In R. Lieber + P. Stekauer, edr. to appear in 2009

CHAPTER 15

CHILDREN'S ACQUISITION OF COMPOUND CONSTRUCTIONS

RUTH BERMAN

CHILDREN's comprehension and production of (mainly noun + noun) compound constructions have been the subject of substantial research over the past twenty years or so.[1] Studies relate to varied issues, including: pluralization in compounding as evidence for or against level-ordering constraints (Gordon 1985; Lardiere 1995a, b; Clahsen et al. 1996; Nicoladis 2005); prosodic factors (Fikkert 2001; Vogel and Raimy 2002); the contrast between root and derived or synthetic compounds – with deverbal heads in English (Clark, Hecht, and Mulford 1986; Murphy and Nicoladis 2006) and with derived nominal heads in Hebrew (Ravid and Avidor 1998); innovative compounding as evidence for children's lexical creativity (Berman and Sagi 1981; Clark 1981; Clark 1988; Becker 1994; Mellenius 1997); compounds in L2 and bilingual acquisition (Bongartz 2002; Nicoladis 2002

I am grateful to Wolfgang Dressler, Dorit Ravid, and Batia Seroussi for helpful feedback on an earlier draft and to the editors of the Handbook for their perceptive and valuable comments. Inadequacies are mine alone.

[1] That the topic is of relatively recent interest in child language research is suggested by the comprehensive survey in Mellenius (1997: Chapter 3). The term 'compound(ing)' does not appear in the index to Slobin (1985) on acquisition of some dozen languages.

Agothopoulou 2003; Nicoladis and Yin 2002 Nicoladis 2003;) and in impaired language development (Dalalakis and Gopnik 1995; Clahsen and Almazan 2001).

In the present context, compounds are analysed as multifunctional constructions that serve different purposes, including lexical labelling of previously unnamed entities and semantic expression of relations between two or more nouns such as possession, hyponymy, or class inclusion. Compound constructions are viewed here as lying on a continuum. At one end are 'established' terms – ranging from frozen, typically idiomatic, to semantically transparent multilexemic items that form part of the familiar word-stock of adult speakers of the target language.[2] These may be extended by compounding as a means of new-word formation, whether for eventually conventionalized coinages or for idiosyncratic or occasional 'contextuals' (Downing 1977; Clark and Clark 1979). At the other end of the scale lie structurally productive compounds that are termed here 'open-ended', since (1) they can be reworded periphrastically and so alternate with semantically corresponding phrasal expressions and (2) their modifying element can be extended by syntactic operations like conjoining with other nouns in a way disallowed in established compounds (Berman and Ravid 1986; Borer 1988).[3] Compare, for example, idiomatic *beeline*, familiar *beehive, beekeeper, bee sting* with novel expressions like *bee wings*, alternating with *wings of a bee*, and novel *bee garden* 'a garden for / full of bees'.

15.1 THE MULTI-FACETED TASK OF ACQUIRING COMPOUND CONSTRUCTIONS

While compounding is 'a common way of introducing new words into the lexicon' (Gagné and Spalding 2006a: 9), it can also be seen as 'the part of morphology which is closest to syntax' (Dressler 2005: 29). As a result, children need to integrate

[2] The term 'lexicalized' is avoided, since lexicalization is essentially a matter of degree, and speaker judgements differ in how they rank compound expressions for familiarity (Berman and Ravid 1986). Besides, children's lexicon of established compounds will differ considerably from that of adults.

[3] Unfortunately, use of the term 'open-ended' conflicts somewhat with the terms 'familiar open-compounds' and 'novel modifier-noun phrases' used by Gagné, Spalding, and Gorrie (2005). However, it is appropriate to the case of Hebrew, as shown by comparing the following (where a caret ^ indicates a bound Genitive relation):

(i) Frozen, idiomatic, almost monolexemic: *orex^din* 'arrange(r) + GEN law' = 'lawyer'
(ii) Familiar, semantically transparent, potentially open-ended: *orex^iton* ('arrange(r) + newspaper') 'newspaper editor'
(iii) Non-established, fully open-ended: *orex^mesibot* (arrange(r) + parties) 'party giver'

The second, modifying element in (ii) – and the modifier in (iii) even more so – can be freely extended syntactically, from singular to plural or vice versa, by coordination with another modifier, or

knowledge at different levels of linguistic structure in order to comprehend and construct compounds. Phonologically, in English, for example, they need to recognize the peculiar prosodic contour associated with compound constructions, with main stress typically assigned to the initial, modifying element, and weaker stress on the head element that follows it (Alegre and Gordon 1996; Vogel and Raimy 2002); in Dutch, children might be aided in recognizing compound constructions, since these take stress on the main stressed syllable of the first prosodic word (Fikkert 2001); in Swedish, children produce the compound-particular fall-and-rise intonation contour with a relatively high pitch from as early as 2 years of age (Mellenius 1997); while in Hebrew, prosody appears to play little if any role in compound acquisition.[4]

Morphologically, in Germanic languages, children may need to know which if any 'linking element' occurs between the constituents of noun + noun compounds, as in Dutch *boek-en-legger* 'bookmark' vs. *boekwinkel* 'book store', or a phonological alternation as in German *händ-e-druck* 'handshake' (Neijt, Krebbers, and Fikkert 2002; *Krott et al. 2007*), as well as so-called 'liaison' elements in Swedish (Mellenius 1997). By contrast, English-acquiring children must observe the constraint on pluralization of the initial modifier (Gordon 1985; Nicoladis 2005).[5] In a case-marked language like Greek, they must learn the particular form of the root noun that occurs in compounds (Dalalakis and Gopnik 1995; Agathopoulou 2003). Relatedly, in Hebrew, children need to master morphophonological alternations on the bound stem form of the initial head noun, including suffixation and stem-internal changes (Berman 1988; Ravid and Zilberbuch 2003a).[6] Compare, for example, *ken* ~ *kinim* 'nest ~ nests', *kiney^dvorim* 'nests + GEN bees' 'bee-hives'.[7]

paraphrased with the genitive marker *šel* 'of', thus: *orex^itonim* 'editor + GEN (of) *orex^itonim ve yarxonim;* 'editor of newspapers and magazines'; *orex šel ha-iton* 'editor of the newspaper'. These operations are prohibited in the case of fully established idiomatic compounds.

[4] I know of no detailed studies of Hebrew compound prosody. Bat-El (1993: 207) notes that 'the main stress of the rightmost [modifier] element is the main stress of the compound and secondary stress falls on the main stress of the first [head] element'.

[5] This language-specific constraint on pluralization of the initial (in English, modifying) element may be violated in some established compounds and in compounds preceded by an adjective, so that children also need to learn in what instances the constraint fails to apply (Alegre and Gordon 1996). Hebrew manifests a converse constraint to English: both the initial head and the second, modifying noun are generally pluralizable, but (indefinite) singular count nouns cannot occur as compound modifiers. Compare the ill-formed compound with a singular modifier **malkódet^axbar* 'trap + GEN mouse' '(a) mouse-trap', with well-formed compounds with a plural or a non-count modifying noun: *malkódet* ~ *malkodot^axbarim* 'trap ~ traps mice' = 'mice trap(s)', *malkódet^mávet* 'trap + GEN death' = 'death-trap', *malkódet^mištara* 'trap + GEN police' = 'police trap' respectively. This helps avoid ambiguity of definiteness, since Hebrew has no indefinite article. Thus, singular count noun modifiers can occur if the compound is definite, cf. *malkodet^ha-axbar* 'trap + Gen the-mouse' = 'the trap of the mouse'.

[6] I use the term 'stem' in preference to 'root', given the special connotation of the term 'root' in a Semitic language like Hebrew (Shimron 2003).

[7] The following conventions are adopted for Hebrew: (1) a caret ^ separates the initial, bound head noun from the following modifier noun; (2) in glossing compounds, the head noun is indicated

Other structural knowledge that children need to master in language-particular ways includes: which lexical categories can enter into compound constructions, what the order of the elements is, and how definiteness is marked. In Germanic languages, compounds are normally right-headed, with the modifier preceding the head noun. This incurs changes in basic VO order in English deverbal compounds, for example, *a person who pulls wagons* ~ *wagon-puller* (Clark et al. 1986; Nicoladis 2003). They thus differ from the left-headed compound order of French (or Hebrew) and from periphrastic genitives in English (cf. *table legs* ~ *legs of (a) table*). In Germanic and Romance languages, determiners precede the modifier–head compound construction, as in noun phrases in general. In contrast, Hebrew compounds observe the canonic left-headed direction of all nominal constructions in the language, but differ from other such constructions in definiteness marking, since the definite article *ha-* 'the' is attached internally to the modifier noun in compounds (cf. *ragley^ha-šulxan* 'table + GEN the-legs' = 'the table legs' ~ *ha-raglayim shel (ha)-šulxan* 'the legs of (the) table'). Definiteness marking in compounds thus presents Hebrew-acquiring children with difficulties through to school age and even beyond (Berman 1985; Zur 2004).

