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**LINGUISTIC INTERFACES IN EARLY ACQUISITION: LEXICAL  
CLASSES AND GRAMMATICAL SYSTEMS IN HEBREW CHILD LANGUAGE**

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by

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## ABSTRACT

The study investigates acquisition of different facets of early Hebrew clause structure – verb-inflection, predicate constituency, and prepositional marking – as three domains that are generally treated in isolation, in linguistic analysis as in child language research. In overall approach, an integrative view of language development is adopted by examination of both paradigmatic and syntagmatic facets of early clause structure in conjunction, with the aim of demonstrating how they interface in acquisition (Allen, 2007; Rothman & Guijarro-Fuentes, 2012; Veneziano & Sinclair, 2000). The goal of the study is thus twofold: first, to delineate developmental patterns in terms of the transition from opacity to transparency in grammatical marking of different facets of simple clause structure; and, second, to examine whether and how the domains of predicate constituency, on the one hand, and of prepositional marking of non-Subject constituents (NSCs), on the other, can be said to “converge” with the domain of verb inflection in the process of acquisition. Across the study, concern is with language-particular properties of Hebrew typology, against the background of shared developmental trends in children’s acquisition of their native tongue.

The data-base for the study consists of rich longitudinal sampling of three Hebrew-acquiring children, with a mean age-range of 1;4-2;5, from the onset of their verb production until verb forms depicted as “opaque”, in the sense defined specifically for this study, and as defined below, no longer occur in their speech. The three children (two girls, Lior and Rotem, and a boy, Shachar), from well-educated middle-class families resident in central Israel, were audio-recorded for one hour each week, in their home environment during everyday activities, in interaction with their caregivers (mother/father/aunt) and, occasionally with other family members or friends. All child and adult utterances were transcribed in broad phonemic transcription following the CHILDES conventions (MacWhinney, 2005), adapted to conform optimally to the non-Latinate orthography and contemporary pronunciation of Israeli Hebrew. The speech output of two of the children (Shachar and Rotem) was also phonetically transcribed and, where possible, a corresponding phonetic target form entered for their usages, while analyses of Lior’s speech took into account the digitalized data-base currently available for her auditory recordings.

Analyses were applied to all and only child utterances that contained a lexical (that is, non-copular) verb (in the sense specified by Berman & Dromi, 1986). Adult input was taken into account as providing linguistic and pragmatic contextualization for children’s speech, so making it possible to identify unanalyzed, “amalgam”-like



instances of direct repetitions, non-clausal completions of adult utterances, formulaic routines and other rote-learned forms of speech output. A total of over six thousand (6,239) verb-containing utterances recorded in the children's speech output were coded for verb inflection, syntactic function of clausal constituents, prepositional marking of non-subject constituents (NSCs) and, where relevant, surrounding linguistic and non-linguistic context.

Each instance of inflections (on verbs) and of prepositional marking (on NSCs) was specified for the two developmentally motivated psycholinguistic variables of **structural transparency** and **usage productivity** – as defined and motivated specifically for purposes of this study, as follows. Grammatical forms produced by the children were defined as either “opaque” – in all and only cases where they were lacking in a clear, unambiguous target form – or as “transparent” – when they were clearly interpretable in terms of an adultlike target (Lustigman, 2012). For example, a truncated verb form like *daber* ‘talk’ is inflectionally ambiguous, and hence defined as opaque, since it can correspond to several target forms, including: *ledaber* ‘to.talk’, *medaber* ‘talks:MASC:SG’, *yedaber* ‘will.talk:3RD:MASC:SG’; while a truncated form such as *aflu*, even though unconventional in terms of adult usage, was defined as transparent since it corresponds unequivocally to the conventional target form: *naflu* ‘fell:3RD:PL’. Usage productivity, in the sense defined below, was taken to apply to self-initiated grammatical forms produced by a child that were clearly neither rote-learned nor repetition-based. Productive knowledge of grammar was identified in the children's speech output by means of a novel contextualized criterion in the form of an adapted version of Brown's (1973) “obligatory contexts”, as follows. Children were credited with productivity in their use of verb inflection once the relevant inflectional affixes were employed only when and where required by the particular syntactic environment in which they occurred (Lustigman, 2013). By this criterion, in the initial stage of productive usage, children may still have produced truncated or bare-stem forms of verbs (Adam & Bat-El, 2008) in contexts where affixed forms were required, but they no longer relied on unanalyzed “amalgams” (Bowerman, 1982; MacWhinney, 1975), hence no longer used inflectional affixes ungrammatically.

Analysis of children's verb forms by the two criteria of transparency and productivity yielded three developmental phases, with the term “phase” applied in the sense proposed by Berman (1986a, 2004) following Karmiloff-Smith (1986, 1992) to characterize recurrent periods in development rather than Piagetian across-the-board

developmental stages. The same three phases emerged for each of the three children in this study: Phase I –beginning with the earliest verb form documented; Phase II – initiated when productive verb inflection was identified, manifested mainly by non-person-marked infinitival and present-tense forms of verbs; and Phase III – exhibiting greater diversity of verb inflections, including marking of the category of person, ending with the disappearance of all verb forms defined as “opaque”. These phases showed a gradual transition from pervasive opacity via initial productivity to full transparency in verb inflection for all three children, together with a concurrent gradual shift between pervasive non-marking of non-Subject constituents (NSCs), via juvenile, partial usage of prepositions to fully explicit marking of verb-NSC relations.

During this transition from opacity to transparency, all three children appeared to rely on two types of “bridging categories” in marking both verb inflection and verb-NSC relations. Initially (in Phase I), they rely almost exclusively on juvenile non-marked elements (truncated bare-stem forms for verbs; and filler-syllables and/or omissions and substitutions for prepositions); subsequently (in Phase II) both domains reveal a shift to major reliance on “neutral” less marked, yet adultlike, categories (present-tense and infinitival verb forms; and non-preposition requiring simplex adverbs and indefinite direct objects) as more advanced, partially specified grammatical marking. Both types of “bridges” are analyzed as manifesting an interim strategy in the transition to grammatical knowledge in the form of a preference for structurally non-marked elements. Even in their initial avoidance of grammatical marking, the children’s usage reflects early sensitivity to target-language syntagmatic structure, as shown in the present study by their attentiveness to morpheme boundaries in distinguishing stems from affixes and to clause-internal constituency in locating prepositional sites. Developmentally, moreover, children’s subsequent selection of “neutral” forms (like Hebrew infinitives or present-tense verbs and non-prepositional NSCs) demonstrates sensitivity to language-particular features of paradigmatic structure.

While the results of the study apply similarly to all three of the children in the sample, certain individual differences were detected in the strategies they adopted in coping with the task of language acquisition (Bates, Dale, & Thal, 1995; Lieven, 1997; Peters, 1977). These differences were particularly marked in the preferences children manifested for non-marking of grammatical distinctions in the transitional shift from one level of knowledge to another and in the degree to which they relied on

rote-learning and imitation as a means for breaking into the structure of the ambient language.

The developmental findings of the study – specifically during Phases II and III, where productive grammatical marking occurs alongside opaque usages of both verbs and NSCs – constituted a point of departure for further analysis of clause-level co-occurrences across different grammatical categories. Two clear patterns of convergence emerged – along lines not previously explicitly demonstrated in the literature – between opacity/transparency in verb inflection, on the one hand, and the ostensibly distinct domains of predicate constituency and of prepositional marking, on the other. Thus, (1) opaque verb forms tend to occur significantly less in isolated syntactic contexts, without associated NSCs, compared with their transparent counterparts; and (2) in any instance of a verb used with an associated NSC, transparent prepositional marking of NSCs occurs significantly more with inflectionally transparent than with opaque verb forms. These statistically significant trends for inter-domain convergences in grammatical development shed new light on the role of structural opacity and of inter-domain interfaces in early language acquisition. On the one hand, the principle of opacity not only plays a crucial developmental role in the selection and construction of bridging categories as a means to children’s breaking into the grammar of the ambient language while, on the other, it also functions importantly in the construction of interfaces between apparently distinct domains in acquisition. The first convergence, between opaque verb forms and elaborated, non-isolated syntactic environments is suggestive of the syntagmatic combinatorial function of inflectionally opaque verbs as a useful means of “gluing” together verbs with NSCs, so promoting acquisition of predicate constituency. More generally, this trade-off between clause-level elaboration by adding NSCs, on the one hand, and word-level non-specification of verb inflections, on the other, suggests that language development does not progress linearly from smaller to larger units. Rather, development of grammar operates on several levels concurrently, so that “higher” levels of linguistic structure (here, Verb + NSC) may be deployed before “lower” levels (Verb Inflections) are fully specified. The second convergence, between transparent prepositional NSC marking and transparent verb inflection, suggests that transparency in one domain may promote concurrent transparent marking in the other domain as well. That is, lack of structural specificity (opacity) in one area of marking of verb-constituent relations contributes to a pervasive “instability” in the status of the other clausal constituents in a given utterance, since their grammatical function

remains ambiguous. More generally, children's use of grammatical marking appears sensitive to the surrounding structural environment (in the case in point here, of simple-clause structure), developing through a continuous process of inter-domain communication between ostensibly distinct linguistic systems.

