87 (17.17)
Adults' Narratives	18.89 (17.5)	8.36 (15.48)	0.95 (2.54)	1.87 (3.58)	0	0
Expositories	14.46 (9.15)	5.64 (5.58)	10.32 (12.36)	8.56 (6.4)	24.78 (19.25)	14.2 (8.41)

that females produced more such adjectives ($M = 54.93\%$, $SD = 15.22$) than did boys ($M = 43.85\%$, $SD = 20.09$). In addition, we found a gender and modality interaction ($F(1,37) = 9.84$, $p < .004$), showing that while males and females had the same number of attributive adjectives in written texts, in spoken texts males had fewer such adjectives, and females had more.

Participation in Complex Structures and Internal Modification. A gender effect emerged for number of adjectives functioning as compound heads per clause ($F(1,55) = 4.35$, $p < .05$): females had more such adjectives per clause ($M = 0.004$, $SD = 0.001$), while boys had none at all. In addition, two interactions of participant gender and genre emerged, regarding adjectives in complex syntactic structures. First, a gender and genre interaction in number of conjoined adjectives per clause ($F(1,55) = 5.19$, $p < .03$), indicating that males had few such adjectives, especially in expository texts, while females had fewer in narratives and strikingly more in expositories. A second gender and genre interaction emerged in number of stacked adjectives per clause ($F(1,55) = 6.89$, $p < .02$), showing that neither males nor females used stacked adjectives in narratives, but females did so in expositories. Finally, an interaction of age, participant gender, and genre in number of adjectives with multiple modifications per clause ($F(3,55) = 2.7$, $p = .05$) showed that the most amount of these adjectives was found in high school girls' narratives.

Discussion

Taken together, our findings show that, as predicted, the adjective class grows larger, richer, and more diverse in the school years – in lexicon, morpho-semantics, and syntax. Second, and also as predicted, adjectives configure by text genres and modalities in ways that provide independent support for other text type analyses (Berman & Nir-Sagiv, 2007; Ravid, 2004a, 2006).

Text Length and Complexity

Our text size analyses showed that the texts in which the adjectives occurred and were analyzed grew longer and more complex. Text size increased mainly in later adolescence, so indicating a general increase in amount of content and hence informativeness. While the more loosely constructed spoken and narrative texts were longer in terms of number of words and clauses, the subtler measure of mean clause length indicated that adolescents and adults produce longer clauses in expository texts. One cause of clause length is lexical complexity – revealed, for example, by use of high-register multi-lexemic expressions such as *éla im ken* 'unless' (Ravid & Berman, 2009). Longer clauses also indicate syntactic complexity, involving more optional phrase-level constituents, mainly modifiers like adjectival and adverbial phrases as well as internally more complex phrases such as heavy NPs (Ravid & Berman, this issue). Mean clause length is thus associated with lexical and syntactic growth, which are in turn necessary for the expression and organization of information in text development. This picture is underlined by mean number of content words per clause, taking only open-class words as contributing to text lexicality. Here, we found an increase in content words in *written expository* texts from 7th grade upwards. Together, these findings point to the late consolidation (around 11th grade, 16–18 years) of a rich lexical and syntactic textual architecture, concentrated mainly in written texts of the expository genre (Nippold, 2007; Tolchinsky, 2004). The abstract and academic nature of these texts entails densely informative linguistic constructions with a complex hierarchical, varied syntactic architecture supported by rich lexical density and diversity (Berman & Ravid, 2008; Ravid & Berman, 2009).

Adjective density follows closely the same trends for general text complexity: increase with age and schooling, and most specifically in the written expositories of 11th graders and adults. Since the primary function of adjectives is noun modification, increase in the number of adjective tokens reflects richer and more informative text content. For example, an 11th grade girl writes in a narrative about her former friend (adjectives italicized): 'There was a scene of *exaggerated* jealousy which resulted in a *verbal* argument, a *scathing* argument, filled with *reciprocal* accusations and yelling.' There is a close correspondence between adjective distribution in types as in the tokens which formed the basis for the statistical analyses of this study – as expository texts almost always contain more adjective types than narratives, suggesting that the *category* of adjectives grows and diversifies along with an increase in usage of adjective tokens.

Our finding that expository texts are richer in adjectives than narratives may initially appear counterintuitive. However, expositories are nominally denser, entailing a rich adjectival texture grounded in complex nominal syntactic structure, since adjectives – especially

lexically specific and loan-word adjectives such as *mašma'uti* 'significant' or *státi* 'static' – participate in the construction of heavy NPs (Ravid et al., 2002). The developmental pattern of adjectival density thus interfaces with the growing complexity and abstractness of the noun category. Recent work demonstrates how nominal density, which underlies much of the referential and syntactic architecture of texts (Biber, 1995; Halliday, 1989), increases dramatically at the same time that adjectives increase in number – between high school and adulthood, especially in written expositories (Ravid, 2006; Ravid & Berman, this issue).