Semantically, children need to understand the relation of modification as providing information about the head and the nature of compounding as a means of semantic subcategorization (e.g. *cheese cake*, *chocolate cake*, and doubly compounded *birthday cake*, *ice-cream cake*). And lexically, they need to learn which combinations are conventionally established, frozen, or idiomatic compounds and what they mean in their language. For example, the same referent is labelled in English by the lexicalized compound *ashtray* but in Hebrew by a single, morphologically derived noun *ma'afera* (from *éfer* 'ash'); conversely, the object labelled by the monolexemic noun 'slippers' in English is referred to in Hebrew by the (well-established) compound noun construction *na'aley^báyit* 'shoes + GEN house'. As a third example of such arbitrary lexicalization processes, both languages refer to shoes with high heels by compound constructions, but English 'high-heeled shoes' involves a complex derived adjective as against the Hebrew bound noun + noun compound *na'aley^akev* 'shoes + GEN heel'.[8]

as + GEN, for 'genitive (case)'; and (3) Hebrew words with non-final stress are marked by an acute accent on the penultimate or antepenultimate syllable.

[8] Complex interweaving of different facets of linguistic knowledge is illustrated by children's coinages in Hebrew:
(1) Merav, aged 5;8, combines the idiomatic compound *kóva^yam* 'hat^sea' = 'bathing cap' with a contrasting novel compound, when she says *lo kóva^yam aval kóva^yabasha* 'not hat + GEN sea but hat + GEN dry-land', to mean she doesn't want to wear a bathing cap but a regular (sun) hat.
(2) Sivan, aged 7;3, says: *baláta shaked^marak* 'you + MASC-swallowed almond + GEN soup [= a soup almond]' (an innovative back-formation from conventional *shkedey^marak* 'almonds + GEN soup' i.e. croutons – see note 5), to which her brother Assaf, aged 6;1, responds: *lo, ze haya bóten^marak, halevay še -yamtsíu marmeládat^marak* 'No, it was (a) peanut + GEN soup, I wish they'd invent marmalade + GEN soup'.

Detailed information on the occurrence of compounds in first-language acquisition is available mainly for English and Hebrew, two languages which differ markedly in how compounds are constructed, and where compounding is a structurally productive option, although more so in English.[9] This chapter focuses on noun + noun compounds, irrespective of whether so-called 'root' or 'synthetic' compounds. As noted, unlike English or Swedish, only noun + noun compounds are productive constructions in Hebrew (Clark and Clark 1979; Berman 1993a; Mellenius, 1997). Besides, Hebrew makes no structural distinction between so-called root and synthetic compounds, since the same word order and the same morphological alternations apply to compounds whether the head is a so-called 'basic' or non-derived noun or a morphologically derived noun (e.g. *simla* 'dress' ~ *simlat^kala* 'dress + GEN bride' = 'bride's / bridal dress'; *simxa* 'happiness' ~ *simxat^kala* 'happiness + GEN (a) bride' = '(a) bride's happiness, happiness of a bride'; while clausal *ha-kala lovéšet simla* 'the-bride wears (a) dress' yields the derived action + noun compound *levišat^simla* 'wearing + GEN dress' = 'the wearing of a dress' – Ravid and Avidor 1998).

Against this background, the chapter presents cross-linguistic findings from experimental studies of how children construe compound constructions and from surveys of established and innovative compounds in children's naturalistic speech output (section 15.2). The developmental patterns that emerge from these varied sources are then traced from early preschool age to middle childhood and beyond (section 15.3). In conclusion, cross-linguistic differences in acquisition of compounding are attributed to the interplay of target-language typology and usage-based factors of frequency and register variation, with suggestions for further research in this domain (section 15.4).

15.2 Cross-linguistic comparisons: children's use of innovative and established compounds

In a series of structured elicitations, children aged three years to school-age were asked to derive new means for labelling agents and instruments that have no

[9] Hebrew compounding is mainly ~~binominal~~. Compound verbs like English *whitewash*, *brainstorm* are structurally prohibited (Berman 2003), and ~~it~~ lacks particles to allow compound expressions like English *runaway*, *teach-in*. Adjective + noun compounds like *arukat^tvax* 'long + GEN.FEM range', *xamumey^móax* 'heated + GEN.PL brain' = 'hot-headed' are lexically restricted and typically high-register in usage, so largely irrelevant to child language input and output.

established lexical entry (English – Clark and Hecht 1982; Clark et al. 1986; Hebrew–Clark and Berman 1984; Icelandic – Mulford 1983). For example, to elicit an agent noun, the experimenter might say something like 'I have a picture here of a boy who likes to pull wagons. What would you call a boy who pulls wagons all the time, or someone whose job is to pull wagons?', and to elicit an instrument noun, children might be asked to give a name for a machine that is used 'to throw buttons', or a tool that we use in order 'to throw buttons'. In both English and Hebrew, less so in Icelandic, children sometimes selected compound forms to construct novel labels, and these became increasingly more complex and better formed with age. For example, English-speaking 3-year-olds might say 'wagon-boy' or 'pull-wagon', 'puller-wagon', whereas 5-year-olds would construct a more acceptable complex form like 'wagon-puller'. Hebrew-speaking children would initially use only the unmarked present-tense (also participial) form of the verb as a head noun, for example, for an instrument that is used *limšox agalot* 'to-pull wagons', 5-year-olds might say *mošex^agalot* 'pull(s) ~ puller + Gen wagons', whereas older children would coin a derived noun head, for example, *mašxan^agalot* 'puller + GEN wagons' or simply *aglan* 'wagoner' (see, further, section 15.3 below).

Children acquiring English and Hebrew differed markedly in the extent to which they relied on compounding for coining labels for people and objects that habitually perform activities (Verb) on entities (Direct Object). Even the youngest English-speaking children used simple compound forms quite widely, and these continued to be a favoured option for the older children and the adults. In Hebrew, by contrast, children started to use compounds only around age 5, with a slight peak at age 7; children and adults alike preferred monolexemic affixation over compounding for coining new terms – a finding indicative of more general typological preferences for new-word formation in the two languages. Moreover, compounding was more prevalent in Hebrew for instruments, and in English for agents – reflecting differences in the established lexicon, since Hebrew is largely lacking in terms like *policeman*, *fireman*, *doorman* (cf. forms produced by English-speaking 2- and 3-year-olds like 'wagon girl', 'wash man'), but has numerous established compounds for instruments like *mxonat^ktiva* 'writing machine' = 'typewriter', *tanur^bišul* 'cooking oven' (Ravid and Avidor 1998; Seroussi 2004). In Icelandic, also a Germanic language, Mulford's (1983) study revealed little reliance on compound constructions in coining novel terms for agents and instruments, with children preferring the suffix *-ari* increasingly from age 3 on, especially for agents. Moreover, as can be expected on typological grounds for a language of Romance origin, an unpublished study of agent and instrument nouns constructed by French-speaking children revealed that 5- and 6-year-olds produced compound forms in these domains as little as around 5 per cent of the time (cited by Clark 1988).

Rather different issues motivate experimental studies in different Germanic languages that investigate children's observation of constraints on pluralization

in English (Gordon 1985; Alegre and Gordon 1996) and of various linking elements on the initial, modifying element of compounds in Dutch (Neijt et al. 2002) and Swedish (Mellenius 1997). Gordon had children aged 3 to 5 years respond to a question like 'What do you call someone who eats _____?', with the missing modifier noun alternating between singular and plural items. He found that the overwhelming majority of children correctly avoided forms like **rats-eater*, although once they knew the appropriate plural form of irregular nouns, they might use it in the same context, to produce, for example **mice-eater* rather than grammatical *mouse-eater*. In an extension of this study, Alegre and Gordon (1996) tested children's ability to distinguish between phrasal and non-phrasal compounds. They found that children used their knowledge of the constraint on plural modifiers in compounds to impose a phrasal interpretation on the string *red rats eater* when it referred to an eater of red rats, as against a compound interpretation on the superficially similar string when it referred to a red eater of rats, that is, a *rat eater* that is red.

