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Morphological Disorders

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Introduction

The present chapter considers knowledge of the morphological class of adjectives in Hebrew-speaking SLI compared with NLA school children. We argue that the domain of derivational morphology is particularly appropriate for the investigation of linguistic disorders in SLI school children, since knowledge of obligatory grammatical morphology is so well-established and automatic in this age bracket that it would not serve as a good diagnostic. Derivational morphology, in contrast, is a semi-productive, rich and complex system, and demonstrates sufficient semantic and structural diversity to constitute an appropriate diagnostic tool for elementary school age. The category of Hebrew adjectives was selected because it is non-canonical in a number of senses, on the one hand, while it maps a variety of meanings onto various types of Hebrew morphological structure, on the other.

We focus on derivational adjective formation in SLI and NLA school-age children with the view to contribute to the debate on the nature of language disorders in children. One view holds that this is a developmental delay relative to children without language disorders. Another view holds that the linguistic system in SLI children is essentially different and deviant from normal development patterns (Leonard, Bortolini, Caselli, McGregor & Sabbadini, 1992). This chapter will show that SLI school children have serious problems in processing the internal structure of

Hebrew adjectives and in using morphological cues in both comprehension and production.

Language development at school age

This chapter focuses on morphological knowledge in normal language acquiring (NLA) and atypically (SLI) developing children who attend elementary school. It is well-accepted by now that natural language development runs its course over a long and protracted period until adolescence and beyond; and that during the school years it interacts intensively with the acquisition of literacy (Berman & Ravid, 1999; Nippold, 1998). Language acquisition during the school years (termed 'later language development') takes place at every linguistic level – lexical, grammatical, and pragmatic - and is accompanied by increasing meta-linguistic awareness, abstractization and explicitation of linguistic representation (Karmiloff-Smith, 1992; Scholnick, Nelson, Gelman & Miller, 1999). Concomitantly, perception of non-literal linguistic functions such as figurative language, linguistic ambiguity, sarcasm, irony, and language puns emerges and consolidates during the school-age and adolescent years (Nippold, 1998; Ashkenazi & Ravid, 1998).

By elementary school, children have acquired a large and varied vocabulary with complex hierarchical lexical and morphological connections (Anglin, 1993; Olson & Astington, 1986). Morphological and syntactic knowledge is well-established beyond the level of the simple clause, and by the end of elementary school, children are able, at the one extreme, to tell well-formed narratives, while at the other extreme, they are familiar with most morpho-phonological variants of words and morphemes in their language (Berman & Slobin, 1994; Ravid, 1995). Growing familiarity with written language both as a notational system and as discourse style contributes to increasing linguistic literacy during the school years, side by side with

the acquisition of new, less canonical structures typical of written language (Levin, Ravid & Rappaport, in press; Ravid & Avidor, 1998; Ravid & Tolchinsky, 2000).

Focusing on the population of the current study, Israeli school children formally relate words by their morphological structure, productively use semantic and structural options in morphology, and show awareness of basic morphological components such as roots and suffixes. By 3rd and 4th grade NLA Israeli children have already mastered reading and writing skills, can tell well-formed narratives, and are well on the way to correct Hebrew spelling, a skill which involves phonological and morphological representation and processing (Berman & Ravid, 1999; Berman & Slobin, 1994; Ravid, in press). They have been exposed to a variety of texts including Biblical Hebrew since 2nd grade, and have been learning English, sometimes also French or Arabic, since 3rd grade.

Language in school children is thus very different from preschool linguistic knowledge, and a critical distinguishing factor is the acquisition of literacy. This has not escaped the notice of language-disorders researchers, as summed up in a number of recent publications which have looked at the relationship between language disorders and literacy (Catts, Fey, Zhang & Tomblin, 1999; Catts & Kamhi, 1999). SLI children's ability to acquire new words, a critical factor in later-language development, is impaired, and they demonstrate difficulty with productive application of morphological knowledge (Nagy, Anderson, Scommer, Scott & Stellmen, 1989). Accordingly, problems in school-related abilities such as persistent spelling errors and dropping morphological suffixes in writing are reported. Though similar to their age-matched NLA peers in oral judgment, SLI children demonstrate more difficulties in spontaneous writing (Rubin, Kantor & Macnab, 1990). The majority of SLI children are thus at a very high risk for learning disability in elementary school, initially with

learning to read, later on in situations requiring complex language skills (Paul, 1995; Weiss, 1997).

In this chapter, we examine the ability to comprehend and produce Hebrew adjectives in SLI school children compared with NLA children of the same age, and with younger NLA language-matched children. In this age group it is possible to examine morphological knowledge beyond the obligatory inflectional systems which are mastered early on, and to look for more subtle differences in formal and semantic mapping, which can supply further clues on the nature of SLI.

Morphological processing

There are a number of reasons for selecting derivational word-formation as the main focus of this study. One relates to the central role of the lexicon in acquisition and in language disorders. Studies have pointed out a host of lexical processing problems in SLI children, such as taking more time in tasks of lexical retrieval and in fast mapping; a reduced tendency to extend new object names to unnamed members of the same category; a need for phonologically and syntactically clearer and more transparent lexical input than NLA children; and inefficient use of sentence and discourse structure in identifying the meaning of unfamiliar words (Stone & Connel, 1993; and see an extensive review by Leonard & Deevy, this volume). Studies have also identified morphological analysis difficulties in SLI children, a reduced ability to manipulate morphemes and generalize morpheme meaning, and resulting problems in word learning, especially under explicit experimental conditions (Swisher & Snow, 1994; Swisher, Restrepo, Plante & Lowell, 1995). In addition, metalinguistic problems have been detected in language-disordered children at a number of levels which interact and affect each other, resulting in some cases in communicative impairment (Bishop, 2000; Rubin, 1988; Swisher et al., 1995). The immense

importance of lexical development in school children, which underlies almost every other linguistic achievement (Berman & Ravid, 1999), directs our attention to words and their structure.