Notwithstanding individual differences between the three children in the shift from opacity to transparency in their use of linguistic forms, and in spite of the typological specificities of Hebrew as the ambient language, results of the study point to quite general, shared patterns of language acquisition and development. By highlighting the impact of productivity as a psycholinguistic principle, by elucidating the nature of opacity in child language production, and by demonstrating the role of interfaces in early grammars, the study underscores language development as a process of gradual consolidation and constant re-integration of knowledge within and between interfacing systems of linguistic structure and use.

## TRANSCRIPTION AND GLOSSARY CONVENTIONS

### 1. Transcription of Hebrew items

- The transcription of Hebrew elements throughout the study follows the CHILDES conventions (MacWhinney, 2005), in lowercase letters, as adapted in the Berman lab to conform optimally to the contemporary pronunciation of Israeli Hebrew and its non-Latinate orthography.
- Hebrew (and other non-English) words have final stress, unless specified by an accent *aigu* as (ante)penultimate.

### 2. Notation of grammatical categories

Grammatical categories are abbreviated in small caps, following the relevant items. The following notations are used throughout the study:

ACC = Accusative marker

FEM = Feminine

FUT = Future

FILL = Filler syllable

MASC = Masculine

NEG = Negation

SG = Singular

PAST = Past

PL = Plural

PRES = Present

1ST, 2ND, 3RD = First, Second, and Third Person, respectively

### 3. Glossary

All examples, in any language, are given in italics, using the following conventions:

- Boldface or underlining is used for emphasis.
- Where an item would be obligatory in English but is omitted in the source-language, the "missing" element is given in parentheses (e.g., *híne buba* 'here (is a) doll').

- Elements in the gloss which are expressed by a single element in the source-language are separated in the gloss by a period (e.g., *oxel* ‘is.eating’).
- Inflectional categories applying to lexical items are indicated successively, separated by colons (e.g., *nafla* ‘fell:1ST:FEM:SG’).
- Seven grammatical items that constitute separate words in English and other European languages but are written as part of the same orthographic word that follows them in Hebrew (the definite article *ha-*; a subset of four basic prepositions meaning ‘*in~at, to, from, as*’ – alone or fused with the definite article; the coordinating conjunction *ve-* ‘and’; and the subordinator *še-*, ‘that’) are separated from the following noun by a hyphen (e.g., *ha-agala* ‘the-  
buggy’; *la-rexov* ‘to-the-street’).

## CHAPTER I – INTRODUCTION

The study addresses acquisition of early clause structure in three grammatical domains – verb inflection, predicate constituency, and prepositional marking of clausal relations – examined from the two psycholinguistic perspectives of developmental processes and principles, and between-domain dependencies as indicators of linguistic interfaces. To this end, a contextualized analysis was conducted of all verb-containing utterances occurring in the speech of three Hebrew-acquiring children sampled longitudinally between ages 15 to 30 months, motivated by the fact that, across languages, verbs constitute the core elements in organization of clause-structure (Bloom, 1991; Tomasello, 1992) while in Hebrew, verb morphology encodes a rich variety of grammatical categories. Underlying the study are two main assumptions. First, a contextualized analysis of children’s utterances makes it possible to tap into levels of linguistic knowledge by identifying elements in their speech output that function as part of broader structural patterns. Second, detailed investigation of Hebrew verbs provides a potentially valuable source of evidence for linguistic interfaces, since verbs both alternate paradigmatically and combine syntagmatically with other clausal constituents, and so require integration of several levels of grammatical structure concurrently.

This introductory chapter starts by briefly reviewing major approaches to language acquisition as a point of departure for the developmental orientation of the study (Section 1.1), followed by a survey of theoretical and research background on the acquisition of the three linguistic domains of investigation (verb inflection, predicate constituency, and prepositional marking of syntactic relations), in both general and Hebrew-specific child language research (1.2). These overviews form the frame of reference for presentation of two psycholinguistic principles that underlie the proposed analysis of child language (1.3) – structural transparency (1.3.1) and usage productivity (1.3.2) – and the role played by each in delineating developmental phases (1.3.3). The chapter concludes by considering these psycholinguistic factors in relation to interfaces between the three linguistic domains analyzed and their role in driving early grammar acquisition (1.4).

## 1.1 Theories of Language Acquisition

Approaches to what is involved in children's acquisition of their native language derive from different views of linguistic structure and use, hence of what underlies early grammatical development and language production. Major such approaches are outlined below, starting with models within the framework of formal generative grammar, followed by consideration of a range of usage-based approaches to the domain.<sup>1</sup>

The nativist view identified with Chomsky's generative theory of Universal Grammar (UG) (Chomsky, 1957; 1965) has had a major impact on the field of language acquisition since the 1950s. Despite modifications in the model over the years (e.g., Fitch, Hauser & Chomsky, 2005), certain ideas remain strongly entrenched in generative theory. One is the separation between competence, as speakers' underlying knowledge of their language, and performance, as linguistic behavior, with the latter typically viewed as being of relatively marginal interest (Crain & Lillo-Martin, 1999). A second autonomy, the modularity of linguistic domains, defines syntax as a self-contained module, distinct from phonology or semantics (Chomsky, 1981), with morphology – a key topic in the present context – typically associated with either syntax or phonology. A generativist perspective on language acquisition, motivated by the need to find a solution to “the logical problem of language acquisition” or “Plato's problem” (Chomsky, 1986), highlights the rich linguistic knowledge that children acquire rapidly and effortlessly, despite “poverty of the stimulus” and the lack of “negative evidence” in the input (Roeper, 1988). In this view, children's innate knowledge of linguistic universals is taken to account for the rapidity and uniformity of how they acquire grammar in a range of linguistic domains (Borer & Wexler, 1987; 1992; Babyonyshev, Ganger, Pesetsky, & Wexler, 2001; Chomsky, 1981; Crain & Pietroski, 2002; Hyams, 1986; 2008).

Nativist scholars differ in their view of the “initial state” of grammar and how complete or “adultlike” is children's initial grammatical knowledge. The “Full Competence Hypothesis” (Borer & Rohrbacher, 2002; Poeppel & Wexler, 1993) assumes that functional features of the target language are available to the child from very early on. A modified view suggests that not all the principles of UG are available

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<sup>1</sup> Pragmatically motivated interactionist approaches such as those of Blum-Kulka (2001) or Ninio and Snow (1996) are not included here, since these treat language acquisition as part of more general processes of socialization, involving issues beyond the scope of the present study.



at the initial state (Hyams, 1988; Radford, 1990), adopting Chomsky's (1981) "core-periphery" distinction to predict that core structures will be acquired before those of periphery grammar (Hyams, 2008). Relatedly, in contrast to hypotheses for "Strong Continuity" and the claim for an innate language faculty available from the outset (Epstein, Flynn, & Martohardjono, 1998; Lust, 1999; Whitman, 1994), proponents of "Weak Continuity" assume that children's grammars will allow structures that are impossible in the target language, just in case they obey the principles of Universal Grammar (Borer & Wexler, 1987, 1992; Crain & Pietroski, 2002; Hyams, 1986, Pinker, 1984; Thornton, 2007). The issue of continuity and the prior knowledge that children bring to the task of language acquisition are relevant to the present study which by and large differs from nativist approaches in its essentially developmental orientation.

Cognitively and/or functionally motivated "usage-based" approaches represent quite different perspectives to nativist generative views on linguistics and language acquisition.<sup>2</sup> Linguists working in various such frameworks share the assumption of an intimate connection between linguistic structure and language use, with grammar viewed as shaped by usage (e.g., Bybee, 2006a, b; Goldberg, 1995; Givón, 1989; Langacker, 1968). Language acquisition research from these points of view proposes radically different directions for solving the "logical problem of language acquisition" from nativist approaches. Not only is the adult linguistic system regarded as more "child-friendly" than is perceived by generative grammarians (Tomasello, 2003), children are taken to be aided in the task of language acquisition by powerful, not necessarily language-specific, learning mechanisms such as pattern-detection, category-formation, and intention-reading (Gerken, 1994; Golinkoff & Hirsh-Pasek, 2008; Gomez, 1997).