Swedish is another Germanic language for which detailed information is available on acquisition of compounding (Mellenius 1997). In one experiment, ten children aged 3;5 to 6;8 were asked to describe picture cards depicting two halves from a memory game 'patched together in two-by-two random combinations' (1997: 82).[10] In keeping with findings for English (Clark, Gelman, and Lane 1985), most of the children provided more compound constructions than other types of labels, and overall more than two-thirds of their responses took the form of compounds.[11] In production of linking elements, children were able to handle 'liaison forms' requiring deletion of *-a* – the most common final vowel in Swedish nouns, typically though not always deleted when the noun functions as a modifier – earlier than addition of *-s* (e.g., *nöjes+resa* 'pleasure trip' versus *nöje* 'pleasure'). Thus, in different Germanic languages, acquisition of noun plural inflections interacts with language-specific lexical knowledge of the particular 'linking' forms required or prohibited in constructing the initial modifying element of compound constructions.

Data from children's use of compound constructions in interactive conversations and monologic narratives make it possible to track occurrence of both established compounds – as evidence for compounding as a means for expressing relations between nouns – and innovative coinages, as evidence of productive knowledge of compounding. The relative productivity of compounding in child language is considered here by these two complementary criteria: how widely

[10] The term 'memory game' refers here to a game where participants have to find and match two halves of the same picture so that the combination yields a complete picture, say the top and bottom half of a doll, or the back and front of a boat. In the present case, the experimenter deliberately combined non-matching pairs, such as part doll and part boat, to elicit novel compounds.

[11] The authors note that this might be due to the elicitation materials no less than to a general preference for compounds over what they term 'descriptive phrases' in Swedish.

children use established compounds in their speech output, and how far they rely on compounding versus affixation for new-word formation.

With respect to 'established' or conventional noun compounds, Clark (1993: 151–9) concludes from her summary of databases in several languages that children acquiring Germanic languages 'make use of compounding very early in combining nouns' and that they rely extensively on compounding for coining novel nouns, more markedly in Dutch and German than in Icelandic or Swedish. Clark's findings are supported by Fikkert's (2001) study of twelve Dutch-acquiring children, nearly all of whom used several different established compound nouns as young as age 2 years or less, and by Mellenius's (1997) findings for Swedish-speaking children from around 3 years.

A very different picture emerges for Hebrew, which shows little reliance on established compounds in early child speech. In cross-sectional samples of adult–child conversations, Hebrew-speaking children aged 2 years or less produce almost no compounds; from age 3 they use on average fewer than five compounds (tokens) per 100 noun terms; and while compound occurrences rise somewhat among the 4- to 6-year-olds, they are used only sparsely by their adult interlocutors as well (Berman 1987). Longitudinal samples of four children aged 1;6 to 3 years in interaction with an adult caretaker (from the Berman corpus of CHILDES) show a similar pattern: Noun compounds accounted for around only 0.2 per cent of all the words used by the children (217 out of 103,226 tokens) and an almost equally negligible proportion of the word stock in the adult input (412 out of 245,384 tokens = 0.39%).[12]

The paucity of compound constructions in conversational Hebrew compared with English child language is supported by figures for conventionally established compounds in children's 'frog story' picture-book narratives (Berman and Slobin 1994).[13] For example, nine of the twelve English-speaking 4-year-olds used compounds at least once, often two or three different terms, e.g. *beehive, mud hole, baby frog, night-time, danger sign.* In contrast, only two Hebrew-speaking children of the twelve in this age-group used such constructions (e.g. *mišpáxat^cfarde'im* 'family + GEN frogs' = 'a family of frogs'), although they often use noun + noun phrases with the genitive particle *šel* 'of', in expressions like *ken šel dvorim* '(a) nest of bees', *ha-cincénet šel ha-cfardéa* 'the jar of the frog', ha-géza šel ha-ec 'the trunk of the tree'. Schoolchildren and adults made rather wider use of bound, so-called 'construct-case' compounds (Gesenius 1910; Borer 1988) in their narrations – e.g. *nexil^dvorim* 'swarm + GEN bees', *géza^ha-ec* 'trunk + GEN the tree', *karney^ha-áyil* 'horns + GEN the-deer' – also quite commonly in alternation with periphrastic

[12] I am indebted to Bracha Nir-Sagiv for calculating occurrences across the Hebrew databases of naturalistic speech samples and monologic texts.

[13] Children aged 3 to 9 years old, native speakers of five different languages, were asked to tell a story based on a picture-book without words that depicts the adventures of a little boy and his dog in search of a pet frog that had escaped from the jar where he was kept.

phrases with *sel* 'of'. These cross-linguistic contrasts are underlined by data from French-speaking children's narratives based on the same pictured storybook (Kern, 1996): noun + noun compounds were almost never used by even the oldest French-speaking children (10- to 11-year-olds), with the marginal exception of (possibly appositive) terms such as *la famille grenouille, mama et papa grenouille.* This can be explained by the general preference in Romance for phrasal, prepositionally marked noun + noun constructions (e.g. *un nid d'arbeilles*).[14]

Consider, next, cross-linguistic differences in use of compounding as a means for new-word formation. For English, Clark's extensive diary data revealed that her son Damon 'favoured compounding [over affixation, RAB] in innovative nominals. Before age 2;0, compounding accounted for all of his innovative nouns, and from 2;0 to 4;11, it accounted for over 70% of them' (1993: 146). J. Becker's (1994) case study of the conversational interactions of an English-speaking boy aged 2;4 to 5;0 years also shows compounding to be a favoured means of lexical innovation. Data from spontaneous innovations of a large number (n = 274) of other English-speaking children 'showed almost identical patterns ... the younger ones – under age four – relied on compounds 80 percent of the time, on zero-derived forms 7 percent of the time, and on suffixes just 13 percent of the time. Older children relied on compounds somewhat less often (63%) and on suffixes rather more (26%) than younger children' (Clark 1993: 148).

Swedish is like English in allowing a range of compound constructions, 'from N-N compounds as most productive, to V-V and Num-V as least productive' (Mellenius 1997: 25). Mellenius concludes from observation of two of her children that compounding is a favoured means of new-word formation in Swedish and that, in fact, children around age 3 to 6 years 'combine words into compounds in an unrestricted manner' (ibid.: 76), particularly when there is substantial contextual support for this process (see, further, section 15.3.2 below).[15]

In line with their infrequent use of established compounds, Hebrew-acquiring children rely relatively little on noun^noun compounding for new-word formation, even though the process is structurally quite unconstrained in Hebrew. Compound nouns accounted for less than 5 per cent of nearly one thousand innovative and unconventional lexical usages recorded in the naturalistic speech output of several dozen Hebrew-speaking children aged 2 to 8 years (Berman 2000). In an almost mirror image of the Germanic data, the vast bulk of children's lexical innovations are through affixation – primarily by means of set morphological patterns assigned

[14] These findings for noun + noun combining in children acquiring different languages are supported by data on bilingual and second-language acquisition that show the effect of frequency in learners' use of such constructions, for example, Nicoladis and Yin's (2002) study of four Mandarin Chinese–English bilingual children and Bongartz's (2002) comparison of Czech- compared with Chinese-speaking adult learners of English.

[15] Instances of compounding were clearly identifiable since they early on adhere to the peculiar stress pattern of Swedish compounds.

to a consonantal root but also linearly, by means of external suffixes – rather than by combining nouns to form novel lexical items (Ravid 1990; Berman 2000; Ravid 2006).

Clark et al. (1986) explain English-speaking children's preference for compounding over affixation as deriving from more general developmental principles, articulated in detail in Clark (1993). These include: (1) formal simplicity, such that children prefer to string words together rather than incorporate parts of words by affixation; (2) semantic transparency, revealing a one-to-one match between form and meaning, such that each word in a compound stands for a specific element; and (3) usage productivity (in the sense of how favoured a given device is in the ambient language, rather than in terms of structural constraints), such that the devices preferred by adult speakers for new-word formation in a given language will be those favoured by children as well. To this I would add the role of typological factors as interacting with frequency in the ambient language to account for these preferences – factors that, with age, come to outweigh the principles of structural simplicity and transparency (see section 15.4).