The focus on Hebrew relates to the growing body of evidence of typological considerations in language learning. Recent crosslinguistic research has demonstrated the powerful impact of target-language typology on the process of acquisition in a range of domains, revealing that children are very early on sensitive to the "typological imperatives" of their language (Berman, 1986). Findings of research in different domains such as speech perception, spatial relations, word-class acquisition, word-formation, narrative development and learning to spell converge to show that children are early on attuned to the language-particular way of encoding form-meaning relationships in their language (Bowerman, 1996; Clark & Berman, 1984; Gathercole, 1997; Gillis & Ravid, in press; Jucszyk, 1997). In each case reported, how children encode form-meaning relations accords with how this is done by adult speakers of the same target language rather than by children of the same age in other languages. Hebrew, a highly synthetic Semitic language, challenges its speakers with a rich and complex morphological system,

Interestingly, comparative studies of inflectional morphology in languages with varying degrees of syntheticity suggest that language-impaired children learning morphologically rich languages such as Hebrew or Italian fare on the whole better than English-speaking SLI children, learning a language with a sparse morphology (Dromi, Leonard & Shteiman, 1993; Leonard et al., 1992; Rom & Leonard, 1990). It seems that children growing up in highly synthetic languages featuring a variety of salient, stressed morphemes find inflectional morphology tasks easier than children growing up in languages with impoverished inflection. Word formation in a highly

synthetic language such as Hebrew seems like a promising domain of investigation in SLI and NLA children.

Current research suggests there is considerable heterogeneity among SLI children, so that this population consists of several subtypes with different etiologies which differ regarding comprehension and production abilities (Miller & Klee, 1995; Stark & Tallal, 1981). This heterogeneity is also found with respect to nonverbal cognition, affecting a variety of symbolic functions: SLI children differ with respect to their performance on tasks such as symbolic play, classification, figurative thinking, and hypothesis formation (Paul, 1995). This is thus a complex disorder, or a complex of disorders, which calls for description, assessment and explanation at more than a single level (Bishop, this volume). We suggest that derivational morphology is such a tool.

SLI disorders, especially in school children who are already fairly proficient in both oral and written facets of their native tongue, calls for an assessment tool which demands elaborate knowledge related to lexicon size as well as to a grasp of network relations between words with the same lexical substance or belonging to the same ontological category. The unpredictable, non-obligatory, semantically opaque nature of derivational morphology contributes to this challenge. Derivational morphology provides a useful, though to date largely untapped, source for examining linguistic command in SLI. Word-formation is a domain which requires complex, integrated knowledge of the interrelation between lexical convention, semantic content, and formal structure, and as such it is an area where knowledge continues to develop well into school age, and is related to literacy.

To date, most studies on derivational morphology in SLI English-speaking children have been conducted on school children, since rich derivational structures in

English mostly require components beyond its (mostly) monomorphemic Germanic core lexicon, and are therefore acquired later on. These studies have found that SLI children are insensitive to derivational relationships (Moats & Smith, 1992), storing words in isolated rather than network forms (Carlisle, 1988). They also have difficulty in applying morphological rules to unfamiliar words, and demonstrate a reduced ability for organizing and accessing words through morphological relations (Freyd & Baron, 1982; Nagy et al., 1989).

In a recent study, Ravid, Avivi Ben-Zvi & Levy (1999) report on comprehension and production of novel Hebrew nouns in SLI and age-matched and language-matched NLA school children. The nominal categories tested ranged from agent, instrument, and place to collective, abstract, and action nominals. The comprehension task tested children's ability to analyze a novel noun into its components, which were extant morphemes in Hebrew - roots, stems, patterns and suffixes. The production task tested children's ability to produce novel nouns from verbs and other nouns. There was no difference among the study groups on the comprehension task, which required the ability to relate words through their roots or stems. However, the SLI group was consistently worse than the age-matched and language-matched controls on the production task, which required relating words through their patterns and suffixes. This suggests that SLI are able to manipulate roots and stems, morphemes conveying lexically encodable information; but they find it harder to manipulate patterns and suffixes, morphemes with a categorizing function which require a higher-order linguistic capacity for analyzing and extending morphological knowledge. The SLI group also showed a deviant pattern on classifying nouns semantically and was not able to make maximal use of the whole possible array of root-and-pattern structures in production.

The novel noun study indicated that derivational nominal morphology is a sufficiently sensitive tool for characterizing language knowledge in typically and non-typically developing Israeli school children. The study discussed in this chapter examines knowledge of adjectives in this population.

Representing adjectives

The three well-known content-word (or *open class*) categories in the world's languages are nouns, verbs, and adjectives. These categories differ in their degree of universality and proto-typicality, as defined by a number of criteria. Semantically, a lexical category is characterized by the concepts it refers to, and syntactically, by the syntactic functions it fulfills. It has also been proposed that lexical categories have discourse roles, and that the prototypical status of category members depends to what extent they introduce participants or events into the discourse (Hopper & Thompson, 1984). Finally, a lexical class may also have language-specific morphological characteristics. Typical members of the *class* of lexical categories fulfill these requirements. Thus the two basic lexical categories that participate in "making up" a language either onto- or phylo-genetically are nouns and verbs. Although these two categories contain more and less typical members (e.g., concrete vs. abstract nouns, dynamic vs. state verbs), they are both primary lexical classes in the sense of referring to the basic lexical notions of objects and events, and implementing primary syntactic functions such as arguments and predicates (Schachter, 1985). In both English and Hebrew, nouns and verbs are rather easy to characterize in uniform grammatical and structural terms such as morphosyntactic behavior: for example, nouns take possession markers and verbs decline in tenses.