An important psycholinguistic facet of this general orientation is the notion of Emergentism, the idea that language structure arises from the interaction of a range of factors and constraints rather than a single monolithic UG (Bates, Elman, Johnson, Karmiloff-Smith, Parisi & Plunkett, 1998; Elman, 1993, 1999; MacWhinney, 1998, 1999). In the framework of connectionist models, for example, linguistic structures at all levels of processing emerge from several interacting factors, including usage

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<sup>2</sup>A succinct overview of these approaches is given in the introduction to Ambridge and Lieven's (2011) detailed, evidence-based analyses of the implications of the contrasts between how they account variously for acquisition in a range of linguistic domains, from speech perception and production via word meanings to inflections and syntax, both simple-clause and complex.

patterns in the input, social interaction, and constraints imposed by the biological and cognitive systems of the child. Approaches of this type argue against the autonomy of grammar, emphasizing that modular dissociations (between, say, lexicon and grammar) emerge over time rather than being hard-wired from the outset (Bates & Goodman, 1999; Karmiloff-Smith, 1992). Such ideas constitute a major motivation underlying the present study, as focusing on interfaces rather than on modular encapsulations in acquisition.

Construction Grammar, as a major usage-based model of linguistic analysis, abandons both the idea of the autonomy of syntax and the “core-periphery” distinction, with all linguistic levels treated concurrently as “constructions”, pairings of forms/structures with functions/meanings (e.g., Bybee, 2006a; Croft, 2001; Goldberg, 2003, 2005; Kay & Fillmore, 1999). In this framework, language development proceeds through increasing abstraction of linguistic structures, where each structure includes several levels of complexity at the same time, rather than as a “lego-like” process in which larger structures are gradually built up from smaller pieces (Diessel, 2004; Diessel & Tomasello, 2000; Tomasello, 1998). Children’s early productions start out as lexically specific, developing subsequently via repeated application of cognitive processes such as analogy and generalization, until they eventually come to reflect mastery of abstract linguistic categories like Agent, Noun, or Subject (Dąbrowska & Tomasello, 2008; Lieven, 2008). Construction Grammar approaches are of relevance to the present analysis of Hebrew verbs as multifaceted complexes interacting concurrently with different facets of clause structure.

Distributional learning, particularly in relation to grammatical classes, is another usage-based principle that has been proposed to account for children’s acquisition of grammar (Maratsos & Chalkley, 1980; Maratsos, 1982; 1988). In this view, grammatical environments are critical for syntactic acquisition in general, and for recognition of linguistic elements as members of a given grammatical class in particular – since learning that particular terms occur in correlated contexts is necessary for children to establish a systems of patterns in order to consolidate notions of ‘verb’, ‘noun’, or ‘adjective’. The distributional approach has been criticized for demanding overly complex analysis of ambient-language input on the part of the language-learning child (e.g., Gobet & Pine, 1997; Pinker, 1984). In addressing such criticisms, Braine (1987) argued that a distributional account of acquisition is possible only if certain basic linguistic distinctions – such as between a

predicate and its arguments – are taken as primitive components from the onset of acquisition. The present study takes into account distributional factors in acquisition from a rather different perspective, as a means of examining between-domain interfaces in children’s speech output (see, further, Section 1.4).

Another data-driven analysis of language acquisition is proposed by the Competition Model (Bates & MacWhinney, 1987; MacWhinney, 1987, 2001, 2004), which is concerned with competing forces in language development that apply at different levels of linguistic structure (MacWhinney, 2004; MacWhinney & Leinbach, 1991). The model relies on a range of general cognitive principles: representational principles concentrated mainly in the lexicon as an organizing component of language; processing principles that characterize the way linguistic elements “compete” with each other; and learning principles that help to shape the connections between items on the basis of positive instances. The model pays major attention to the mapping between form and function in language comprehension, production, and acquisition, on the assumption of a direct mapping in all three areas (Bates & MacWhinney, 1987; MacWhinney, 1987). It also highlights the important role of input cues, in the sense of surface structures that direct the child to the semantic-pragmatic functions underlying linguistic forms, considering cue validity and cue strength as the basis for predictions regarding the order in which grammatical elements will be acquired in different languages and so accounting for cross-linguistic variation. While not examining the factor of “competition” *per se*, since this typically requires computational or experimental designs beyond the scope of the present study, account is taken here of the structural “cues” provided to Hebrew-acquiring children by the ambient language and how these dictate early verb usage in Hebrew.

A range of acquisitional strategies and operating principles have been formulated within various psycholinguistically motivated approaches characterizing children’s grammar in terms of the acquisition of form-meaning relations and the mechanisms involved in mapping between the two. The need for children to recognize the kinds of objects and events that are encoded in their language and to segment the stream of speech into meaningful linguistic units (Gleitman & Wanner, 1982; Gleitman, Gleitman & Wanner, 1988) involves mapping between objects and events and the linguistic units that encode them in both lexicon and syntax (Karmiloff-Smith, 1992; Clark, 2009; Slobin, 1973). Evidence for the conceptual notions underlying linguistic categories is proposed by Clark (2001) in terms of “emergent categories”,

particularly lexical devices or constructions that children select to express all instances of a given category, since some notions are so salient to young children that they may express them using grammatical constructions in ways not necessarily licensed in their linguistic input (see, too, Clark & Carpenter, 1989). As a further aid to achieving form-meaning mappings, Clark (1987) specifies the Principle of Contrast (“Every two forms contrast in meaning”) as constraining the process of acquisition, both alone and in combination with other acquisitional principles. In the present context, the issue of form-meaning mappings will be examined in terms of children’s shift from reliance on ambiguous or opaque forms to more explicit and transparent marking of linguistic categories and relations.

In addressing the issue of abilities that children come equipped with when approaching the task of language learning, Slobin (1973) articulated the “cognitive prerequisites” necessary for children to organize their knowledge about their surroundings when mapping between their conception of the world and their emerging language. Subsequently, Slobin’s (1979) view of language as a “specialized form of representation” led him to suggest that rather than direct mapping of cognitive underpinnings, the mapping of semantic notions into the conventional systems of linguistic expression demands both general cognitive and language-specific skills. The Operating Principles formulated by Slobin (1985) as characterizing children’s Language-Making Capacity specify both cognitive and language-specific prerequisites for language development. This capacity yields a “Basic Child Grammar” constructed by means of both general and language-specific principles that guide children by directing them to pay attention to such features of linguistic patterning as allomorphy, morphological paradigms, connectives, and canonical clause structure. These ideas are important for the current analysis of children’s early selection of verb stems out of the options provided by the rich inflectional paradigm of Hebrew verb, while Slobin’s (1990) insights into the progression from “child speaker” to “native speaker” provide a major motivation for the developmental view espoused here.

An important typological facet of Slobin’s ideas derives from the impact on his thinking of Bowerman’s (1994, 1996) conclusions from her cross-linguistic research to the effect that, although children acquiring different languages seem to talk about similar topics, each target language has important implications for how they structure semantic notions both lexically and grammatically right from the outset.

Along these lines, Slobin has more recently proposed a relatively usage-based, functionalist approach to the consolidation of what he terms “grammaticizable” notions, with language-particular properties playing a key role in determining the nature and order of acquisition of grammatical elements (Slobin, 1997, 2001). That is, while some domains of linguistic knowledge may show great uniformity in their underlying organization across children and languages, others are more open to variation. Slobin and Bowerman (2007) further stress the need for collaboration between typological and acquisitional research, with typologists taking into account developmental and cognitive implications of cross-linguistic patternings, and acquisition research taking into consideration richer possibilities of cross-linguistic variation. The idea of children’s language-particular sensitivity to target-language typology plays an important role in the present analysis of three morpho-syntactic domains in Hebrew as detailed further in this chapter, while cross-linguistic factors are discussed by comparison of verb acquisition in languages that differ markedly from Hebrew as noted in the concluding chapter.