15.3 Developmental patterns in compound acquisition

This section reviews age-related developmental patterns that have been observed for different facets of compounding acquisition: comprehension (section 15. 3.1), semantics (15.3.2), and morphosyntactic structure (15.3.3), supplemented by analysis of changes across time in the nature and function of compound constructions in Hebrew (15.3.4). It turns out that, while compound forms typically emerge as early as age 2 years or even before, the path to mastery may continue into and even beyond middle childhood (Berman 1987; Vogel and Rainy 2002; Ravid and Zilberbuch 2003a). Moreover, progress in command of the formal features of compounding is accompanied by age-related expansion and change in the function of such constructions in different target languages.

15.3.1 Comprehension

finding for

Children appear to understand compound constructions early on in different languages, typically before they are able to produce well-formed compounds. Clark and Barron's (1988) ~~study of~~ English-speaking children's judgements compared with their corrections of ungrammatical compounds is attributed to the fact

that, in general, 'children understand linguistic forms before they can produce them correctly themselves', and that comprehension provides children with representations against which to judge the forms they hear. In a Hebrew-based study, children were tested for both comprehension and production of matching sets of novel compounds, including initial head nouns with the same form as the free noun in isolation and morphologically bound head nouns (Bilev 1985; Clark and Berman 1987). Three-year-olds identified the head noun appropriately in half the cases where the head noun was the same as its free form or had a feminine *-t* suffix (e.g. *karit* 'pillow' ~ *karit tsémer* 'pillow + GEN wool' = 'wool pillow'; *buba* 'doll' ~ *bubat tsemer* 'doll + GEN wool'). In contrast, the number of novel compound responses that the same children ***produced*** overall reached around 50 per cent only later, at age 4 to 5 years, taking until school-age to reach ceiling (Berman 1987).

Similar designs in English (Clark et al. 1985), Hebrew (Berman and Clark 1989), and Swedish (Mellenius 1997: Chapter 6) tested children aged 2 to 6 years for comprehension of the modifier–head relationship in novel 'root compounds' (e.g. *apple knife, boat ladder, mouse hat*), where both the head and modifier noun take the base form of the free noun. In both English and Swedish, children succeeded on this task around half the time by age 2;4, and reached nearly ceiling (over 80 per cent) by age 3;4. These parallel findings suggest that it takes children until around 3 years of age to identify the head as compared with the modifier, in two languages where the modifier precedes the head and is identifiable by a unique stress pattern, but without any surface morphological cue to specify which noun is head and which modifier. In contrast, in the parallel Hebrew study, even 2-year-olds identified the head–modifier relation correctly nearly 80 per cent of the time. This precocious success on the task could be attributed to surface order and the idea that 'first is most important', since the head noun came before the modifying noun in the forms they heard. Besides, compounds are like *all* nominal constructions in Hebrew, with an initial head noun preceding its modifying elements (another noun in compounds, an adjective or adjective phrase, a prepositional phrase, or relative clause). That is, Hebrew-acquiring children are early on cued to the canonic right-branching nature of nominal constructions in their language, where the first element represents the entity being referred to and the elements that follow provide more information about that entity.

Children's construal of compound nouns might also be affected by the lexically determined factor of 'family size', defined by Krott and Nicoladis as 'the number of compounds sharing the modifier with the target compound' (2005: 140). This was suggested by the lexical-decision study of de Jong et al. (2002), cited as showing that participants recognized English compounds written as two words faster depending on the family size of the modifying noun. Krott and Nicoladis (2005) had children aged 3;7 to 5;9 explain 'why we say...' with the blanks filled in by established noun compounds in English, differing in the family size of either head or modifier or both. They found children more likely to mention modifiers of compounds with

large rather than small family sizes, but this effect was less clear in the case of head nouns. Their conclusion that family size does not play a significant role in how preschoolers construe compounds in English is supported by the finding of Bilev's (1985) study on Hebrew, which controlled for family size of head nouns in established compounds likely to be familiar to children. For example, the nouns *kise* 'chair', *kóva* 'hat' – that have the same surface form when morphologically free or bound – and also *ugat^* 'cake + GEN', *na'aley* 'shoes + GEN' – serve as heads of numerous established compounds, in contrast to other stimulus nouns in the study like *ganénet* 'nurseryschool teacher', *karit* 'cushion', *gamadey^* 'dwarfs/elves + GEN', which rarely if ever occur as heads of established compounds. The Hebrew study, too, failed to elicit more or better compound responses in relation to family size of the head nouns, and this factor had no significant effect on either children's comprehension or production of compounds.

15.3.2 Lexico-semantic factors

In addition to a general understanding of the head–modifier relation, children need to assign an appropriate interpretation to this relation as expressing different types of subcategorization. Clark et al.(1985) propose that, initially, children interpret this relation not in the form of hyponymy from a generic to a superordinate entity ('a dog is a kind of animal ~ pet', 'a cake is a kind of food ~ dessert'), but in terms of class-inclusion ('a house-dog is a kind of dog', 'a chocolate cake is a kind of cake'). This finding is supported by children's spontaneous innovations of compounds – like the two Hebrew examples in note 8, where a 'land-cap' is coined in contrast to a 'sea-cap' (established term for 'bathing cap') or a 'soup marmalade' is coined to contrast with a 'soup-nut' (established term for a crouton). And it is consistent with research on children's acquisition of generic nouns in advance of superordinate terms. In fact, compounding may help children acquire the notion of subordinate members of a class, as in, say, *cheese cake, birthday cake, chocolate cake, wedding cake*, or Hebrew *na'aley^báyit* 'shoes + GEN house' = 'slippers', *na'aley^sport* 'shoes + GEN sport' = 'sneakers'.

The relation between the two nouns is another facet of compounding semantics that was examined, following Bilev (1985), by Clark and Berman (1987). Their test of children's comprehension and production of novel Hebrew compounds considered five different semantic relations between the head and modifier noun: Possession ('a blanket that a doll has, the blanket of a doll' > *a doll blanket*); Purpose ('a chair that a baby uses, a chair for a baby' > *a baby chair*); Container ('a box that holds buttons, a box that has buttons in it' > *a button box*); Material (' a cake that is made of sand, a cake from sand' > *a sand cake*); Location ('trees that grow in the mountains, trees in the mountains' > *mountain trees*). Counter to prediction, these different relations had no effect on either the number of compounds produced by the children

or the ease with which they provided paraphrases identifying the different possibilities – even though some of the five relations seemed inherently more abstract and hence more difficult to process. For example, we assumed that temporal location (as in 'a night that exists in winter' > *a winter night*) would be more difficult than concrete relations like material (e.g. 'a pillow made out of silk' > *a silk pillow*), but this did not seem to affect either children's comprehension or production of the target constructions. Nor was the basic genitive relation of possession favoured over others – even though, as noted below, it appears to be the earliest noun+noun relation expressed by children.[16] Instead, morphological form rather than semantic content seems to be a determining factor in Hebrew-speaking children's processing of compound constructions (see section 15.3.4).

Mellenius (1997) designed an elaborate set of criteria for testing Swedish-speaking children's grasp of compounding semantics, testing the same children once a year over a period of four years, from age 7 to 10. She presented children with novel compounds constituted of two nouns in different semantic categories: for example, pairs where one noun denotes an animal and the other a kind of vegetation, or one an animal and the other something that grows on animals, or a man-made object plus a material, etc. The children's paraphrases to her question 'try to tell me what you think these (funny) words mean' yielded a role inventory of eleven categories: *location*, genitive, similarity, preference, *material*, *purpose*, obligation, *possession*, co-occurrence, source, and taste (the four italicized categories were also targeted in the Hebrew study described earlier). The two commonest interpretations were of Location (overwhelming preferred, for example, for both *fågelträd* 'bird tree' and *trädfågel* 'tree bird'), followed by Material (e.g. 95 per cent of the responses for *lädersko* 'leather shoe', as against the purpose interpretation preferred for *skoläder* 'shoe leather'). The paraphrases given by the children show that by age 7 years, children are in all cases able to identify the modifier–head relationship as such. Beyond that, Mellenius concludes that the semantic connection children attribute to the two nouns of a compound depends very largely 'on the semantics of the component nouns'. This is clearly the case where children are given novel terms in isolation, with no pragmatic or linguistic context to aid in their interpretation. Possibly for this reason, the developmental picture yielded by this facet of Mellenius's research is not too clear. Some nouns appeared to retain a stable interpretation across the four years of the study (e.g. *plätbil* 'metal car' is given the sense of Material out of which the head is made), while others fluctuate (e.g. *bilplät* 'car metal' is interpreted as expressing a relation of Location by half the 6-year-olds but of Purpose by half the older children).