Adjectives constitute a third content-word class, which is less primary in a number of senses. From a pragmatic point of view, Thompson (1988) shows that

adjectives have differential discourse functions in spontaneous conversation, together with nouns and verbs. Semantically, adjectives denote attributes or properties of nouns, that is, they serve in a secondary function to a primary class. 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 NP modifiers (e.g., *the smart student*). In both cases, the adjective denotes a property attributed to a noun - either the subject of the sentence or the NP head (Ferris, 1993).

In classical linguistic terms, nouns are those terms that refer, describe or designate objects in some way, whereas adjectives characterize them (Lyons, 1966). This is reflected in the fact that in many languages, adjectives agree with the noun they modify in number, gender, and in many others also in additional values such as definiteness or case (e.g., French, Latin, Hebrew). In his survey of linguistic universals, Greenberg (1966) 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 them. This implies that nouns have a fixed form independent of any modifier they receive, whereas adjectives presuppose a noun and adjust their form to correspond to its inflection (Markman, 1989).

The secondary nature of adjectives is expressed typologically in the fact that many languages lack an open-class category of adjectives. In some languages this is a closed-class system expressing mainly dimensions, color, age and value. Others, such as Biblical Hebrew, lack an adjective class altogether (Gesenius, 1910). In such cases, adjectival meanings are expressed by (mainly abstract) nouns (e.g., in Hausa), and

(again, mainly) relativized stative verbs (e.g., Bemba and Mandarin Chinese) (Dixon, 1977; Schachter, 1985).

In psycholinguistic terms, the representation of adjectives in the mental lexicon is less richly structured and more arbitrary than that of nouns. Working within a categorization framework, Markman (1989) presents evidence that people expect nouns but not adjectives to refer to concepts that have considerably enduring and permanent inferential depth, that provide fundamental, essential information about the object and its identity, that are more readily placed in a taxonomy, and are difficult to combine with richly structured categories (1989:116-135). 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 vs. criminal lawyer* (Bolinger, 1967). Comparing the two lexical categories, Markman claims that frequently used nouns tend to convey richer, stronger, more stereotyped information than do common, frequently used adjectives. Adjectives point to arbitrary categories – where a single property might be the defining characteristic implying a contrast between members of the same noun category and specifying subdivisions within a richer category along many different dimensions. It seems that adjectives presuppose nouns in some way, whereas nouns do not presuppose adjectives.

Another facet of the representation of adjectives vs. nouns is the different ways the two lexical classes function in the way people organize and retrieve information in memory. Markman (1989) presents evidence from studies of paired associate learning and semantic memory in English that suggest that nouns may have some privileged status in memory, allowing more accurate, quicker access to

information, and being more effective as memory cues than adjectives and verbs. For example, nouns are better retrieval cues than adjectives, and when nouns precede adjectives, N-A pairs are learned better despite the word order mismatch in English.

The essential difference between the lexical classes of nouns and adjectives emerges early on in development. Gelman & Markman (1985) report an experimental study of noun and adjective interpretation in young children (aged 2;6-3;6) who were asked to "find the ball" or to "find the red one". When asked to interpret adjectives, children tended to focus on a contrast between members of the same object category, but nouns prompted children to select the more distinctive exemplar of the category.

Diary studies and surveys of natural language acquisition show that adjectives appear later in child speech than do nouns and verbs (Casseli, Bates, Casadio & Fenson, 1995; Rice, 1990; Sommers, Kozarevich & Michaels, 1994). They also constitute a low-frequency class when compared to other content words in children's early lexicons in various languages (Dromi, 1987; Marvin, Beukelman & Bilyeu, 1994; Ravid & Nir, 2000; Valian, 1986). Nevertheless, after an early phase of acquiring predominantly common nouns, children come to acquire larger numbers of verbs and adjectives as well (Barret, 1995). Ninio (1988) claims that the emergence of abstract predicative categories such as verbs and adjectives in child language follows the emergence of hierarchical syntax involving the insight of creating higher-order complex units. According to Berman (1988), adjectives enter the child's repertoire relatively later than do verbs and nouns since they share features with both, and are therefore less prototypical than verbs and nouns. It thus takes time for children to integrate semantic, syntactic and morphological cues to make the necessary distinctions between nouns and verbs, on the one hand, and adjectives, on the other.

Given this background, it is clear that adjectives constitute a non-canonical lexical class across languages, that their representation is less robust than that of nouns, and that they nevertheless have clearly defined semantic, syntactic and discourse characteristics. This category is thus a promising candidate for a study of later language development during the school years.

The case of Hebrew

Hebrew adjectives are interesting both as a language-specific example of this category, but even more so because of their diverse morphological structures in Hebrew.

INSERT TABLE 1 ABOUT HERE

Hebrew morphology makes use of two major types of word formation devices: root-and-pattern Semitic forms, alongside with concatenated, linear structures. Thus it permits testing contrasts which are not found in non-Semitic languages (Bolozky, 1997).

All Hebrew verbs and most nouns and adjectives contain a tri- or quadri-consonantal core, the Semitic *root*, which carries the main lexical substance of the word. This structural core appears discontinuously in the word, since it is interdigitated by vowels provided by the complementary vocalic structure of the *pattern.* The combination of root and pattern into a word is termed *nonlinear affixation*, and is illustrated in Table 1 in a set of words related by the consonantal skeleton constituting root *k-l-t* ‘take in, absorb’. Patterns have classificatory functions indicating features of syntactico-semantic nominal and verbal classes. The seven verbal patterns are termed *binyanim* (literally, ‘buildings’), and they indicate transitivity values. For example, *kalat* ‘absorbed’ is a transitive verb, while *hiklit* ‘recorded’ is causative and *huklat* ‘was recorded’ is its passive counterpart. Nominal

patterns, a few dozen in number, indicate ontological categories (Clark, 1993) such as agent, instrument, place, and abstract nominal. For example, *CoCCan* is an agent pattern (cf. *tsolelan* 'submariner'), while *maCCeC* indicates instruments (cf. *mavreg* 'screwdriver').