Of particular relevance to the present study are the developmental models of Karmiloff-Smith (1986, 1991) for a range of cognitive domains including language and of Berman (1986a, 2004) in relation to early grammar and later language development in Hebrew. Karmiloff-Smith’s (1992) constructivist model of Representational Redescription (RR) depicts development as a continuous process by which children’s knowledge-base expands constantly through interaction with the environment. In her view, the modular structure of language (and of human cognition in general) is a product of development, rather than pre-specified as the basis for acquisition, evolving through recursive processes of self-redescription and re-organization that enable the mind to (re)construct its own internal representations. In relation to language development, Karmiloff-Smith’s model integrates a constructivist view of children’s grammar with domain-specific internal organization of linguistic knowledge across development. The present study, more specifically, adopts Karmiloff-Smith’s (1986) idea of developmental “phases” as recurrent processes applied by both children and adults when confronting new problems within and across knowledge domains, as distinct from developmental “stages” in the canonic, non-recurrent, domain-general, across-the-board Piagetian sense (Dromi, 1986). Of importance for the present study is the idea that a given phase may occur at more than

one overall stage of development, and in more than one linguistic domain, so recursively characterizing transitions from one level of knowledge to the next.

Berman's analyses of morpho-syntactic and lexical acquisition delineates a developmental progression "from emergence to mastery", as evolving from pre-grammatical non-analysis to productive mastery of linguistic elements in five recurrent phases: (1) rote-learned unanalyzed forms, (2) initial alternation of several familiar forms, (3) transitional strategies in the application of non-normative rules, (4) structure-dependent command of relatively unconstrained normative rules, leading up to (5) appropriate rule application, including mastery of lexical exceptions, and adultlike mastery of conventions of language use manifesting integration between different systems. These phases recur in different linguistic domains – including, for example, acquisition of narrative abilities (Berman, 1995a) – and at different stages of overall development from early childhood to adolescence and beyond (Berman, 2007, 2008). The present study focuses on developmental phases in early child grammar in terms of successive shifts between opacity and transparency of form-meaning mappings, on the one hand, and on recurrent phases in the elaboration of interfaces between morphological and syntactic knowledge, on the other (see Section 1.3.3 below).

In sum, the analysis of early Hebrew grammar presented in this study incorporates insights from the various approaches to language acquisition outlined above, taking into consideration both language-specific abilities and general cognitive and developmental principles. Non-modular considerations take into account Construction Grammar approaches in the concurrent analysis of different levels of language structure and use as well as the integrative implications of the Competition Model along the lines of a "confluence of cues" in language acquisition (Berman, 1993a, 1994; Hirsh-Pasek & Golinkoff, 1996). The work of Bowerman (1994, 1996), Clark (1977, 2001, 2009), and Slobin (1985, 1997) are of direct relevance to the psycholinguistic perspectives adopted in the study, since they refer to acquisitional principles from both language-specific and cognitive-general perspectives, while also relating to the impact of target-language typology. The concept of distributional learning, as articulated by Maratsos and Chalkley (1980) figures in the analysis, by considering children's use of grammatical items in different morpho-syntactic environments at different periods of time. Finally, as noted, the study relies heavily on the developmental proposals of Karmiloff-Smith (1992) and Berman (2004), with

children viewed as being equipped throughout the process of acquisition with capacities that enable them to expand and reorganize their existing knowledge in order to reach new levels of mastery in different linguistic systems.

Underlying this study, then, is the view that children do not proceed directly from either full command or total absence to mastery of a grammatical category. Rather, they evince a gradual progression of knowledge such that, at each step in development, partial generalizations at first applied to subsets of items are subsequently extended to increasingly larger, more abstract, and more inclusive categories, with inter-domain co-dependencies occurring at each developmental phase providing evidence for linguistic interfaces, as a key issue in this investigation.

## **1.2 Domains of Grammatical Analysis**

The study is concerned with the interplay between linguistic elements at different levels of grammatical structure (word, phrase, clause) as manifested in early child speech. Children's linguistic knowledge is examined as reflected by the utterances that they produce in naturalistic contexts, with their overt speech output constituting the prime source of evidence – as detailed in the next chapter.

As a point of departure, the study takes the idea of a “combinatorial principle” governing children's ability to analyze and compose linguistic structures of more than a single element as prerequisite to establishing productive interrelations within and between different linguistic systems. In addressing the issue of compositionality in acquisition, Brown (1973) early on formulated a “law of cumulative complexity” to the effect that if children are able to construct two components into one, it follows that they are also able to construct each of them separately. This means that children's grammatical knowledge can best be evaluated once they are able to attach linguistic elements to one another, whether within words (e.g., English *going*, Hebrew *haláx-ti* ‘went+1st = I went’) or between words (e.g., *go home*, *halax habáyta* ‘(he) went home’) or even clauses (e.g., *go home and lie down*, *halax habáyta ve-nirdam* ‘went home and fell-asleep’).

Acquisition of the three clause-internal, verb-related systems considered here – verb inflection, predicate constituency, and prepositional marking of syntactic relations – has been the subject of rich research from varying theoretical perspectives in a range of languages, including Hebrew. The following sections (1.2.1 to 1.2.3) review relevant studies in each of these three domains.

### 1.2.1 Verb Inflection

The level of “word” constitutes the narrowest domain within which grammatical, morpho-syntactic elements can be combined (Anderson, 1988). Non-simplex words (like verbs in Hebrew) are made up of morphemes that reflect the abstract nature of the categories involved in morphological representations and of the paradigmatic alternations between different forms of a given lexeme (Anderson, 1992; Hockett, 1958). At the core of the present study are grammatical inflections that mark words in relation to other elements in a given context. As such, inflectional morphology differs from derivational processes of word-formation – a topic dealt with from different points of view in linguistics by Aronoff & Fudeman (2005; Bloomfield (1933), and Bolinger (1968) and reviewed for child language by Clark, (1993) and for Hebrew lexical development by Berman (1995b, 2000, 2003). In contrast to derivation, inflection is typically obligatory and largely productive, applying relatively freely, often across the board, to a given lexical category (Bybee, 1985; Aronoff, 1994). The pervasiveness of verb inflection as a factor in simple clause structure in general and in Hebrew in particular is crucial to the present study.

As a widely studied, and often controversial domain in both linguistic and acquisitional research, inflectional morphology has been accorded rather more attention in the study of child language than the other two domains of current concern (predicate constituency and prepositional marking). Acquisition of inflections has served as a source of insight into more general issues, such as whether children learn grammatical categories item-by-item or by generalized rules, and how and to what extent typological, formal, and/or conceptual factors play a role in shaping developmental processes (e.g., Clark & Berman, 2004; MacWhinney, 1978; Slobin, 1985). Researchers approaching the field from different perspectives agree that linguistic systems consist of abstract, formal representations – whether in the shape of rule-governed generalizations (Hyams, 1986; Pinker, 1984) or of cognitive schemas (Bybee, 1995; Tomasello, 2003). Whatever view is taken, acquisition of inflectional systems typically requires children to approach language as a “formal problem space” in mastering often arbitrary or semantically unmotivated rules and conventions (Karmiloff-Smith, 1983; Levy, 1983a, b). In the present context, verb inflection constitutes a pivotal component in the analysis undertaken below, both in delineating



developmental phases (Section 3.1.1), and in analyzing between-domain interfaces (3.2).

Initial occurrences of verb inflection have been characterized as rote-learned or non-productive (see, further, Section 1.3 below) among children acquiring different languages, including French (Bassano, 2000) as well as Hebrew (Berman & Armon-Lotem, 1996; Kaplan, 1983). This is consistent with findings not only for the generally “non-productive” nature of early inflected forms, but also with studies demonstrating an incremental developmental path in acquisition of verbs in other linguistic domains as well, such as verb-argument structure and lexical semantics (e.g., Allen, 2000; Ninio, 1999a, b; Tomasello, 1992). Different proposals have been made to account for the pace and order of acquisition of inflectional systems, all of which note that, at first, forms in a single inflectional category tend to predominate in children’s speech in various languages (Berman, 1981a; Brown, 1973; Bybee, 1978; Dressler & Karpf, 1995; Laaha, Ravid, Korecky-Kroll, Laaha & Dressler, 2006; Ravid & Farah, 1999), an observation that is confirmed for Hebrew by the findings of the present study. Since each inflectional modulation adds both structural and conceptual complexity to the word, it follows that inflections combining several features will be acquired later than representing one-to-one form-meaning correspondences. For example, Italian-speaking children mark the category of person on singular before plural forms of verbs (Pizzuto & Caselli, 1994); Spanish-speaking children’s acquisition of the categories of person, tense, and number follows a piecemeal rather than across-the-board pattern (Gathercole, Sebastián, & Sotro, 2002); while in Hebrew, the masculine plural suffix *-im* is acquired earlier than the suffix *-ot*, which encodes both plural number and feminine gender (Levy, 1983a; Ravid, Dressler, Nir-Sagiv, Korecky-Kröll, Souman, Rehfeldt, Laaha, Bertl, Basbøll, & Gillis, 2008). Relatedly, the principle of “formal simplicity” (Clark, 2009) explains why, for example, English-speaking children acquire the *-iz* suffix on nouns that end in a sibilant later than other markers of plural or 3rd person present tense (Berko, 1958); while semantically, future tense on verbs is acquired later than present and past in English (Brown, 1973, Tomasello, 1992) as well as Hebrew (Berman & Dromi, 1984). There, may, moreover, be an interplay between the factors of morphological form and semantic content, explaining why, for example, Hebrew-acquiring children use two out of the three forms of resultative participles (*CaCúC* as in *katuv* ‘written’ and *meCuCáC* as in *megulax* ‘shaven’) earlier and more accurately than *muCCaC*

(e.g., *munmax* ‘lowered’), which is both structurally and conceptually more complex (Berman, 1994).