[16] This finding is also interesting on language-specific grounds. In marked contrast to classical Hebrew, where bound compound (so-called 'construct state') constructions served the core genitive relation of possession (Gesenius 1910), in current Hebrew, possession is typically expressed periphrastically with the genitive particle *shel* (Berman 1988; Ravid and Shlesinger 1995).

The issue for child language here – as considered for English by Clark et al. (1985) and Windsor (1993) and for Swedish by Mellenius (1997) – is whether compound innovation serves mainly to express an inherent, permanent or a more incidental or transient relation between head and modifier. Taken together, findings from the very different English, Hebrew, and Swedish studies suggest that, in line with the pragmatically motivated idea of 'contextuals' (Clark and Downing 1977; Clark 1979), how children construe compound relations depends on the semantic function they meet in a particular communicative context. In other words, in the case of children's innovative constructions, compounds are highly 'context-dependent' and hence more likely to express temporary rather than intrinsic relations.

15.3.3 Acquisition of compound form and structure

In order to comprehend and produce compounds, children need, as noted, to attend to the peculiar phonological features of such constructions, including compound-specific prosodic contours, linking elements, and consonant clusters disallowed in single words. Relatively little research is available on acquisition of compound stress patterns, apart from suggestions to the effect that it is acquired as young as by age 2 in Dutch (Fikkert 2001), English (Clark et al. 1985) and Swedish (Mellenius 1997). As against this, in their comparison of compound versus phrasal stress in American English, Vogel and Raimy (2000) cite studies documenting the relatively late development of different prosodic structures in Dutch and British English. They presented children aged 5 to 12 years and a group of adults with N + N and N + A minimal pairs with contrasting stress pattern, for example, the compound *hot dog* as a type of food versus phrasal *hot dog* as a hot canine. Although they had not predicted this, they found a marked difference in response to known versus novel noun + noun combinations. Across age-groups, subjects gave an overwhelmingly phrasal interpretation to novel items (for example, they interpreted the string *rédcup* as a cup that is red – that is, as an adjective-plus-noun phrase, rather than as a novel compound naming a kind of flower). The authors explain this as owing to the fact that a novel compound like *rédcup* lacks an established lexical entry that it can be matched with. In contrast, the known items showed a clear age-related change, with an increasing preference for a compound interpretation, regardless of stress, among 11-year-olds and especially adults. The authors conclude that 'the knowledge required to distinguish between compound and phrasal stress is quite distinct from, and more abstract than, the ability exhibited by young children when they produce novel compounds with the correct stress pattern'. They suggest that command of compound versus phrasal stress in a language like English requires knowledge of higher-level prosodic constituents and the rules that govern them, and that only much later in development 'is the stress pattern separated from the morphological operation that

combines individual lexical items into larger lexical items (i.e., compound words)'. Their study highlights the impact of familiarity with compounds on how they are interpreted across development. A rather different explanation for the late development of prosodic structures in English is suggested by Štekauer, Zimmerman, and Gregová (2007) in terms of the quite general oscillation of stress in compounds: their experimental study revealed significant individual differences in people's pronunciation of N+N compounds.

Similar studies might usefully be conducted in languages like Dutch or Swedish, not only for N+N versus A+N combinations, but for a range of compound constructions with prosodic contours that contrast with phrasal stress. As noted, Hebrew N+N compounds are not distinct from phrasal noun+adjective combinations in prosody, but differ from them markedly in morphology and syntax. In periphrastic genitives with the particle *šel* both head and modifier noun are morphologically free (e.g. *rega'im šel emet* 'moments of truth' = 'reality') as against the morphologically bound head noun in compounds (cf. *rig'ey^émet* 'minute-s+GEN truth' = 'moments of truth, of true reckoning'). In contrast, in N+A phrases, the modifying (denominal) adjective agrees in number and gender with the (morphologically free) head noun (cf. *rga'-im amitiyim* 'moment-s true+PL' = 'true, authentic, real moments') (Ravid and Shlesinger 1987). As detailed further below, it takes Hebrew-speaking children until adolescence or beyond to command and alternate these two constructions appropriately (Ravid 1997; Ravid and Zilberbuch 2003b).

Acquisition of linking elements and plural marking on the modifying noun in Germanic compounds was earlier noted as arguing for or against level-ordering structural analyses. Another facet of acquisition of compound structure that has been studied quite widely for English is the impact of word-order changes and derivational morphology in Object Verb-*er* deverbal compounds (cf. established *truck driver*, innovative *wagon puller*). English-speaking children go through a stage where they produce ungrammatical compounds like *drive truck* or *pull wagon* for such constructions (Clark and Barron 1988). Relying on both spontaneous data and experimental elicitations, Clark et al. (1986) note that children 'typically acquire affixes like *-er* before they master the appropriate noun-verb word order, and they nearly always place *-er* on the appropriate base, the verb'. They identified three developmental phases in children's acquisition of O+V-*er* compounds: Given a cue such as being asked to label a boy who pulls wagons, they may start by giving the lone noun *puller*, or by merely juxtaposing V+N (e.g. *pull man*, *pull wagon*), followed by a derived compound without the required order inversion, V-*er*+O (e.g. *puller wagon*), and only subsequently the correct *wagon puller*. Murphy and Nicoladis (2006) tested the hypothesis that the frequency of different complex forms in the input language affects their acquisition of compound constructions by comparing deverbal compound production of British versus Canadian children. They had groups of 4- and 5-year-olds coin compounds by a task similar to that

used by Clark and her associates, for example: 'Here is a machine that is watering a hat, brushing cows. What could we call that?' The Canadian children produced more O + V-*er* forms – e.g. *cow-brusher, hat-waterer* – and fewer (ungrammatical) V + O compounds (e.g. *brush-cow*) than their British English peers. The authors explain this by the fact that British English allows more V + O compound constructions (like *answer-phone*) – and possibly also more V + N compounds – than North American dialects of English. They interpret these findings as support for the role of frequency in the ambient dialect on the type of compound constructions coined by children, and also as putting into question the account proposed by Clark and her associates to the effect that children rely on phrasal ordering in producing OV-*er* type compounds.

These issues in children's acquisition of the ordering of elements in synthetic compounds deriving from Verb + Object combinations contrast with findings for Hebrew as typologically differing from both dialects of English as well as from French. First, in structured elicitations, Hebrew speakers across the board preferred to use monolexemic derived forms of the Object Noun rather than of the Verb; for example, *aglan* '*wagoner*' from *agala* 'wagon' was commoner as a label for someone who pulls a wagon than *mašxan* 'puller' from the verb *li-mšox* 'to-pull'. Second, surface VO forms like *mošex agalot* 'pulls/puller/pulling wagons' – given mainly by the youngest children in the Clark and Berman (1984) study – constitute a well-formed compound N^N construction, since the head *mošex*, in the intermediate *benoni* form of the verb *li-mšox* 'to-pull', can be interpreted as either a participial or present tense verb and/or as an agent or instrument noun derived from the verb by syntactic conversion (cf. established *šomer^šabat* 'observe(r) + GEN Sabbath' = 'Sabbath observer', *holex^régel* 'walk(er) + GEN foot' = 'pedestrian'). Third, word-order errors in such constructions are not an issue, since the order of elements in the compound construction remains the same as clausal VO – for example, *li-mšox agalot* 'to-pull wagons' yields *mašxan agalot*. And this is true of other derived nouns – both heads and modifiers – that preserve the order of simple clause constituents, e.g. *šmirat^šabat* 'guarding + GEN Sabbath' = 'Sabbath observance' (cf. *anašim šomrim šabat* 'people observe Sabbath') or *kalbey^šmira* 'dogs + GEN guarding' = 'guard-dogs' (cf. *klavim(še)-shomrim* 'dogs (that-) guard + PL'). Rather, a major structural task for Hebrew-acquiring children is learning the appropriate morphological alternations required by the bound stem form of the initial head noun, as detailed below.