In addition to root-and-pattern structures, the Hebrew lexicon contains concatenated or *linear* stem-and-suffix forms, e.g., *mal'ax-i* 'angel-ic', *amin-ut* 'trustworthi-ness'. Table 2 illustrates linear structures in derivation.

INSERT TABLE 2 ABOUT HERE

The components of linear formation are more analytic than those of nonlinear forms. Unlike Semitic roots, which are unpronounceable, discontinuous entities, Hebrew stems contain vowels and they are almost always words in their own right (Nir, 1993). The concatenated stem-and-suffix form marks the boundaries of discernibly distinct entities, e.g., *kos-it, lamdan-ut,* and the stem is usually an identifiable, independent, pronounceable lexical unit.

Hebrew adjectives constitute a recently-evolved lexical class, since Biblical Hebrew, though highly synthetic, did not have a morphological class of adjectives (Gai, 1995; Gesenius, 1910). Primary property notions such as *tov* 'good', *ra* 'bad' were mainly expressed by present-tense (*benoni)* participial verb forms which shared many features with nouns. At the same time Biblical Hebrew had a small class of nouns denoting ethnic origin with the suffix *-i,* e.g., *Yevusi*, belonging to the nation of *Yevus*. These constitute the roots of present-day adjectival derivation in Hebrew.

Modern Hebrew, which is about one hundred years old, has three[1] structural classes of adjectives: The most basic both semantically and structurally is an essentially closed class of primary *CVC* adjectives originating in Biblical present-

[1] A fourth class of diminutives is not included in this study. Please see Ravid (1998) for some discussion.

tense verbs (e.g., *xam* ‘hot’, *tov* ‘good’). These adjectives are *morphologically simplex,* since despite their verbal origin, they are monomorphemic as well as monosyllabic, having lexicalized into a single unit. They also designate basic semantic relations such as good, bad, hot and cold (Ravid & Nir, 2000). As a result, they are very early acquisitions. This study, which focuses on morphologically complex adjectives in Hebrew, does not include basic *CVC* adjectives

A second structural class of adjectives takes a nonlinear root-and-pattern form. Except for a class of color terms, which is inherently adjectival (e.g., *kaxol* ‘blue’, *sagol* ‘purple’), these are always structures appropriated from either verbal or nominal patterns. For example, *mahir* ‘fast’, and *axil* ‘edible’ take the agentive noun pattern *CaCiC* (cf. *pakid* ‘clerk’); while *mafxid* ‘scary’ and *mesukan* ‘dangerous’ use present-tense *maCCiC* and *meCuCaC* verbal patterns, some of which are depicted in Table 1. The semantic content of these classes varies across structural categories, and designates a range of general and specific properties, attributes, and states. Times of acquisition also vary in accordance with the semantic content of the adjective class. For example, color terms are acquired and conjugated correctly early despite their structural complexity (Ravid, 1995), while resultative adjectives emerge and consolidate between the ages of 4 and 6 (Berman, 1994).

The current study contains three types of root-and-pattern adjectives: A category of resultative adjectives, sharing their patterns with present-tense verbs (patterns *CaCuC, meCuCaC, muCCaC*); and two nominal-pattern attributive adjective types: *CaCCan* agentive-attributive and *CaCiC* potential-attribute adjectives.

The third and most productive class of adjectives in Modern Hebrew is a late historical development deriving from those Biblical ethnic nouns which evolved in Medieval Hebrew into a full-fledged class of denominal adjectives, e.g., *xashmal-i*

'electr-ic', *tsibur-i* '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, such as literary prose, journalistic and expository texts, and their meaning is quite complex (Berman & Ravid, 1999; 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 child-directed speech. Denominal *i*-suffixed adjectives are the last type of adjectives to emerge in Hebrew child language around age 6, and they do not emerge in text production before highschool (Berman & Ravid, 1999; Levin et al., in press; Ravid & Nir, 2000; Zilberbuch, 1998). Denominal adjectives constitute another adjective category tested in this study.

This array of possible nonlinear vs. linear morphological structures, coupled with the variety of semantic types encoded in them, makes Hebrew adjectives a promising class to focus on in the examination of NLA vs. SLI language in elementary school.

The Hebrew adjective study

In this study, we examined the ability to comprehend and produce Hebrew adjectives in SLI school children compared with NLA children of the same age, and with younger NLA language-matched children.

Research questions

Given the problematic nature of the adjective category, we were interested in SLI and NLA school children's ability to comprehend and produce Hebrew adjectives in the structural classes described above. Specifically, we were interested in finding

out whether the two populations follow similar or distinct paths in analyzing adjectives.

Subjects

The test group consisted of 14 SLI children (9 boys, 5 girls), age range 8;7-10;3. They were all 3rd and 4th graders who had been diagnosed at the municipal speech services clinic by a speech pathologist. All of them had taken tests indicating a discrepancy of at least 15 points between their verbal and non-verbal abilities. There were two NLA control groups: The age-matched controls were 14 NLA children (9 boys, 5 girls), age range 8;3 -10;3, with no language or other problems. They were matched one to one to the SLI subjects by chronological age +/- 4 months and by SES (high, middle, low). There was also a NLA language-matched control group of 14 children (9 boys, 5 girls), age range 6;4 - 8;3. This group was matched one to one to the SLI subjects by language level (+/- 6 months), using a subset of the ITPA test that examines completion of auditory analogies (which is the only normed tool in Hebrew for this age bracket, up to 10 years of age), and by SES. All the study children were native monolingual speakers of Hebrew with normal hearing and no other disorders.