A unique source of evidence for the existence or lack of linguistic knowledge in early child language is found in non-adultlike, juvenile forms, often referred to as “errors”, since these indicate usages that are self-initiated rather than merely repetitions or imitations. In this connection, Clark (2009) distinguishes between two types of deviations in children’s initial use of inflectional forms: errors of “omission”, where children omit inflections altogether, as against “commission”, where over-generalization is applied to irregular items, hence indicative of morphological knowledge. The present study will argue that in some cases, omission of inflectional morphology may, in fact, reflect at least a partial level of linguistic knowledge.

In a generative framework, children’s omissions of verb inflections in matrix clauses is attributed to a phenomenon termed Root or Optional Infinitives (e.g., Haegeman, 1995; Wexler, 1993), at a stage where their grammar optionally allows use of ungrammatical non-inflected forms, prior to parameter-setting (Hyams, 1986) or maturation of the relevant grammatical principles (e.g., Borer & Wexler, 1992). Root Infinitive (RI) analyses differ with respect to whether or how inflectional categories such as Tense are specified in children’s syntactic representation, ranging from crediting children with full syntactic representation (e.g., Phillips, 1996; 2010) to the claim that some functional projections are optional (Wexler, 1993, 1998). Others attribute the non-surfacing of Tense to other grammatical features such as missing “+/-Past” (Wexler, 1993), to the absence of a Number category in the “tense-chain” in the target language (Hoekstra & Hyams, 1996; Schaeffer & Ben-Shalom, 2004), to the optional lack of a Tense projection in RIs (Wijnen, 1998), or to truncation of functional nodes of the syntactic tree (Rizzi, 1993/1994; 1994).

In a generative approach that describes the rate and duration of the Optional Infinitive (OI) stage as deriving from distributional features of child directed speech (CDS), the Variational Learning Model of Legate and Yang (2007) attributes cross-linguistic variation in RI to the amount of evidence for +Tense marking in the target language, in the form of a gradual process of parameter-setting based on competing potential grammars. Alternatively, the usage-based constructivist Model of Syntax Acquisition in Children (MOSAIC) (Freudenthal, Pine, & Gobet, 2006; 2010) predicts RI rates at the OI stage as deriving from strings of “compound finites” such as *can I play*, *will Daddy go* and lifted from the right edge of utterances in the input.

Other developmental approaches attribute lack of inflectional marking in early verb usage to the more general stepwise route of acquisition rather than as a specific phenomenon of “non-finiteness” (e.g., Theakston & Lieven, 2008; Wittek & Tomasello, 2002). For example, Brown (1973) took into account morphological structure in acquisition of English only from the emergence of initial verb and noun inflections at what he defines as Stage II. Tomasello’s (2003) perspective on early child grammar analyzes morphological markings not in terms of operations applying to non-inflected or base forms, but as representing connectionist networks of paradigmatically related forms (Bybee, 1995), so that non-finite forms in themselves do not necessarily reflect a special phase in morphological knowledge. Dressler’s morphologically motivated developmental model draws a distinction between the initial phase of Premorphology, when morphology has not yet dissociated from other cognitive, non-language-specific systems, with the subsequent acquisition of morphological knowledge (Dressler & Karpf, 1995; Dressler, Kilani-Schoch, & Klampfer, 2003). Other developmentally motivated analyses in more richly inflected languages than English or German delineate a gradual path in the mastery of verb inflections in terms of the relative productivity of early inflectional categories such as Person and Number (e.g., Gathercole, Sebastián & Soto, 2002 – on Spanish, Pizzuto & Caselli, 1994 – on Italian, Armon-Lotem & Berman, 2003 – on Hebrew) or the temporal and aspectual reference of early verbs (e.g., Weist, Wysocka, Witkowska-Stadnik, Buczowska, & Konieczna, 1984 – on Polish). While in many ways compatible with the developmentally motivated approach of the present study, these latter analyses are not directly concerned with questions of non-finiteness and the role played by non-inflected forms in acquisition. In what follows, non-finiteness is analyzed as an important feature of acquisition of verb grammar in Hebrew, taking into account both the generative notion of optional infinitives together with usage-based insights as applying across different phases of development and as crucial to interfaces between verb inflection and other grammatical domains.

Hebrew inflectional morphology provides a valuable source of insight into the development of grammatical relations since, *inter alia*, several different grammatical categories are obligatorily specified for the three major lexical categories – nouns, verbs, and adjectives (Levy, 1988). As detailed in Table 1 below, Hebrew verbs are marked for five categories of Tense/Mood (Berman, 1978a; Berman & Nir-Sagiv, 2004), with no grammatical marking of Aspect (Berman & Dromi, 1984; Berman &

Neeman, 1994), as follows: Infinitives are marked invariably by an initial prefix; Imperatives are marked for 2nd Person and for Number (singular/plural) and Gender (masculine/feminine); Past and Future Tense verbs are marked for 1st, 2nd, and 3rd Person, for Number and Gender; and Present-Tense *benoni* ‘intermediate’ forms are inflected for Number and Gender alone (Berman, 1978a, 1990). In addition, all, although not only, verbs in Hebrew are formed in one of the *binyan* morphological patterns in the form of a restricted set of prosodic templates (Bat-El, 2002; Berman, 1982; 1993b; Bolozky, 1986; Schwarzwald, 1996; 2002).<sup>3</sup> Table 1 illustrates the inflectional categories of Number, Gender, and Person for verbs formed with the consonants *g-d-l* in three high-frequency *binyan* patterns: P1 *qal* (for a verb meaning Intransitive ‘grow’), P3 *pi’el* (Transitive ‘raise’), P5 *hif’il* (Causative ‘make.bigger, enlarge’).

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<sup>3</sup> Command of alternations between the *binyan* morphological patterns, as a derivational system, is a later acquisition (Clark & Berman, 2004), so the *binyan* system is considered here only in the role it plays in shaping verb stems (in Section 2.3.2).

**Table 1.** Tense/Mood values of verbs based on the consonants *g-d-l* in three *binyan* patterns, inflected for Number, Gender, and Person