Adjective Diversity

The overall amount of adjectives in texts also implies lexical diversity, that is, the more adjectives, the more diverse their categories. We examined this from three different perspectives: morpho-semantic ranking, number, and size of the different adjective categories. Ranking of morpho-semantic categories again revealed an increase across the school years, especially between adolescence and adulthood. This quantitative finding highlights the gradual developmental increment in adjective 'quality' – from core adjectives such as *adom* 'red' and *xadaš* 'new' in 4th grade to resultatives like *me'orav* 'mixed' in 7th grade; nominal-pattern, e.g., *ragiš* 'sensitive,' in 11th grade; and finally diminutive and denominal, e.g., *šavriri* 'fragile' (from *šavrir* 'fragment'), in the adult group. In line with greater adjective density, the adjective score was higher in expository than in narrative texts – reflected, for example, in the fact that 4th grade expository texts contained 'advanced' adjectives such as Category 3 *no'az* 'reckless' and Category 4 *pir'i* 'wild' – a far cry from the uniform Category 1 items that make up the bulk of the adjective lexicon in the 4th grade narratives.

A second perspective on adjective diversity emerged from the analysis of different adjective categories, focusing on the lexical class rather than on its items. We found a steady increment in number of adjective categories from one or two categories in 4th grade to three and more among the adults, indicative of the growth of a rich and diverse lexicon that takes advantage of a range of Hebrew-specific structural options to express a range of semantic notions. Interestingly, earlier adjective diversity was revealed in expositories than in narratives in all school-age groups. For example, the compiled list of adjective types in 4th grade *expositories* already displays the full variety of adjective categories from basic *yafe* 'nice' and *kaše* 'hard' through resultative *mexumam* 'heated, hot-headed' and *mesuyam* 'certain,' verbal/nominal patterns *meca'er* 'distressing' and *mevix* 'embarrassing,' to denominal *xinuxi* 'educational' and *tarbuti* 'cultural.' In contrast, the list of adjective types in 4th grade narratives contains mostly core adjectives.

Diversity of adjective categories also distinguished written from spoken texts. Spoken texts, constrained by the narrow window of online processing in real time and relying heavily on shared knowledge and cooperation with the addressee, do not permit much organization and planning. As a result they contain a large amount of ancillary non-informative material and are less lexical and informative. Written texts, which encourage planning, revision, review, and rewriting, allow the retrieval of literate lexical items and morpho-syntactic structures without the pressures of online processing, and are consequently more informative, and grammatically more complex (Berman, 2008; Berman & Ravid, 2008; Britton, 1994). As a modifying category, adjectives are particularly susceptible to this general distinction. Compare, for example, the two expository texts produced by the same

adult in speech and writing: the spoken text contains 81 words in 17 clauses, with only two adjectives – *ra* 'bad' (Category 1) and *racuy* 'desirable' (Category 2). In contrast, the written version, 107 words in 20 clauses, contains 10 different adjectives – one Category 1 adjective (*tov* 'good'), three Category 2 resultative adjectives (e.g., *mexo'ar* 'ugly'), three Category 3 adjectives (e.g., *mazik* 'harmful'), and three denominal adjectives (e.g., *sportívi* 'sportive'). As we show later on, this lexical diversity accompanies a more variegated syntactic structure in which these adjectives are embedded.

A third perspective on adjective diversity examined the size of Hebrew adjective categories across development and text types both as relative proportions and as items per clause. All analyses point to *core adjectives* as the most prevalent class in all groups. This semantically and morphologically simplex category is mostly composed of opaque Classical *beynoni* verb forms such as *xam* 'hot,' *ra* 'bad' (Gai, 1995). They are most numerous in the youngest group, and to a lesser extent in the 7th graders. Importantly, in all groups, those text types that are less lexically complex and/or informative, relying less on rich nominal structure – narratives and spoken texts – contain more core adjectives than do the written expositories.