Experimental tasks

The adjective test consisted of two tasks: comprehension and production, each containing 13 items in three adjective categories. Two of them had non-linear root-and-pattern structure: resultative adjectives (employing verbal patterns), and attributive adjectives (employing nominal patterns). A third category of denominal *i*-suffixed adjectives had linear stem-and-suffix structure. The comprehension task preceded the production task in order to serve as a facilitator. It introduced the child to thinking about the components of adjectives, their structure and semantics, so that by the time s/he got to the production part it was no longer an unfamiliar task The final

form of the adjective test was decided on after a pilot test. Before the construction of the tests, elementary school teachers were consulted about the words selected so as to make sure they were all known to school children. Internal consistency of both tests was computed and found to be α (Kronbach) 0.8. The appendix lists the two parts of the adjective test.

Comprehension

The comprehension task tested children's ability to analyze 13 adjectives into their morphological components - roots, stems, patterns and suffixes - by interpreting a set of given adjective stimuli. The child was told that the investigator had some hidden pictures (used as incentives), and that s/he would be asked a question, and then they would both look at the pictures (see the Appendix for a full set of the instructions). Then the child was presented with an adjective embedded in a sentential context, and asked to explain its meaning, which entailed using a related noun or verb. For example: "I have a picture here showing a glass with some juice, and a picture of some *spilled* juice (*mits shafux* 'juice spilled'). What happened here?" The expected response to this resultative adjective was: *shafxu oto* '(they) spilled,Pl it', an impersonal active verb form from the same root and in the appropriate verb pattern (see the Appendix for more examples and a full list of the comprehension task items). The accompanying picture was <u>not</u> shown, and was only revealed after the item was completed.

The *comprehension* responses were scored on a scale of 1-4. A score of 1 was assigned to no response and responses such as 'don't know'. A score of 2 was assigned to a semantically, but not morphologically, appropriate response, e.g. *ko'éset* 'is angry,Fm' instead of *mit'atsbénet* 'becomes annoyed' as a response to the stimuli *atsbanit* 'nervous, annoyed'. A score of 3 was assigned to a partial, though

morphologically appropriate, response, where one structural element – stem or root, suffix or pattern – was absent. For example, the 'laughy' boy (*tsaxkan*) *matsxik harbe* 'makes (you) laugh a lot' instead of *tsoxek harbe* 'laughs a lot', where the verb pattern used is the inappropriate causative instead of the desired simple active pattern. A score of 4 was assigned to a fully correct response.

Production

The production task tested children's ability to produce 13 adjectives from randomly presented verb and noun stimuli. The child was told that the investigator had some more hidden pictures, that s/he would be asked a question, and then they would both look at the appropriate picture (see the Appendix for a full set of the instructions). The child was then presented with a sentence containing a verb or noun, and asked to derive an adjective from it. For example: "I have a picture here of a hand that got *stuck* in *glue* (*nidbeka be-dévek*). What can we say now about the hand that has got glue on it?" This sentence contained the requested root *d-b-k* in the two stimuli *stuck* and *glue.* The response could be something like '*hi dvika* 'it (is) sticky', an attributive adjective in the nominal *CaCiC* pattern, with the same root (see the Appendix for more examples and a full list of the comprehension task items). The picture again was produced only <u>after</u> the child had given the response.

The *production* responses were scored on a 1-7 scale. A score of 1 was assigned to no response and responses such as 'don't know'. A score of 2 was assigned to a repetition response. A score of 3 was assigned to analytic rather than morphological expression, e.g. 'can kill somebody' for *arsi* 'venomous'. A score of 4 was assigned to a semantically, but not morphologically, appropriate response, e.g., *paxdan* 'coward' for *xamkan* 'slippery', as a response to the stimuli *xomek* 'slips away'. A score of 5 was assigned to a partial response with the requested root but

from another lexical category, e.g., *bniya* 'building' for *banuy* 'built', as a response to *banu oto* '(they) built Acc-it', from root *b-n-y*. A score of 6 was assigned to an unconventional adjective, e.g., *pruka* (*CaCuC* pattern) for *meforéket* (*meCuCaC* pattern) 'taken apart', as a response to *perku ota* '(they) took it apart'. A score of 7 was assigned to a fully correct response.

Predictions

No differences were predicted among the test and control groups on comprehension, since the task requirement was minimal: The semantic content of the categorial element, which is the most difficult to identify (i.e., the pattern or the suffix) was provided in the question, and the child was requested only to provide the same lexical substance (root or stem) by a verb or a noun related in structure to the given form. Root and stem functions are present in children as young as 5 (Ravid & Malenky, submitted). This prediction also stemmed from the results of the nonce nouns test (Ravid et al., 1999)

For the production task, two alternative scenarios were hypothesized: the SLI group would fare as well as the young language-matched controls, supporting a delayed development model; or would do worse than them, supporting the deviant development model.

A hierarchy of difficulty on the adjectival categories, suggested by evidence from acquisition, was predicted: All groups were expected to find easiest the resultative category, which is acquired in late preschool years (Berman, 1994). The next category on this scale of difficulty was predicted to be attributive adjectives, containing two sub-categories: *CaCCan* nominal-pattern items, a structural category which is semantically very close to agent and instrument nouns and which is acquired early on by Hebrew speakers (Clark & Berman, 1984; Ravid et al., 1999); and a more

difficult *CaCiC* category that also shares its pattern with nouns, yet is less accessible to children since it contains potential-attribute *–able* adjectives. Last on this hierarchy should come denominal *i*-suffixed adjectives, which are completely absent in preschool language as well as from everyday speech (Berman & Ravid, 1999; Levin et al., in press).

Results

A one-way Pearson test between the comprehension and the production tasks showed a positive correlation ($N=42$, $p< 0.001$, $r=0.64$), indicating that success on comprehension and production was correlated.

INSERT TABLE 3 ABOUT HERE

Comprehension

Table 3 presents the mean scores of correct responses on the comprehension task by the three study groups. A one-way ANOVA showed an effect of group ($F(2,39)=15.51$, $p<.001$), counter to our prediction. A Scheffé procedure showed this effect to derive from a difference between the study SLI group, on the one hand, and the two control groups, which did not differ from each other, on the other.