Tense/Mood Person, Number, Gender	Past	Present-tense <i>benoni</i>	Future	Imperative	Infinitive
1 <sup>st</sup> Person Singular Masculine /Feminine	1- <i>gadál<sup>ti</sup></i> 3- <i>gidál<sup>ti</sup></i> 5- <i>higdál<sup>ti</sup></i>	1- <i>gadel/a</i> 3- <i>megadel/et</i> 5- <i>magdilla</i>	1- <i>ʔegdal</i> 3- <i>ʔagadel</i> 5- <i>ʔagdil</i>	---	
1 <sup>st</sup> Person Plural Masculine /Feminine	1- <i>gadál<sup>nu</sup></i> 3- <i>gidál<sup>nu</sup></i> 5- <i>higdál<sup>nu</sup></i>	1- <i>gdelim/ot</i> 3- <i>megadlim/ot</i> 5- <i>magdilim/ot</i>	1- <i>nigdal</i> 3- <i>negadel</i> 5- <i>nagdil</i>	---	
2 <sup>nd</sup> Person Singular Masculine	1- <i>gadál<sup>ta</sup></i> 3- <i>gidál<sup>ta</sup></i> 5- <i>higdál<sup>ta</sup></i>	1- <i>gadel</i> 3- <i>megadel</i> 5- <i>magdil</i>	1- <i>tigdal</i> 3- <i>tegadel</i> 5- <i>tagdil</i>	1- <i>tigdall/gdal</i> 3- <i>tegadel/gadel</i> 5- <i>tagdil/hagdel</i>	
2 <sup>nd</sup> Person Singular Feminine	1- <i>gadalt</i> 3- <i>gidalt</i> 5- <i>higdalt</i>	1- <i>gdela</i> 3- <i>megadélet</i> 5- <i>magdila</i>	1- <i>tigdeli</i> 3- <i>tegadli</i> 5- <i>tagdili</i>	1- <i>tigdeli/gidli</i> 3- <i>tegadli/gadli</i> 5- <i>tagdíli/hagdíli</i>	1- <i>ligdol</i> 2- <i>legadel</i> 3- <i>lehagdil</i>
2 <sup>nd</sup> Person Plural Masculine	1- <i>gadál<sup>tem</sup></i> 3- <i>gidál<sup>tem</sup></i> 5- <i>higdál<sup>tem</sup></i>	1- <i>gdelim</i> 3- <i>megadlim</i> 5- <i>magdilim</i>	1- <i>tigdelu</i> 3- <i>tegadlu</i>	1- <i>tigdelu/gidlu</i> 3- <i>tegadlu/gadlu</i>	
2 <sup>nd</sup> Person Plural Feminine	1- <i>gadál<sup>ten</sup></i> 3- <i>gidál<sup>ten</sup></i> 5- <i>higdál<sup>ten</sup></i>	1- <i>gdelot</i> 3- <i>megadlot</i> 5- <i>magdilot</i>	5- <i>tagdilu</i>	5- <i>tagdílu/hagdílu</i>	
3 <sup>rd</sup> Person Singular Masculine	1- <i>gadal</i> 3- <i>gidel</i> 5- <i>higdil</i>	1- <i>gadel</i> 3- <i>megadel</i> 5- <i>magdil</i>	1- <i>yigdal</i> 3- <i>yegadel</i> 5- <i>yagdil</i>	---	
3 <sup>rd</sup> Person Singular Feminine	1- <i>gadla</i> 3- <i>gidla</i> 5- <i>higdíla</i>	1- <i>gdela</i> 3- <i>megadélet</i> 5- <i>magdila</i>	1- <i>tigdal</i> 3- <i>tegadel</i> 5- <i>tagdil</i>	---	
3 <sup>rd</sup> Person Plural Masculine	1- <i>gadlu</i> 3- <i>gidlu</i>	1- <i>gdelim</i> 3- <i>megadlim</i> 5- <i>magdilim</i>	1- <i>yigdelu</i> 3- <i>yegadlu</i>	---	
3 <sup>rd</sup> Person Plural Feminine	5- <i>higdilu</i>	1- <i>gdelot</i> 3- <i>megadlot</i> 5- <i>magdilot</i>	5- <i>yagdilu</i>	---	

Acquisition of inflectional morphology has been the subject of extensive child language research in Hebrew (e.g., Berman, 1981a, 1985; Kaplan, 1983; Levy, 1983a; Ravid, 1995; Ravid & Nir, 2000). Studies concerned specifically with verb inflection

deal with different facets of the domain. Studies on children's initial verb forms (Berman, 1978b; Berman & Armon-Lotem, 1996) and the grammatical knowledge reflected by verb forms occurring in the early phases of acquisition paid special attention to children's pervasive reliance on unaffixed "bare stems" (Armon-Lotem & Berman, 2003; Adam & Bat-El, 2008; Lustigman, 2012). While some of these bare stems are actually used in adult language (e.g., *šev* 'sit', *zuz* 'move', *kum* 'get-up'), not merely in everyday CDS but sometimes representing normative forms of imperatives (Berman, 1985), these are relatively limited in Hebrew children's usage, compared with the large number of their strictly juvenile bare stems, that constitute the bulk of children's verb forms in their early verb usage. Later on, after productive affixation emerges, some inflectional categories have been shown to gain a preferred status along the course of acquisition (Armon-Lotem, 1996; Berman & Dromi, 1984; Dromi, Leonard, Adam, & Zadoneisky-Erich, 1999; Lustigman, 2013; Uziel-Karl, 2001), with account for individual differences among children (Bat-El, 2012a; Ravid, 1997a). The analysis presented below focuses on the developmental path of Hebrew verb inflections from two additional, rather different points of view: the relation of early verb forms to the more general notion of opacity in acquisition (Section 2.3.2) and how these forms interface with other clause-internal domains across different phases of development (Section 3.2).

### 1.2.2 Predicate Constituency

A second domain of concern for this study is how children construct their early clause structure by relating verbs to their associated constituents, with attention directed specifically at Non-Subject-Constituents (henceforth NSCs), including different types of objects as well as adverbs. Subject and predicate are traditionally treated as the two basic constituents from which clauses are constructed, with predicates characterized as composed of either an intransitive verb standing alone or a transitive verb together with its complements (Lyons, 1968). The relatively neutral, if rather awkward, term Non-Subject Constituents (abbreviated by the label NSCs) is used in the present study for analysis of predicate constituency, taken as involving both object-like complements of verbs as well as adverbial adjuncts that modify the entire predication. This separation between Subject and Non-Subject constituents is, in fact, compatible with generative approaches that analyze subjects as VP-external in contrast to verb complements (Bach, 1974; Borer, 1994; Chomsky, 1965).

Characterization of verbs in relation to their associated constituents or argument structure is dealt with in linguistic theory and description from various points of view. One group of approaches considers the issue in terms of “valency”, introduced into linguistics from the field of chemistry by Tesnière (1959) as the number and type of elements with which a given lexical item – typically a verb – can combine. The notion was subsequently adopted in structuralist descriptions (e.g., Crystal, 2003; Matthews, 2007) and extended in typological comparisons (e.g., Haspelmath & Müller-Bardey, 2004; Van Valin & LaPolla, 1997) – generally in relation to the number of arguments governed by a particular verb or by other types of lexical items. The idea of valency is central to research in the framework of Dependency Grammar (e.g., Anderson, 1971; Hudson, 1984; Mel'čuk, 1987; 2003), where all word-forms occurring in an utterance are analyzed as linked to one another by adjacent dependencies, with dependency constituting a core principle in linguistics, one that determines for any given word-form both its linear position and its grammatical identity.

Other approaches to the relations between verbs and their associated non-Subject constituents (NSCs) refer to related and overlapping notions such as transitivity, subcategorization, complementation, and verb-argument structure. The notion of Transitivity is treated in structure-dependent syntactic terms in different types of languages in terms of whether a verb is object-requiring or not (e.g., Anderson & Chung, 1977; Berman, 1982, 1993b; Lyons, 1968) and from a functional point of view as the transfer of an activity from an agent to a patient (Hopper & Thompson, 1980; Slobin, 1985). Generative theories relate to the issue in terms of subcategorization frames (Chomsky, 1965; Everaert, 2010; Fromkin et al., 2000) or complementation (Lester, 1971; Radford, 2004), in relation to constituents that are required or allowed by a given lexical item. The issue of verb-argument relations also figures importantly in current linguistic theories of Construction Grammar (Goldberg, 1995) as well as specification of “theta-grids” in terms of the thematic roles assigned to verb-related phrases (Reinhart, 2000, 2002).

The question of how children acquire verbs in combination with other constituents has been widely researched from several of these perspectives. Relevant studies consider, for example, the proportion of transitive versus intransitive verbs in children’s productions compared to adult speech (Cenko & Budwig, 2006);

preferences for argument realization in children's speech in relation to adult usage (Allen, 2009; Bowerman & Brown, 2008); or the level of productivity in children's use of argument structure and the role of verb-argument relations in the acquisition of constructions (Abbot-Smith, Lieven, & Tomasello, 2004; Fukuda & Choi, 2009; Lieven, Pine, & Baldwin, 1997; Tomasello, 1992). Considerable attention has also been accorded by prior research on acquisition to the question of "pro-drop" or Subject ellipsis (Hyams, 1994; Valian, 1991) including in Hebrew (Berman, 1990; Berman & Neeman, 1994). Less common is work on object ellipsis in different languages (Bavin, 2000), where pragmatic, communicatively motivated factors as well as structure-dependent grammatical constraints need to be taken into account in order to explain what underlies constituent realization and/or ellipsis in child speech, as demonstrated for Hebrew by Uziel-Karl and Berman (2000).