15.3.4 A long developmental route: The case of Hebrew

Compounding was characterized at the outset of this chapter as representing a possibly unique intersection of morphophonology, syntax, and lexicon in both structure and function, and hence, too, in acquisition. In tracing the developmental

route of Hebrew-speaking children in acquiring compound constructions, this section aims at providing an integrative overall view of the domain. The path that emerges can be summed up as follows: (1) initial very early ***lexicalized compounds*** – at the stage of single words and early word-combinations; (2) subsequent ***syntactic combination*** of two associated nouns with juxtaposition the only formal operation – around age 2 to 3 years; (3) acquisition of relevant ***lexico-syntactic knowledge*** reflected in morphosyntactic processes of ***new-word formation*** including suffixation and stem change – age 3 to 5 years; (4) command of a full range of required *morphosyntactic changes* – beyond middle childhood to late grade-school age; and (5) finally, *syntactic productivity*, where different types of noun + noun constructions provide high-register, more formal means of expression – from high-school age into adulthood.

Below, these developmental phases are outlined and illustrated by data from naturalistic speech samples combined with experimental and semi-structured elicitations from older speaker-writers.

(1) UNANALYSED LEXICAL ITEMS (Single-word phase, age 1 to 2): To start, Hebrew-speaking children use well-established compound nouns as unanalysed amalgams, like other monolexemic nouns in their repertoire. This is evidenced by morphophonological blending – e.g. *yom^hulédet* 'day + GEN birth' = 'birthday' is pronounced as *yomulédet* and typically pluralized as *yomuladetim* ~ *yomuladetot* (cf. normative *yemey^hulédet*), *bet^šimuš* 'house + GEN use' = 'lavatory' also pluralized as *betšimúšim* (cf. normative *batey^šimuš*).

(2) N N JUXTAPOSITION (Early word-combinations, age 2 to 3 years): At this stage, children may combine two nouns in a structurally unmarked string, analogously to English-speaking 2-year-olds – e.g. *fire-dog* for a dog found near a fire or *lion-box* for a box with a lion's head on the cover (Clark et al. 1985) – or 3-year-olds' *pull man, pull wagon* (Clark et al. 1986). In Hebrew, these may yield well-formed combinations like *bakbuk tinok* 'bottle baby' = 'baby bottle ~ baby's bottle', or an ungrammatical string like *báyit a-kéle* 'house the-dog' = 'the dog's home, kennel' (cf. well-formed *bet^ha-kélev* or periphrastic *ha-báyit šel ha-kélev*). Semantically, early noun + noun combinations express mainly possessive relations between an inanimate head and an animate possessor as modifier. These are soon replaced by periphrastic genitives with the genitive particle *šel*, e.g. *ima šel Tali* '(the) Mommy of Tali', *ha-mita šel ima* 'the-bed of Mommy' = 'Mommy's bed', around age 2 to 3 years.

(3) INITIAL, PARTIALLY MARKED N^N COMBINATIONS (Basic morphosyntax, derivational morphology, age 3 to 5 years): Next, children will mark a range of nominal relations between two nouns by combining two nouns with, in some but not all cases, appropriate morphological adjustments on the head noun where required. That is, they may produce – from the head noun *uga* 'cake' – correct forms of both established *ugat^šókolad* 'cake + GEN chocolate' and innovative

ugat^shabat 'Sabbath cake'; at this stage, children may fail to produce other changes where required – e.g. **madafim sfarim* 'shelves books' in place of required *madafey^sfarim* 'shelves + GEN books' = 'bookshelves'; or they may use a bound genitive form of a noun in a phrasal context – e.g. **tmunat šel parpar* 'picture + GEN of (a) butterfly' vs. required *tmuna šel parpar* or compound *tmunat parpar.* (Berman 1987; Clark and Berman 1987).

In general, however, as noted earlier, when asked to coin names for agents and instruments, Hebrew-speaking children prefer affixation to compounding for new-word formation. Moreover, in two separate studies with different designs and populations, when children were provided with paraphrases requiring attention to two related nouns, they produced noun + noun combinations between only two-thirds and three-quarters of the time by age 5, and only 7-year-old schoolchildren responded at an adult-like level (Berman and Clark 1989; Clark and Berman 1987). These findings from structured elicitations are supported by naturalistic data revealing a general preference of Hebrew-speaking children for affixation rather than compounding as a device for new-word formation (Berman 2000).

(4) MORPHOSYNTAX OF COMPOUND CONSTRUCTIONS (Grade-school age, 7 to 12 years): Command of the formal structure of noun^noun compounds as a bound-head + free-modifier construction consolidates only around age 9, with stem-internal changes taking even longer. In a structured elicitation of novel compounds (Bilev 1985), 4- to 5-year-olds were able to add final *-t* to the free feminine ending stressed *-a* (e.g. *uga* ~ *ugat^šabat* 'cake ~ cake-GEN Sabbath'); by age 5 to 6 years they changed the free masculine plural ending *-im* to *-ey* (e.g. given *tsiporim še-xayot ba-ya'ar* 'birds that-live in-the-forest', they produced the well-formed compound *tsiporey^ya'ar* 'forest birds'); but even 9-year-olds made appropriate stem-internal changes only around three-quarters of the time (e.g. given *láyla šel xóref* 'night of winter' or *láyla še-yesno ba-xóref* '(a) night that-is in-winter', they might produce incorrect *layl xóref* rather than required *leyl^xóref* 'winter night'; or given *praxim šel xag* 'flowers of holiday' = 'festival' or *praxim še-notnim be-xag* 'flowers (people) given on (a) holiday', they might say **praxey^xag* instead of required *pirxey^xag* 'flowers + GEN holiday' = 'holiday flowers'. Interestingly, a few such errors continue into adolescence and even adulthood (e.g. people use the free form of the noun *šemot* 'names' to form the established compound *šemot^mišpaxa* 'names-GEN family' = 'surnames' without the required vowel reduction, cf. normative *šmot^mišpaxa*). Definiteness marking in compounds, where the definite marker is affixed to the second, modifying noun rather than to the initial head, is a particularly late acquisition in Hebrew (Zur 1983, 2004). This is shown by errors in the few compound constructions that occurred in the oral 'frog-story' narratives of Hebrew-speaking 9-year-olds (e.g. *ha-nexil^dvorim* 'the-swarm + GEN bees' in place of well-formed *nexil^ha-dvorim*). Analysis of noun + noun constructions in stories and essays written at school age reveals that 'by the end of grade school,

complex nominals still constitute a challenge to Hebrew writers' (Ravid and Zilberbuch 2003a).

(5a) PRODUCTIVE COMPOUNDING (Mastery of expressive options, from adolescence): By high school, Hebrew speaker-writers use compounding as a ***structural device*** for combining nouns in high-register style, typically in expository, scientific, and literary prose. That is, in more formal contexts, bound compounds – the 'construct state' constructions of traditional grammar – are selected in preference to periphrastic alternatives with the genitive particle *shel* or prepositional phrases and/or in alternation with N + A phrases with denominal adjectives. This is shown by analysis of biographical, expository, and encyclopedic Hebrew texts written by students and established authors (Ravid and Zilberbuch 2003a, b). A similar trend for greater, age-related use of bound N^N compounds in more formal written usage is shown by comparison of oral narratives and expository essays elicited from 9-year-old fourth-graders and 17-year-old eleventh-graders (Berman and Nir-Sagiv 2004). The younger children used very few, only lexicalized compounds in their oral narratives (e.g. *bet^sefer* 'house + GEN book' = 'school', *yom^sport* 'sports-day', *xadar^morim* 'room + GEN teachers' = 'staffroom'), and just about none in their compositions (two out of a total of 750 items). The older students likewise used few such constructions in their oral narratives (only five in all, also familiar or established expressions like *misxakey^yeladim* 'children's games', *malkat^ha-kita* 'queen + GEN the-class'), but they used far more – both tokens and types – in their essays (accounting for almost 10 per cent of the total number of words; and these included both familiar although high-register terms like *aruc^ha-yeladim* 'the children's channel', *misrad^ha-xinux* 'the Ministry of Education' and also innovative, syntactically productive strings like *memadey^ha-tofa'a* '(the) dimensions (of) the phenomenon', *ófi^ha-ben^adam* '(a) person's character').