INSERT TABLE 4 ABOUT HERE

Production

General results. Table 4 presents the general mean scores of correct responses on the production task by the three study groups. A one-way ANOVA showed an effect of group ($F(2,39)=18.98$, $p<.001$), as predicted. A post-hoc Scheffé procedure showed this effect to derive from a difference between the SLI group and the language-matched younger controls, on the one hand, and the age-matched older controls, on the other.

Category analysis. Table 4 also presents the mean scores of correct responses on the production task by adjectival category: resultative adjectives, e.g., *muxba* 'hidden'; attributive adjectives, e.g., *navranit* 'pokey,Fm'; and denominal adjectives, e.g., *kalbi* 'canine'. A two-way ANOVA on study group (3) X morphological category (3) showed an effect for group ($F(2,39)=17.16$, $p<.001$), and for morphological category ($F(2,78)=38.59$, $p<.001$). To detect the source of the differences t-tests were conducted between each two morphological categories (significance at the .05 level). These showed that the category of resultative adjectives differed significantly from the other morphological categories, and was easier for all study groups, as predicted. The attributive and denominal adjectives did not differ, counter to our prediction.

Focusing on the three adjectival categories, one-way ANOVAs were carried out on each of adjectival categories, by group.

Resultative adjectives. A significant effect was found for group (($F(2,39)=12.59$, $p<.001$), which the Scheffé procedure showed to derive from a difference between the two control groups, on the one hand, and the SLI group, on the other.

Attributive adjectives. A significant effect was found for group (($F(2,39)=15.28$, $p<.001$), which the Scheffé procedure showed to derive from a difference between the older age-matched control group, on the one hand, and the younger language-matched control group and SLI group, which did not differ from each other, on the other.

Denominal i-suffixed adjectives. A significant effect was found for group (($F(2,39)=5.91$, $p<.001$), which the Scheffé procedure showed to derive from a

difference between the older age-matched control group, on the one hand, and the SLI group, which did not differ from the younger language-matched control, on the other.

Conclusions and discussion

This study investigated knowledge of Hebrew adjectival categories in three study groups: a group of SLI school children, and two NLA control groups matched one-to-one to the study group by language level (a younger group) and by age (same age as the SLI). The results do not clearly support either the model of deviant or of delayed development in SLI children (see below). These results, however, justify the choice of derivational morphology, and specifically of the category of adjectives, in order to assess the language of SLI, allowing an in-depth look into the nature of the differences between them and normally-developing children.

Comprehension vs. production

One surprising result, which had not been anticipated, was the difference between the SLI and the control groups on comprehension. Although all groups did quite well on this task, the control groups, even the younger language-matched group, almost reached ceiling, while the SLI did more poorly. The nonce noun test (Ravid et al., 1999) was not sensitive enough to discern such differences. The greater difficulty experienced by the SLI on the adjective test may have derived from the non-canonical, semantically and structurally diverse category of adjectives. This may have been exacerbated by the fact that the comprehension task required the analysis of extant adjectives into their morphological components. Specifically, correct responses consisted of morphologically appropriate nouns and verbs with specific patterns, related to the stimulus adjective by root. Thus, although comprehension responses involved nouns and verbs rather than adjectives, the required analysis may have proved too difficult for the SLI school children, especially on the more difficult

categories of attributive and denominal adjectives. This result reflects a weaker processing capacity for linguistic information, difficulty in using sentence structure for the analysis of word meaning, and a reduced ability of perceiving derivational relations among words (Carlisle, 1988; Moats & Smith, 1992; Swisher et al., 1995).

On the production task, the scenario providing support for the deviant development model may be indicated. Almost all production results point to a reduced morphological ability in the SLI group: They scored lowest of the three study groups, while both control groups did better. However, this rather extreme scenario may not be necessary to explain these results. Although the SLI children were older than the language-matched group and therefore officially had more schooling, it can be assumed that their level of linguistic literacy was not as advanced (Ravid & Tolchinsky, 2000). SLI interferes with the acquisition of reading and writing skills, so that children from this group were less familiar with written language. This means they had had less exposure to written texts and fewer opportunities to write, and therefore were less likely to learn new words from the written language, which constitutes the main source for new vocabulary in elementary school (Anglin, 1993; Rubin et al., 1990).

Moreover, this linguistic disorder is characterized by problems in phonological and morphological processing: SLI children are not sensitive to derivational information conveyed by words, they tend to remember words as separate, discrete units rather than members of networks and hierarchies, and they find morphological generalization especially difficult. In addition, they have difficulties in storing and retrieving linguistic information based on derivational relations. These considerations would explain why the SLI group found it difficult to interpret and create lexically-linked words (Swisher & Snow, 1994). However, note that no interaction was found

between study group and morphological category: The SLI group did not exhibit deviant patterning in their morphological knowledge. Like the control groups, they found resultatives to be easier than both attributive and denominal adjectives.

Morphological strategies

Two production strategies were found to be especially prevalent in the responses of the SLI group as compared with the two control groups. These were designated above as "analytic expression" and "semantic response" respectively on the production scale. Analytic responses made use of periphrastic or syntactic means of expression. These were syntactic responses such as *ha-pérax ibed máyim* 'the-flower lost water' for *meyubash* 'dried', or *sharvul ad la-katef* 'sleeve up to-the-shoulder' for *mufshal* 'turned up'. Semantic responses were retrieved extant words which were semantically close to the required form, e.g., *atsits* 'potted plant' for *ets gamadi* 'tree dwarf-like = dwarf-like tree', *sharvul katsar* 'sleeve short = short sleeve' for *mufshal* 'turned up', *pérax navul* 'flower dead= dead flower' for *meyubash* 'dried'. These two non-morphological strategies - retrieval of familiar forms from the stored mental lexicon and syntactic expression - reflect morphological processing problems in SLI, and were not as widely used by the younger language-matched group. They point at difficulties in performing meta-linguistic derivational analyses in an online experimental situation, and a failure to identify shared morphemes, which would facilitate establishing connections between words from the same morphological family.