Concern in the present study differs somewhat from such prior research, focusing, rather, on **predicate constituency** in the sense of how Non-Subject Constituents (NSCs) function in children's construction of verb-based, clause-level predications. At issue here are thus questions that relate to domains variously defined in general linguistics as verb valency, transitivity, and/or dependencies, with focus deliberately confined to the syntactic functions of NSCs rather than their thematic roles or semantic content (Bowerman, 1990). As detailed in the next chapter (Section 2.3.1), analysis of predicate constituency in this study is based on two main variables: (1) the status of the verb lexemes occurring in the data-base as dependent or non-dependent, defined as whether or not they require one or more NSCs in order to construct a grammatically well-formed predication; and (2) how these verbs are realized in the children's speech output, with or without associated NSCs at different phases in their grammatical development.

### 1.2.3 Marking of Non-Subject Constituents [NSCs]

A third domain of analysis is marking of Verb-NSC relations, as another key facet of clause-internal grammatical structure. In Hebrew, whose basic simple-clause structure has the surface form N V PP (Berman, 1993a), these relations are virtually always indicated by prepositions, whose use in all and only obligatory contexts requires knowledge of both paradigmatic alternations and syntagmatic constraints in combining clausal elements. The marking of grammatical relations between verbs and their associated NSCs have been analyzed in various ways in linguistics. These



include different types of combinatorial phrase-structure grammars following Chomsky's (1957) original formulation of generative phrase structure rules, such as generalized phrase structure grammars (Gazdar, Klein, Pullum, & Sag, 1985); Fillmore's (1968) "case frames" in terms of the cases selected by a given verb; and typologically motivated analyses of correlations between grammatical features such as location and type of adpositions and clause-internal constituent order (e.g., Haspelmath, Matthew, Dryer & Comrie, 2005).

From whatever perspective, prepositions are key elements in marking the relations between verbs and all non-subject clause constituents in Hebrew. As essentially relational terms (Gentner, 1982), prepositions are typically "little words" (Leow, Campos, & Lardiere, 2009) and yet they also represent complex conceptual and structural categories (Bolinger, 1971; Saint-Dizier, 2006). In a Construction Grammar perspective, they have been characterized as typically ambiguous elements that "occupy a kind of intermediate position", in some cases functioning as purely grammatical, in others expressing conceptual content (Schilperoord & Verhagen, 2006), in line with Berman's (2001) discourse-based proposal for lexical items as ranged on a continuum in which prepositions may be defined as "between-class" elements, rather than as either clearly "open" or "closed" class" items. As such, prepositions share certain properties with adverbs, connectives, and discourse markers, which differ, on the one hand, from canonically open-class items since they lack an autonomous semantic interpretation while, on the other hand, they are distinct from prototypical closed-class items since they are interpretable only in the context of a particular piece of discourse rather than by the structural relations they encode in grammatical constructions (Nir & Berman, 2010). In the present study, prepositions also constitute a kind of "mixed" group of items, since they are taken into account both when functioning to mark grammatical case relations such as accusative and dative and for marking typically semantically motivated adverbial relations of time and place.

In Hebrew, together with Word Order and Subject-Verb agreement, prepositions play an important role in simple clause structure, hence in its acquisition. Word Order – in the sense of the combinatorial principles governing constituent location – provides a weaker cue to clause structure than in, say, English or French, since rich inflectional marking of Subject-Verb agreement combines with overt prepositional marking of Objects to allow for relatively free ordering of constituents

(Berman & Neeman, 1994; Guri-Herling, 1988; Ravid, 1997b). Importantly in the present context, the relation between predicates and their associated NSCs is not morphologically realized but is marked by prepositions, in line with the largely verb-initial typology of Modern Hebrew (Berman, 1980). As in language like English or French, Hebrew prepositions may be basic or simplex, typically monosyllabic (analogously to, say, *in*, *on*, *with*) or else complex, often derived forms (analogously to, say, *instead-of*, *because-of*, *in-order-to* (Hoffman, 2005; McMichael, 2006)). In Hebrew, as in English, the more basic prepositions are both higher frequency in usage in general and acquired early in child language in particular (Berman & Neeman, 1994; Nir & Berman, 2010). However, structurally speaking, all Hebrew prepositions, whatever their origin or composition, are inflectionally bound as prefixes to all and only non-nominative pronouns with which they are associated (Berman, 1982; 1983). Compare, for example, nominative *ani* ‘I’ as against other, suffixed forms of this pronominal category attached to different prepositions: *li* ‘to-me’, *miméni* ‘from-me’, *bišvili* ‘for me’, *lema'ani* ‘for-(the sake of) me’.

Below, Hebrew prepositions are presented in relation to the syntactic functions they serve in marking case and adverb relations in the simple clause. Nominative case Subject NPs are not relevant here, since they are never marked by a preposition (Berman, 1978a), and as such differ clearly from the NSCs which are the focus of concern in the present study.

**Accusative Case Direct Objects** are marked by *et*, which is unique, first, since it alternates with zero in a variety of syntactic contexts (Berman, 1981b) and, second, it has no associated semantic content or adverbial function, occurring only with definite direct objects (Danon, 2001; Reinhart, 1997; Siloni, 1997); compare, for example, *hu maca tapúax* ‘he found (an) apple’, *hu maca et ha-tapúax* ‘he found ACC the-apple’, *hu maca et Dani* ‘he found ACC Dani’, *hu maca oto* ‘he found ACC-him’. Despite these differences between *et* and other prepositions, direct-object marking appears early on and frequently in child speech, at first in an unanalyzed, fused form in combination with the deictic pronoun *et-ze* ‘ACC this~that~it’ (Zonshain, 1975), subsequently before nouns with the definite marker *ha-* (Berman, 1985).

**Oblique “Governed” Objects** are associated with a large class of verbs which represent the traditional notion of Hebrew grammars as *hacraxa* ‘government’ in the sense that they obligatorily “govern” an associated prepositional marker linking a verb to its object (e.g., *hu ba'at ba-kadur* ‘he kicked at-the-ball’, *hu 'azar le-ima* ‘he

helped to-Mommy’, *hu histakel al ha-tmuna* ‘he looked at the-picture’). The term “oblique” is thus used here in the sense of Berman (1981b), rather than in the adverbial sense of Keenan & Comrie (1977), since these prepositional markers are similar to *et* in being semantically drained of meaning (compare *huazar le-ima* with its English equivalent ‘he helped Mommy’) and relative arbitrariness in which verbs do or do not require accusative or oblique object status (compare, for example, *hu hirbic la-sus* ~ *hu hika et ha-sus*, both meaning ‘he hit the horse’, which differ in register of usage but not in meaning). On the other hand, these verb-dependent prepositions differ radically from the accusative marking *et*, since they are obligatory in all contexts, preceding both definite and indefinite objects, and not subject to ellipsis in a variety of syntactic processes such as nominalizations, information questions, relative clauses, and passive voice (Berman, 1978a).

**Dative Objects** are marked by the preposition *le-* ‘to’ which also serves in the sense of English ‘for’, and which, like oblique object prepositions, is not subject to ellipsis irrespective of whether the Direct Object or Dative Object occurs first (e.g., *ima natna le-Rina et ha-séfer* ‘Mommy gave to-Rina ACC the-book’ ~ *ima natna et ha-séfer le-Rina* ‘Mommy gave ACC the-book to-Rina’) (Berman, 1982). In early child speech, the dative marker occurs with high frequency, typically in pronominal contexts, and without specification of a Direct Object (e.g., *tmi li* ‘give to-me = gimmi’, *la’azor lax* ‘to-help to-you = help you’), subsequently also with lexical nouns (e.g., *hu asa et ha-ciyur le-aba* ‘he drew ACC the drawing to-Daddy = for daddy’).

**Adverbial Constituents** in Hebrew, as in languages like English, French, or Spanish, often take the form of Prepositional Phrases that express a variety of semantic relations, including Locative (e.g., *hu yašav al ha-kise* ‘he sat on the-chair’), Temporal (e.g., *hu yishan ad maxar* ‘he will.sleep until tomorrow’), Instrumental (*hu mecayer im iparon* ‘he draws with (a) pencil’), or Manner (*hu rac bi-mehirut* ‘he ran with-quickness = quickly’), etc. (Nir & Berman, 2010; Ravid & Shlesinger, 1999; Schlesinger, 1979).

**Non-marked NSCs** occur without prepositional marking in several contexts, as follows. (1) **Indefinite Direct Objects** (e.g., *hu ra`a cipor* ‘he saw (a) bird’); (2) simplex, typically monolexemic **Adverbs** (e.g., *hu kofec axšav* ‘he is-jumping now’; *hu kofec po* ‘he is-jumping here’); (3) **Information questions** on Direct Object or Adverbial elements (e.g., *ma hu ose?* ‘what (is) he doing?’, *éyfo hem garim?* ‘where

(do) they live?'); and (4) **Complement clauses** (e.g., *amárti še-ani avo* 'I said that I will.come', *tiri ma asíti* 'look what (I) have-done').