These figures contrast markedly with the distribution of compound nouns in a comparable set of English-language texts, elicited by closely parallel procedures (Berman and Nir-Sagiv 2007): The English-speaking high-schoolers used compound nouns as freely in their oral narratives as in their more formal-style written essays (accounting for about 4 per cent of the total words in both text types), even though the latter typically manifested more formal, high-register language in English as in Hebrew (Bar-Ilan and Berman 2007; Ravid and Berman, submitted). Taken together, these findings demonstrate that syntactic compounding by bound 'construct state' constructions of the type labelled here as N^N is a very late acquisition, and a hallmark of more formally monitored Hebrew prose style.

(5b) SYNTACTIC COMPOUNDING: 'DOUBLE COMPOUNDS': Hebrew has another, highly complex type of N^N compound construction, the so-called 'double compound': the head noun is suffixed by a bound pronominal form of the modifying noun to which it is linked by the genitive particle *shel* (e.g. *sipur-av šel Agnon* 'stories-his of Agnon' = 'Agnon's stories', *xaver-a šel Rina* 'boyfriend-her of Rina' = 'Rina's boyfriend'). Syntactically, these constructions require backwards

pronominalization agreeing with the modifying noun in number, gender, and person; they are semantically far more restricted than N^N compounds or N *šel* N phrases; and they are confined to high-register, formal Hebrew (Ravid and Shlesinger 1995; Shlesinger and Ravid 1998). Structural complexity thus interacts with semantic productivity and low usage frequency to explain our finding that children never and educated adults only rarely use this construction.

In sum, the developmental patterns traced in this section indicate that initially, children acquiring two very different languages like English and Hebrew start out by treating compounds in much the same way, as unanalysed monolexemic labels, then as a means of juxtaposing two nouns with some unspecified semantic relation between them. Across age-groups, and most markedly in the preschool years, compound constructions serve as a means of new-word formation for labelling nominal referents from as young as age 2 in English, but only much later, and far less than affixation in Hebrew. Moreover, from around age 3, compound constructions reflect the impact of target-language structure and function. For example, English-acquiring children need to learn to manipulate deverbal compound formation, in the move from, say, *wagon-boy* to *push wagon* to *pusher wagon* to *wagon pusher*, while Hebrew-acquiring children take a long time to master the full range of morphological alternations required by noun compounds. And only once literacy is well established will they make use of compounding as a syntactic option for elevating the stylistic level of linguistic register in more formal, typically written contexts of use.

15.4 Discussion

Analysis of a range of other constructions have led me to argue that language acquisition depends on multiple factors and that the interplay between them changes over time (Berman 2004). In line with this non-monolithic view of the acquisition process and children's developmental path in moving 'from emergence to mastery', the following factors are considered below as impinging on compound acquisition in different languages: structural complexity (15.4.1), functional load (15.4.2), and the impact of target-language typology on form–function relations (15.4.3).

15.4.1 Formal factors of structural complexity

Among the principles she has formulated to explain children's lexical acquisition in different languages, Clark (1993) points to the principle of 'formal simplicity' as

explaining, for example, the difficulty English-speaking children encounter in producing OV-*er* compounds in English or in alternating the morphological form of head nouns in Hebrew, or in assigning appropriate linking elements in Dutch or Swedish compounding (Mellenius 1997), while the structural complexity of 'double compound' constructions can account for their late acquisition in Hebrew. However, while structural difficulties clearly affect the *accuracy* of children's initial production of compound constructions, they do not seem to be crucial to the *extent* to which children in fact make use of such constructions in their own language production, nor do they appear to affect children's generally early comprehension of modifier–noun or noun–modifier relations. While formal simplicity together with the principle of 'semantic transparency' – the one-to-one mapping of form and meaning – may be important for children to initially break into the system, these alone cannot account for children's preference for compounding versus affixation as a means of new-word formation. Rather, increasingly with age and the development of a larger lexicon, features of target-language typology and frequency of usage in the ambient language outweigh structural difficulties that young children may initially encounter in constructing well-formed compounds.

15.4.2 Functional load: Linguistic and discourse functions

Another factor in compound acquisition concerns the linguistic function served by these constructions. In research on English and the other languages surveyed here, compound acquisition has been dealt with primarily as a means for new-word formation.[17] This might well be the major role of compounding among young English-speaking children, when the bulk of their vocabulary is still from the basic Germanic word-stock of their language (Anglin 1993; Carlisle 2000; Bar-Ilan and Berman 2007). On the other hand, where developmental data are available beyond early school age, a rather different picture emerges. As noted above, in Hebrew, compound constructions constitute a critical facet of acquisition of morphosyntax in what has been termed 'later language development' and access to a formal, more literate style of expression (Ravid and Zilberbuch 2003a; Berman 2004) so that, from around adolescence, speaker-writers use N^N construct-state compounds as structural alternatives to periphrastic prepositional phrases, increasingly alternated with high-register N + Denominal-A constructions.

Use of alternative means to meet the function of expressing relations between two nominals thus emerges as a facet of the 'rhetorical options' selected or preferred by speaker-writers for meeting different discourse functions out of the

[17] This also seems to be true of psycholinguistic research on compound processing (e.g. De Jong et al. 2002; Gagné and Spalding 2006b; Gagné et al. 2005).

range of available constructions in their language (Slobin 2004). This has been demonstrated for later language development in use of passives in different languages (Jisa et al. 2002), devices for agent downgrading in Spanish (Tolchinsky and Rosado 2005), and types of text-based clause linkage in English, Hebrew, and Spanish (Berman and Nir-Sagiv in press). These observations are supported by findings for acquisition of compounds in Hebrew, where compound constructions typically change not only in amount and form, but also in the linguistic and discourse functions that they serve across later, school-age language development.

15.4.3 Target language typology in form/function interrelations

English and Hebrew manifest clear typological differences in compounding, including (1) a distinctive stress pattern versus morphological change, (2) left versus right head-branching order, and (3) a large range of non-N + N compound types in English, where Hebrew has no equivalents to, say, A + N (*high school, sidewalk*), V + N (*playpen, push button*), Particle + N (*downstairs, backpack*), and no compound verbs (*whitewash, piggyback*), even though denominal verb-formation is morphologically productive (Berman 2003). Lexical innovations in both structured elicitations and naturalistic usage showed English-acquiring children to favour juxtaposing of two words for new-word formation whereas their Hebrew-acquiring peers prefer to coin new words by affixation. I suggest that this is due to the traditional typological distinction between English as more analytic and Hebrew as more synthetic, so that children acquiring these two languages will attend more to relations ***between*** words in English, and ***inside*** words in Hebrew. Thus, Hebrew-speaking children may rely less on compounding for coining new terms because they have numerous word-internal alternatives that are readily accessible from an early age for this purpose.

The fact that preschoolers are from early on sensitive to the 'typological imperatives' imposed by their language (Berman 1986, 1993b) is attested by cross-linguistic research in different domains (e.g. Slobin 1996; Bowerman and Choi 2001). In the case in point, word-internal morphological processes – both linear to the ends of words and interdigitated with consonantal roots – are typologically highly accessible and mastered early by children acquiring a Semitic language like Hebrew (Berman 1985; Shimron 2003). In contrast, more sophisticated derivational affixation is a late acquisition in English when applying to more advanced, high-register, Latinate elements of the lexicon (Nagy & Herman 1987; Carlisle, 2000).

Frequency of occurrence in the ambient language interacts with structurally motivated typological factors. In line with usage-based theories of grammaticization (e.g. Bybee 2006), current psycholinguistic research demonstrates the acquisitional impact

of frequency of distribution of particular constructions in naturalistic speech use. Such approaches view input as central to acquisition, in the sense that, based on frequency of occurrence (both types and tokens), certain concrete structures of the target language are stored and processed until they eventually become reformulated into more abstract linguistic representations (e.g. Cameron-Faulkner, Lieven, and Tomasello 2003; Tomasello 2003). In other words, the type of 'positive evidence' to which children are exposed plays a major role in acquisition (MacWhinney 2004). In the present context, children acquiring Germanic languages like English, Dutch, or Swedish are exposed early on to numerous exemplars of compound constructions. In contrast, the bulk of the content vocabulary that Hebrew-acquiring children hear around them is made up of morphologically complex items constructed out of consonantal roots plus affixal patterns, while the bulk of the noun + noun combinations that they hear and produce are in a phrasal form with the genitive particle *shel*.