However, a third, morphological strategy *was* shared by the SLI and their language-matched peers. This was "unconventional adjective", which also appeared on the production scale. In such responses the root was correct and the semantic content appropriate, but the resulting combination was an unconventional form. Such

"unconventional adjectives" typically arose from the application of an incorrect resultative pattern to the correct root, e.g., *nexba* (*niCCaC* pattern) for correct *xavuy* (*CaCuC*) 'hidden', or *muvne* (*muCCaC*) for correct *banuy* (*CaCuC*) 'built'. This strategy is well-known from both naturalistic and experimental Hebrew child language data, and is characteristic of spontaneous expression in preschoolers (Berman, 1994). Thus it indicates juvenile, less well-developed morphological skills, rather than deviant strategies in the SLI group.

Morphological categories

This study provided a window on typical and atypical acquisition of later-emerging adjectival constructions in Hebrew. The results of this study were uniform in placing resultative adjectives as a much earlier acquired form in both populations than other adjectival classes, supporting previous findings (Berman, 1994). In both SLI and NLA populations, resultative adjectives scored higher than the other morphological categories, though the control groups have almost perfect scores while the SLI lag behind. From a structural point of view, resultatives are not harder than other root-and-pattern forms which children acquiring Semitic languages manipulate from early on (Berman, 1985; Ravid & Farah, 1999). They occur in early child speech from the very first as lexicalized forms such as *meluxlax* 'dirty'; but they emerge productively only in preschool age (4-6) not only due to their passive, resultative semantics, but also simply because they belong to the semi-productive, semantically opaque and unpredictable derivational system which does not consolidate before school age (Berman, 1995).

The fact that *i*-suffixed denominal adjectives did not differ significantly from attributive adjectives was not predicted. Both categories were more difficult than the

resultatives for all populations, demonstrating the interface of semantic and structural factors in the acquisition of a complex morphological system.

The non-linear root-and-pattern attributives could be expected to be more difficult than the linear stem-and-suffix denominals: Root-and-pattern (non-linear) morphology is more abstract and difficult to process than the linear attachment of suffixes onto stems. Each of the components of the non-linear template occurs at a different representational tier or plane (Anderson, 1992), which makes them less accessible to speakers than linear segments. However, since all verbs, and most other categories in Hebrew are constructed of roots and patterns, there should be no reason why school children should have trouble with them. Moreover, *i*-suffixed denominals may undergo radical stem changes as in *kélev / kalbi* 'dog / canine' (cf. English *five / fifth*), which are known to pose structural difficulties to young learners (Jones, 1991; Levin et al., in press; Ravid, 1995).

Semantics seems to a more weighty factor in this case. The attributive category that we tested consisted of two structural constructions: One was *CaCCan* adjectives (e.g., *xamkan* 'slippery'), an early-emerging attributive-agentive class which is immensely productive and occurs frequently in both child and child-directed speech (Clark & Berman, 1984). The second was *CaCiC* potential-property adjectives, whose semantics is comparable to the English *–able* category (e.g., *axil* 'edible). The option of encoding a *potential* attribute morphologically is not available to preschoolers, and is typical mostly of formal, written Hebrew. The combination of the two attributive adjective categories with the easier and the more difficult semantics resulted in similar scores to those of the denominal category.

Focusing on denominals, it is not the formal addition of the suffix *-i* to the noun base and the consequent morpho-phonological stem changes that make it so

difficult. These same morpho-phonological stem changes as in *kélev / kalbi* ‘dog / canine’ occur across the board in all types of nominal operations in Hebrew, both inflectional and derivational, some of which (such as noun plurals, noun feminines, noun possessives, and noun compounds) are acquired early on. Children have plenty of opportunities to learn the rules and intricacies of the system from early childhood, although radical, idiosyncratic stem changes are difficult even for school children (Levin et al, in press; Ravid, 1995).

Denominal adjectives are semantically complex entities. A construction such as ‘venomous’ has the general meaning of ‘A with the property of N’. However, the appropriate property of the base noun that is carried over to the derived adjective is not always predictable, as in other cases of denominal derivation (Aronoff, 1980; Clark & Clark, 1979). In order to create a denominal adjective, the base N has to be “dissolved” into its component semantic properties so as to select the specific property that will be carried over to the derived adjective. Like potential-attribute *CaCiC* adjectives, denominals are typical of formal, written Hebrew, and occur almost only in expository texts (Ravid & Shlesinger, 1987). While Hebrew-speakers are exposed to such texts in school and school-related activities, they do not use them productively before the end of highschool (Berman & Ravid, 1999; Zilberbuch, 1998). Certainly, the younger language-matched group and the SLI group have had fewer opportunities to encounter such forms and are less able to process them.

In general, what makes morphological forms in a synthetic language like Hebrew hard or easy in acquisition does not seem to be solely structural, formal factors, but rather their combination with semantic factors together with processing factors such as transparency and saliency of form and meaning.

How specific are morphological disorders?

In this chapter we examined morphological abilities in Hebrew-speaking school children with SLI compared to their NLA age-matched and language-matched peers. We focused on adjectives, a structurally rich and semantically diverse non-canonical lexical category, which made it possible to investigate both formal and semantic facets of morphological knowledge. Examination of adjective comprehension and production suggests that in this domain, morphological knowledge is patterned in a similar way in both SLI and NLA school children. However the SLI lagged behind both control groups, indicating serious problems in processing the internal structure of adjectives and in using morphological cues in both comprehension and production.