The first morphologically complex class of adjectives to emerge in preschool language is *resultative adjectives* (Berman, 1994), denoting passive resultative states of objects such as *šavur* 'broken' from *šavar* 'broke.' However, the three resultative patterns are also assigned to other, not necessarily passive or resultative, adjectives – on the one hand, everyday modal adjectives (e.g., *asur* 'forbidden = don't,' *mutar* 'allowed = you may'), and, on the other hand, lexically specific, high-register adjectives with no active counterparts, such as *mesugar* 'withdrawn,' *mufnam* 'introverted.' As a result, this category is pervasive in both genres, and though it clearly increases with age and schooling in both analyses, resultative adjectives remain more numerous in spoken texts. To illustrate, consider an adult written expository that contains four different resultative adjectives (in free translation, underlined) of all types and registers: *alimut hi tofa'a mexo'éret u-mazika* 'violence is an <u>ugly</u> and harmful phenomenon'; *beyt ha-séfer alul lihyot gehinom avur yeladim mesuyamim* 'school <u>may</u> be hell for <u>certain</u> kids'; and . . . *ma še-mitraxeš be-nafšam ha-mesuxséxet* 'what goes on in their <u>troubled</u> soul.'

Category 3 of *verbal/nominal adjectives* contains an array of adjectives based on verb and noun patterns (e.g., *mat'im* 'suitable,' *ca'ir* 'young'), and has not been examined systematically in psycholinguistic perspective prior to the current analysis. Findings demonstrate that verbal/nominal pattern adjectives constitute a late-emerging category that increases in leaps and bounds across the school years. They emerge gradually in spoken texts and increase dramatically in written texts – again, more in expositories than in narratives. In younger groups, such adjectives are often based on transparent present-tense participial verb forms, as in the written 4th grade expository excerpt, e.g., *alimut ze davar <u>mag'il</u> . . . ze gam kcat <u>meca'er</u>* 'violence is something <u>disgusting</u> . . . it is also a bit <u>saddening</u>'; or in *he'evarnu méser <u>šone</u>* 'we conveyed a <u>different</u> message' (11th grade written narrative). In older groups, these also occur in medial-passive verb patterns, e.g., *zo axen truma <u>nixbada</u>* 'this is indeed a <u>considerable</u> contribution,' *hu raca axrayut ve-samxut <u>noséfet</u>* 'he wanted <u>additional</u> responsibility and authority' (adult written narratives), and *alimut be-beyt-séfer ze davar <u>nadoš</u>* 'violence in schools is a <u>banal</u> thing' (11th grade written expository).

The most frequent nominal-based pattern is *CaCiC* (cf. agent noun *pakid* 'clerk'), starting with basic modal *carix* 'have to = necessary' in younger groups. The texts of the older groups reveal a rich variety of *CaCiC*-based adjectives, as underlined in the following freely translated excerpts: *ha-šulxan alav katávti lo haya <u>yaciv</u>* 'the desk on which I wrote was not <u>steady</u>'; *yexasim <u>kalilim</u> beyn xaverot* '<u>light</u> relationships between girl-friends' (11th grade written narratives); *šerut <u>ya'il</u>, levavi ve-<u>zariz</u>* '<u>efficient</u>, amiable, and <u>speedy</u> service' (adult written narrative); *alimut . . . hi davar <u>šaxí'ax</u>* 'violence . . . is a <u>frequent</u> thing' (11th grade written expository); *ha-alimut eyna stam mila <u>tmima</u>* 'violence is not just an <u>innocent</u> word'; *xadar kóšer <u>zamin</u>* 'an <u>available</u> gym' (adult written expositories). Adjectives based on other agentive nominal patterns also occur in older text production, for example *CaCaC* (cf. *nagar* 'carpenter'), e.g., *alimut be-beyt-séfer <u>kayémet</u>* 'violence is <u>existent</u> in schools'; and *CaCCan* (cf. *safran* 'librarian'), as in *horim <u>savlanim</u>* 'parents who are <u>patient</u>' (adult written expositories).

The most 'advanced' adjective category in Hebrew consists of *denominal -i* suffixed forms, the only genuine adjectival class which is not dependent on verbal or nominal patterns, and which emerges last in acquisition (Ravid, 2004b; Ravid & Nir, 2000). As the smallest class, it does not show age/grade effects; however it is the hallmark of written, and especially expository, texts in all groups. In younger groups, most denominal adjectives are frequently occurring and formulaic, as in the following excerpts: *beyt-séfer im alimut ze lo beyt-séfer <u>normáli</u>* 'a school with violence is not a <u>normal</u> school' (4th grade spoken expository); or *alimut kolšehi – im <u>milulit</u> ve-im <u>fízit</u>* 'some violence – whether <u>verbal</u> or <u>physical</u>' (7th grade written expository). But starting in pre-adolescence, written texts – and especially expositories – also contain some genuinely derived denominal -i suffixed adjectives such as *yeladim še-yeš lahem hašpa'a <u>xevratit</u>* 'kids who have <u>social</u> influence' (7th grade written expository), or *zo hitnahagut lo <u>humánit</u>* 'this is <u>non-humane</u> behavior' (11th grade written expository). The most sophisticated denominal adjectives are used by adults, e.g., *hi garma le-mifga <u>betixuti</u>* 'she caused a <u>safety-related</u> obstruction,' or *netuley xešbonot <u>katnuniyim</u>* 'devoid of <u>petty</u> calculatons' (written adult narratives).