Interestingly, these preferences reflect quite different historical developments. N + N compounding is a favoured device for the basic Germanic stock of everyday English – as in examples cited earlier from children's narratives – in contrast to higher-register, later-developing A + N phrases with Latinate denominal adjectives like *world order* ~ *universal arrangement, water bug* ~ *aquatic insect* (Levi 1976). In marked contrast, classical Hebrew N^N compounding has been largely replaced in everyday usage, hence in the input to young children, by periphrastic options (mainly with the post-Biblical genitive particle *shel*), while classical Semitic devices of affixation remain favoured for new-word formation – along with newer, more linear morphological devices (Ravid 2006). This line of reasoning explains why, although N^N compounding (as against compounding in general in languages like English or Swedish) is ***structurally*** highly productive in Hebrew, it is relatively marginal in actual occurrence in the language heard and hence used by young children.

These typological and usage-based factors intersect with level of usage and ***linguistic register*** to explain developments in acquisition of compound constructions. Recall that, in closely parallel sets of Hebrew texts, compounds were infrequent in the oral narratives of children and adults alike, occurring more in written essays only from high school up. In English, by contrast, compounds (mainly Germanic N + N forms) were quite common in English oral narratives from preschool on. This is understandable, since young English-acquiring preschoolers hear and use such constructions, together with a small group of native derivational suffixes like agentive *-er* or action nominal *-ing* (Clark 1993). At school age, as part of acquiring a 'literate lexicon', English speakers are exposed to more formal types of constructions, including Latinate denominal adjectives, on the one hand, and presumably (although to the best of my knowledge, this topic has not been investigated in English) a broader range of compound constructions, including denominal compound verbs and participial adjectives (*fine-tuned, clear-thinking*, etc). In contrast, in order to acquire a formal written

style of expression, Hebrew-speaking students need to master several high-register binominal constructions (N^N compounds, N + Denominal-A, and N-Pro shel N double compounds, which they master in that order). The fact that it takes so long for these constructions to consolidate derives from usage variables of low frequency in everyday register and conversational style, interacting with typologically motivated factors of formal complexity and the ready accessibility of structural alternatives.

15.4.4 Further directions

Usage-based explanations point to the need for detailed studies of the ***relation between input and output*** in compound acquisition – not in the behaviouristic sense of imitation or a one-to-one mapping of in-at-one-end, out-at-the-other, but by adopting a systematically tested, corpus-based account of the notion of 'frequency' in the ambient language. Current studies on a range of grammatical constructions demonstrate that caretaker input to young children in the critical period of early language acquisition is constrained in non-obvious fashion. Compound acquisition in different languages affords a suggestive site for similar inquiries, beyond early acquisition and across school age.

A second possible line of investigation would be to compare acquisition and use of different types of ***binominal constructions*** – not only minimal pairs of N + N / A + N constructions (as in Vogel and Raimy's study) but, say, for English N + N compounds, Denominal-A + N phrases, possessives with 's, and phrases with genitive *of* (compare, say, *flower dress*, *flowery dress*, *flowered dress*, *floral dress*); and the full range of constructions noted earlier for Hebrew. Infelicitous strings of nominals or overuse of genitive phrases is common in the usage of even advanced learners of English as a second language from different language backgrounds. This, too, cannot be evaluated without a careful, usage-based analysis of these alternating, apparently 'synonymous' expressive options for combining two nouns in different languages.

Along the same lines, as initiated by the experimental studies of Eve Clark and her associates on coining labels for agent and instrument nouns, cross-linguistic research could be designed to compare the ***alternative devices*** favoured by children acquiring different types of languages for coining lexical items in a range of domains. Carefully controlled research of this kind could provide important further evidence for the role of target-language typology, usage frequency, and linguistic register in children's acquisition of compounds and related constructions.

Finally, given the rather ambiguous results of earlier, experimentally structured studies in different languages (as reviewed in section 15.3.2 above), further research is needed to ascertain which, if any, ***semantic relation*** is most favoured

in compounding and which, if any, such relation is more basic or earlier acquired in different languages. Currently, the basic genitive category of possession appears to be the earliest-acquired noun + noun relation in both English and Hebrew – not through compound constructions but by inflection in English (*Mummy's bed*) and phrasally in Hebrew (*ha-mita šel ima* 'the-bed of Mummy').[18] This points to a more general methodological implication of the foregoing review of children's acquisition of compound constructions: the need to combine results of structured experimental elicitations with data from varied samples of naturalistic language use in different communicative contexts.

[18] The language-particular arbitrariness of the form–meaning relations of binomial constructions is demonstrated by another English/Hebrew contrast. The often highly lexicalized partitive relation is expressed periphrastically in English (e.g. *a cup of tea, box of matches*) in contrast to the container relation (*teacup, matchbox*). In Hebrew, both are typically compounded (*kos^te, kufsat^gafrurim*) – first showing up in children's usage in established expressions like *bakbuk^xalav* 'bottle (of) milk ~ milk bottle' (cf. possessive *bakbuk šel tinok* 'baby's bottle').

RAVID, D. D. (1990). 'Internal structure constraints on new-word formation devices in Modern Hebrew', *Folia Linguistica* 24: 289–346.

—— (1997). 'Between syntax and the lexicon: The parallel between N-N compounds and N-A strings in acquisition', in A. Sorace, C. Heycock, and R. Shillcock (eds.) *Proceedings of the GALA 1997 Conference on Language Acquisition*. Edinburgh: University of Edinburgh, 138–41.

—— (2006). 'Word-level morphology: A psycholinguistic perspective on linear formation in Hebrew nominals', *Morphology* 16: 127–48.

—— and A. AVIDOR (1998). 'Acquisition of derived nominals in Hebrew: Developmental and linguistic principles', *Journal of Child Language* 25: 229–66.

—— and R. A. Berman (~~submitted~~). 'Developing linguistic register in different text types: The case of Hebrew.' *Pragmatics and Cognition*. (in press)

—— and Y. SHLESINGER (1987). 'On the classification and structure of-suffixed adjectives', *Hebrew Linguistics* 25: 59–70. [In Hebrew.]

—— (1995). 'Factors in the selection of compound-type in spoken and written Hebrew', *Language Sciences* 17: 147–79.

—— and S. ZILBERBUCH (2003a). 'Morpho-syntactic constructs in the development of spoken and written Hebrew text production', *Journal of Child Language* 30: 395–418.

—— (2003b). 'The development of complex nominals in expert and non-expert writing: A comparative study', *Pragmatics and Cognition* 11: 267–97.

REFSING, K. (1986). *The Ainu Language*. Aarhus: Aarhus University Press.

REICHSTEIN, A. D. (1984). *Nemeckie ustojčivye frazy i ustojčivye oredikativnye edinicy*. Moscow.

REINHART, T. (1983). *Anaphora and Semantic Interpretation*. London: Croom Helm.

—— and T. SILONI. (2005). 'The lexicon–syntax parameter: Reflexivization and other arity operations', *Linguistic Inquiry* 36: 389–436.

RENOUF, A. and L. Bauer (2000). 'Contextual clues to word-meaning', *International Journal of Corpus Linguistics* 2: 231–58.

REUSE, W. J. DE. (1994). 'Noun incorporation in Lakota (Siouan)', *International Journal of American Linguistics* 60(3): 199–260.

REUSE, W. DE. (2006). *A Practical Grammar of the San Carlos Apache Language*. Munich: Lincom Europa.

RICE, K. (1988). 'Continuant voicing in Slave (Northern Athapaskan): The cyclic application of default rules', in M. Hammond and M. Noonan (eds.) *Theoretical Morphology. Approaches in Modern Linguistics*. San Diego: Academic Press, 371–88.

—— (1989). *A Grammar of Slave*. Berlin: Mouton de Gruyter.

—— (2003). 'Doubling of agreement in Slave (Northern Athapaskan)', in A. Carnie and H. Harley (eds.) *Form and Function: Essays in Honor of Eloise Jelinek*. Amsterdam/ Philadelphia: John Benjamins, 51–78.

RIEGEL, M., J.-C. PELLAT, and R. RIOUL (1994). *Grammaire méthodique du français*. Paris: PUF.

RIEHEMANN, S. (1998). 'Type-based derivational morphology', *The Journal of Comparative Germanic Linguistics* 2: 49–77.

RIESE, T. (2001). *Vogul*. Munich: Lincom Europa.

RITTER, E. (1988). 'A Head-Movement approach to Construct-State NPs', *Linguistics* 26/6: 909–29.

RIVERO, M. L. (1992). 'Adverb incorporation and the syntax of adverbs in Modern Greek', *Linguistics and Philosophy* 15: 289–331.