This study highlights the importance of derivational morphology in testing linguistic abilities in school children and in particular language-disordered populations. Berman and Ravid (1999) identify lexicon size and diversity as crucial in later language development in morphology, syntax, and text production. According to Anglin (1993), processes of morphological analysis and generalization underlie lexical expansion in children, and at least half of the words in a child's lexicon are acquired through morphological form-to-meaning mapping. Future studies of specific derivational domains will further help to determine the boundaries of lexical and morphological limitations of children with SLI growing up in a highly synthetic language.

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Verb	Gloss	Pattern	Pattern meaning
kalat	absorbed	*CaCaC*	Basic verb
niklat	was absorbed	*niCCaC*	Passive verb
hiklit	recorded	*hiCCiC*	Causative verb
huklat	was recorded	*huCCaC*	Passive verb

Noun	Gloss	Pattern	Pattern meaning
klita	absorption	*CCiCa*	Action nominal
haklata	recording	*haCCaCa*	Action nominal
kélet	input	*CéCeC*	Abstract noun
taklit	record	*taCCiC*	Derived nominal
maklet	receiver	*maCCeC*	Instrument noun
miklat	shelter	*miCCaC*	Place noun
koltan	receptor	*CoCCan*	Agent noun
kalit	absorbable	*CaCiC*	Potential attribute adjective

Table 1. Non-linear structure in Hebrew: Words related by the root *k-l-t* ‘take in, absorb’

Derived Word	Gloss	Stem and Derivational Suffix	Stem and Suffix meaning
mada'an	scientist	*mada-an*	science-agent
pa'oton	nursery school	*pa'ot-on*	toddler-collective
kosit	wine glass	*kos-it*	glass-diminutive
ma'afiya	bakery	*ma'afe-iya*	baked product-place
lamdanut	scholarship	*lamdan-ut*	scholar-abstract

Table 2. Linear structure in Hebrew

Study Group →	SLI		Language-matched		Age-matched	
General results	Mean	SD	Mean	SD	Mean	SD
Comprehension: Scale 1-4	3.57	0.21	3.82	0.16	3.9	0.11

Table 3. Mean scores (on a scale of 1-4) and standard deviations on the comprehension task, by study group.

Study Group →	SLI		Language-matched		Age-matched	
Adjective Category	Mean	SD	Mean	SD	Mean	SD
General results	4.81	0.79	5.4	0.68	6.31	0.42
Resultative	5.34	1.21	6.17	0.63	6.86	0.19
Attributive	4.22	0.62	4.60	1.08	5.89	0.74
Denominal	4.52	1.27	4.88	0.8	5.78	0.86

Table 4. Mean scores (on a scale of 1-7) and standard deviations on the production task, by study group and morphological category.

Appendix (Note Hebrew word order within the NP is N-A)

I Comprehension

I have a pack of pictures here. I will ask you some questions, and then we will look at the pictures together.

Sample questions:

1. I have a picture here of a baby, and a diaper, and a picture of *tinoket mexutélet* '*diapered*,Fm' baby,Fm' (root *x-t-l*, pattern *meCuCaC*). What's happened to her?

Possible response: *xitlu ota* '(they) diapered,Pl Acc-her (root *x-t-l*, pattern *CiCeC*).

2. I have a picture here of *béged raxits* '*washable* garment' (root *r-x-c*, pattern *CaCiC*). If we want to, what can we do to it?

Possible response: *li-rxots oto* 'to-wash Acc-it (root *r-x-c*, pattern *li-CCoC*).

3. I have a picture here of a boy with *halixa barvazit* 'duck-like,Fm walking,Fm'. What is duck-like walking?

Possible response: *halixa shel barvaz* 'walking of (a) duck = duck-like walking'.

Comprehension Test Items

1) Resultative adjectives

CaCuC pattern	*shafux* 'spilled'
	atufa 'wrapped up,Fm'
meCuCaC pattern	*menusar* 'sawn'
	mexutélet 'diapered,Fm'
muCCaC pattern	*muram* 'elevated'
	mushxal 'threaded'

2) Attributive adjectives

CaCCan pattern *tsaxkan* 'laughy'

atsbanit 'nervous,Fm'

CaCiC pattern *ra'il* 'poisonous'

raxits 'washable'

3) Denominal adjectives

tinoki 'babyish'

xorpi 'wintry'

barvazit 'duck-like'

II Production

I have another pack of pictures here. I will ask you some more questions, and then we will look at the pictures together.

Sample questions:

1. I have a picture here of a chain that *perku ota* '(they have) *taken*,PL *it apart'* (root *p-r-k*, pattern *CiCeC*). What can be said now about the chain that (they have) taken apart?

Possible response: *hi meforéket* 'it (is) taken apart,Fm' (root *p-r-k*, pattern *meCuCaC*).

2. I have a picture here of something that *efshar le-exol* 'possible to-eat' (root *'-x-l*, pattern *li-CCoC*), for example, ice-cream; and something that is impossible to eat, like a shoe. What can you say about something that's possible to eat?

Possible response: *ze axil* 'it's edible' (root *'-x-l*, pattern *CaCiC*).

3. I have a picture here of a snake with *éres* ‘venom’ (root *‘-r-s*, pattern *CéCeC*. What can you say about a snake that has venom?

Possible response: *hu arsi* ‘it’s venomous’ (root *‘-r-s*, adjectival suffix *–i*).

Production Test Items

1) Resultative adjectives

CaCuC pattern *tsavua* ‘painted'

banuy ‘built’

meCuCaC pattern *meyubash* ‘dried’

meforéket ‘taken apart,Fm’

muCCaC pattern *mufshal* ‘turned up’

muxba ‘hidden’

2) Attributive adjectives

CaCCan pattern *xamkan* ‘slippery’

navranit ‘pokey,Fm’

CaCiC pattern *axil* ‘edible’

dvika ‘sticky,Fm’

3) Denominal adjectives

arsi ‘venomous’

gamadi ‘dwarf-like’

kalbi ‘canine’