Taken together, these examples of different adjectival forms in acquisition indicate to what extent the adjective lexicon diversifies and becomes enriched with linguistic and cognitive development coupled with schooling.

Syntactic Analyses

The discourse-embedded nature of this study enabled us to explore the syntactic configurations of those same adjectives examined from lexical and morphological perspectives. Of the four possible syntactic sites in Hebrew, only the predicative and attributive in fact featured in our findings, with few adjectives in adverbial and NP head positions. A clear and robust picture emerges from all analyses: predicative adjectives decrease while attributive adjectives rise with age and schooling, setting mature adults apart from grade-school children. This finding complements the picture of preschool adjective acquisition (Ninio, 2004; Ravid & Nir, 2000), where predicative adjectives constituted the overwhelming majority of adjectives, while attributive adjectives emerged and increased toward age 5. The current study shows that in sharp contrast to early childhood development, noun modification is the major function of adjectives in older and more literate Hebrew speaker/writers, as

illustrated in the following excerpt from an 11th grade written narrative, whose adjectives are all high register and morphologically complex: *hirgášti še-bimkom yexasim* <u>*kalilim*</u> *beyn xaverot, anu mefatxot ma-aréxet yexasim* '<u>*romántit,*</u>' *še-milvad ha-intímiyut ha-*<u>*fízit*</u> *hi kolélet ha-kol – kin'a, mexuyavut ve-xu . . . hitpate'ax beyneynu vikú'ax* <u>*nokev,*</u> <u>*male*</u> *be-ha'ašamot* <u>*hadadiyot*</u> *u-vi-ce'akot* 'I felt that instead of a <u>light/frivolous</u> relationship between girlfriends, we were developing a '<u>romantic</u>' relationship which, apart from <u>physical</u> intimacy, included everything – jealousy, commitment, etc. . . . a <u>poignant</u> argument developed between us, <u>full</u> of <u>mutual</u> accusations and screaming.'

Interestingly, adjectives in head NP positions occurred more frequently in spoken texts by junior high school. These, however, were almost always partly ill formed, in colloquial constructions where noun ellipsis was infelicitous, e.g., *ani mištadélet kama she-paxot le-hitkarev le-alimim* 'I try to approach violent (ones) as little as possible' (7th grade written narrative); or *tamid yihyu kama mufra'im* 'there will always be some disturbed (ones)' (7th grade spoken expository). There were very few well-formed, high-register adjectival NP heads such as *talmidim elu hem ha-mevugarim šel maxar* 'these pupils are tomorrow's mature (ones = adults)' (written adult expository); *le-da'ati yeš lišpot kol exad me-hem be-nifrad* 'I think each of them has to be judged in-separate (= separately)' (written adult expository). The actual deployment of this interesting morpho-syntactic Hebrew class deserves a separate study.

In line with the general results for lexical, morphological, and syntactic density and complexity, attributive adjectives participate in greater quantity in the rich nominal and informative structure of written and expository texts. In general, NPs with abstract nominal heads tend to attract more morphologically and semantically complex attributive adjectives, e.g., *ha-alimut ha-rováxat* 'the widespread violence,' *še'elot relevántiyot* 'relevant questions,' *tofa'a mexo'éret u-mazika* 'an ugly and harmful phenomenon' – so that semantic and syntactic complexity work in tandem (Ravid & Berman, this issue; Ravid & Cahana-Amitay, 2005).

Analyzing adjective complexity as a function of internal modification supports the previous analyses and completes the picture. Conjoined adjectives (almost always high register and morphologically complex) occur in a variety of syntactic structures mostly in written, expository texts of older writers, e.g., *martí'a u-mavxil* 'daunting and revolting'; *bilti recuya u-mesukénet* 'unwanted and dangerous,Fm'; *šguya aval mitkayémet* 'erroneous but existent,Fm.' Classical bound compound structures with post-nominal adjectival heads occur only in adult texts, e.g., *alimut tluyat-macav* 'situation-dependent violence' or *dvarim xasrey-to'élet* 'use-lacking (= useless) things.' Written and expository texts are also more likely to contain adjectives with advanced and multiple adverbial modifications, often embedded in high-register formulaic expressions, e.g., *plilit le-xol davar* 'criminal in all respects,' *alim yoter ve-yoter* 'more and more violent,' *gvoha bi-myuxad* 'especially high,' *gru'im pi kama* 'multiply worse,' and *psula mikol va-xol* 'totally proscribed.' These modifications provide much of the informational richness and lexical and syntactic intricacy and sophistication which characterize mature texts.

Gender Analyses

One of the 10 'basic assumptions' that Robin Lakoff (1975) made in her pioneering study about the special nature of women's language was the presence of numerous 'empty

adjectives' such as *divine*, *lovely*, *adorable* – empty, we suppose, as used for procedural rather than for semantic discursive functions (Sperber & Wilson, 1995). The results of the current analyses stand in stark contrast to this assumption. All gender effects point in the direction of Hebrew-speaking girls and women employing a richer and more diverse adjective lexicon than boys and men in this study. Females have a higher proportion of adjectives, with more diverse adjective categories in their content lexicon, and they use rarer and more morphologically complex adjectives, especially in writing. These adjectives tend to cluster in attributive positions and to participate in complex syntactic structures which are rare and even absent in males' texts – interestingly in both expositories and narratives. In other words, these adjectives could not be further removed from the ancillary qualifiers described in Lakoff's study of 'powerless' women's language. We offer two explanations for this disparity. First, the current analysis focuses on monologic texts rather than on conversational interactions – where the former have been shown to foster much more complex language than the latter (Berman, 2008; Ravid, Olshtain, & Ze'elon, 2003; Ravid & Zilberbuch, 2003). Second, while studies of early language acquisition do not reveal gender differences, a recent cross-linguistic study of literacy practices in adolescence (Chiu & McBride-Chang, 2006) indicates that in school age, girls may tend to make more use of written language than boys. Greater adjectival complexity and diversity may result from either of these reasons, but further implications should await a systematic study of the impact of participant gender on more lexical categories.

Conclusions

In sum, this text-embedded analysis of adjectives reveals them to be a later-emerging lexical class that encodes a variety of often subtle properties of nouns, diagnostic of genre and modality. The study shows that adjectives become lexically more diverse, morphologically more complex, and semantically richer across the school years, and that they also participate in increasingly more complex syntactic constructions. The rich nominal structure of mature written texts, in particular expositories, consolidates very late in terms of language development, around 11th grade (16–18 years). We hope to have demonstrated that this is largely contingent on the emergence of the adjective class – secondary, but critical to linguistic 'richness.' Finally, this study joins a series of different text production studies converging to show that linguistic maturation follows confluent rather than separate paths for lexicon, grammar, and discourse.

Acknowledgments

Notes

1   We use *c* to denote the unvoiced coronal affricate.
2   Word stress is marked only penultimately. In all other cases, stress is word-final.

Appendix (information derived from Berman & Ravid, 1999)

1. The Four Task Orders

(NS = narrative spoken; NW = narrative written; ES = expository spoken; EW = expository written):

	Session I		Session II	
Order A:	NW	ES	NS	EW
Order B:	NS	EW	NW	ES
Order C:	ES	NW	EW	NS
Order D:	EW	NS	ES	NW

2. Test Conditions

NS   Each participant brings a friend of his or her choosing, and tells the story to this friend, someone s/he knows well from the same class or neighborhood. This ensures some social context.

NW   Participants do the written version sitting on their own in a quiet room.

EW   Participants are asked to do the written version in school, during class time (once the class teacher agrees), since this ensures a more formal setting.

ES   The interviewer sits opposite the participant at a desk, to simulate a more formal setting.

3. Instructions

The wording of the instructions is adapted for each of the four orders; the wording given below is that of 'Order B,' starting with NS and EW in the first session. Instructions to participants in the first session for this order are given below (translated from the original Hebrew version):

NS   We're doing background research for a movie about why people fight or quarrel. I imagine you have been involved in some kind of quarrel. Think about a case like that, where you were involved in a fight or quarrel, and say what it was like, talk about the incident. I hope you don't mind if I record your story for our research.

EW   We're doing background research on what children/people think about the subject of violence in schools. We're collecting material on this topic, so we would like you to write a composition on the subject of violence in schools. Describe what your opinions are on this subject, what you think about it. Don't write a story, but explain what your attitude is. Here's a sheet of paper. You can take your time to write the composition, and you can write out a draft first if you want to.

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