Research on the acquisition of prepositions has been concerned mainly with the strategies children adopt in marking relevant relations between verbs and their associated constituents (e.g., Bowerman, 1990; Veneziano, 1999). Four such usages noted in the literature are: (1) omissions of required prepositions (e.g., *nafal mita* 'fell bed') (Clark, 2009); (2) partial marking by use of "filler syllables" in preposition slots (e.g., *nafal a-mita* 'fell FILL-bed') (Peters & Menn, 1993; Veneziano & Sinclair, 2000); and (3) rote-learned forms (e.g., *tni-li mita* 'give-to-me (a) bed') (Berman, 1985); and over-use of "general purpose" prepositions, in Hebrew typically *be-* 'in, at' or *le-* 'to, for' (e.g., *nafal ba-mita* 'fell in-the-bed' instead of *nafal me-ha-mita* 'fell from=off the bed') – where "basic" prepositions (Nir & Berman, 2010) serve as a platform for entry to a more complex system, analogously to children's early reliance on "path-breaking" or "light verbs" (Clark, 1973; 1993; Ninio, 1999b; Hollebrandse & van Hout, 1998). These different types of non-marking of NSCs play a critical role in the analyses proposed below.

Relatively little research is available on prepositional (non-)marking of constituent relations in acquisition of Hebrew. Once children master the definite marker *ha-*, they use the accusative marker *et* in all required contexts (Zur, 1983), and make few errors in choice of prepositions governing oblique objects, which Berman (1985) attributes to the fact that children acquire these governed prepositions as a semantically unmotivated part of the lexical entry of the verb. Dromi (1979) found a clear developmental order in acquisition of locative prepositions by 2- to 3-year-old Hebrew-acquiring children – corresponding to English stative 'in~at', followed by directional 'to', 'on', and ablative 'from', which she attributes to factors of semantic complexity, similar to what occurs in other preposition-marking languages. The Hebrew-specific structural knowledge of the form taken by non-nominative prepositions when fused with pronoun suffixes is noted by Berman's (1985) observation regarding children's common, relatively early and typically unanalyzed use of the preposition *le-* 'to' as in *li* 'to-me', *lax* 'to-you:FEM). Rom and Dgani's (1985) structured elicitation of fused preposition+pronoun constructions among children aged 2 to 5 years revealed a complex interaction between structural simplicity and one-to-one mapping of semantic relations, with the possessive Noun-Noun marker *šel* attaining higher scores than the two verb-marking prepositions

Accusative *et* and Locative *al* ‘on’, a finding they explain as due to a combination of morpho-phonological opacity and irregularity of the system together with factors of conceptual complexity.

In contrast to prior Hebrew-based studies, the present analysis focuses on the strategies adopted by young Hebrew-speaking children in the path from opaque or partial to appropriate and explicit use of prepositions in the marking of relations between verbs and their associated NSCs.

### 1.3 Psycholinguistic Principles

The linguistic domains specified in the preceding section – verb inflections, predicate constituency, and NSC (non-)marking – are considered below in relation to two psycholinguistic principles impinging on children’s grammatical development: transparency of structure (Section 1.3.1) and productivity of use (1.3.2).

#### 1.3.1 Structural Opacity/Transparency

Underlying this study is the developmental issue of the transition from **opacity** to **transparency** as a general structural property of child language. As such, the notion “transparency” as used here differs from the sense in which the term is referred to from various perspectives in (psycho)linguistic research. For example, phonological opacity (Chomsky & Halle, 1968; Kiparsky, 1973; 2000; McCarthy, 1999) refers to phonological generalizations (or rules) that are not apparent on the surface due to applications of subsequent rules; Semantic or contextual opacity (Jackendoff, 1983; Keenan & Ebert, 1973) refers to instances of sentences that have several possible readings, due to ambiguous use of pronominalizations or quantifications, or lack of attention to shared knowledge by speakers; lexical or word-formation transparency (Dressler, 1985; Plaut & Gonnerman, 2000; Marslen-Wilson, Tyler, Waksler & Older, 1994; Slobin, 1980) refers mainly to the combinatorial clarity and predictability of derivational or inflectional processes as it is reflected in morphologically-related items, including transparent form-meaning mappings in the ambient language, referring to compositional clarity of morphologically complex words as affecting the order of lexical acquisition (Clark, 2009). Here, “opacity” refers to children’s early production of linguistic strings that are ambiguous since their grammatical targets are not fully specified (Lustigman, 2012; 2013), whereas “transparent” forms are structurally unambiguous and hence fully interpretable, even out of context. Opacity

in this sense arises in the following cases: (1) omission of required markings of relations between linguistic constituents (such as affixes, prepositions, or conjunctions), (2) use of inappropriate juvenile forms (such as truncated verb stems or filler syllables), or (3) rote-learned forms. The criteria applied in the present study for defining linguistic constructions as either transparent or opaque are detailed in the next chapter (Section 2.3.2).

The phenomenon designated here as “opacity” in children’s early grammatical forms is implicit in prior research on the domains at issue here. For example, in their study of acquisition of verb inflections in Italian, a highly inflected language, Pizzuto and Caselli (1994) refer to the extensive use of “unclassifiable verbs” as indicative of the instability or what they term the “degree of uncertainty” of children’s knowledge at given points in development. Relatedly, Veneziano (1999) refers to children’s use of “ambiguous” verb forms in French, a language whose verb system is characterized by pervasive homophony. Studies on acquisition of prepositional marking of verb constituent relations, describe relevant output forms in terms of filler-syllables (Veneziano & Sinclair, 2000) or as over-extended “general purpose” lexical items (Bowerman, 1982; Clark, 1987; Pinker, Lebeaux, & Frost, 1987). Such instances, defined for present purposes as representing “opaque” usages in children’s early speech, reflect a state of knowledge in which grammatical categories are not yet fully established and so are not adequately realized in all and only relevant linguistic contexts.

Two major factors impinge on the shift from opacity to transparency: target language typology and developmental trends. With respect to the first, cross-linguistic research reveals children’s speech output as increasingly reflecting the typological particularities of the ambient language in different grammatical domains (Bowerman & Choi, 2003; Slobin, 2004; and for Hebrew, Berman, 1986b; Ravid, 1995). The present analysis aims to show that this sensitivity to the ambient language is also reflected in children’s construction of structurally opaque forms. As for general developmental underpinnings, as further detailed below (Section 1.3.3), the shift from opacity to transparency is motivated by phase-based models of language development (Berman, 1986a; 2004; Karmiloff-Smith, 1986, 1992), characterized, *inter alia*, in terms of the relative proportion of opaque marking of grammatical distinctions compared with more explicit and hence more maturely transparent marking in a given

linguistic domain. And transitions from one developmental phase to the next are defined in terms of the notion of productivity of usage, as discussed below.

### 1.3.2 Usage Productivity

The progression from the earliest phase of pervasive opacity to initial marking of clause-internal relations is identified for present purposes by what is specified below as **productive** use of verb inflections. The term “productivity” has different senses, depending on particular domains and perspectives of linguistic research. In general linguistics, a “productive operation” is one that applies with relatively few constraints to a large number of items, so that productivity represents a structural property of both forms (e.g., affixes) and operations (e.g., affixation) (Aronoff & Schvaneveldt, 1978; Baayen, 1992). From this perspective, inflection is more productive than derivational morphology, since it applies with fewer constraints to a larger number of items (Anderson, 1988; Schwarzwald, 1982), while within inflectional systems, some affixes may be more productive than others – for example, English plural marking by *-s* compared with *-en* (Clark, 1993) or, in Hebrew, the feminine suffix stressed *a* compared with unstressed *-et* (Bat-El, 2009; Schwarzwald, 1982). In such studies, productivity is typically viewed as interacting with a range of structural as well as usage-based factors including lexical compositionality, semantic transparency, and frequency of use.

In child language research, the notion of productivity is used in yet another range of senses. In Clark’s work on acquisition of derivational morphology as a means for new-word formation, for example, productivity of a given process in speaker usage combines with other acquisitional principles such as formal simplicity and semantic transparency to determine which forms are acquired earlier than others (Clark, 1993; Clark & Berman, 1984). Ingram (1989) considers productivity from a rather different perspective, as defining one of two assumptions made by child language researchers in seeking evidence for linguistic knowledge from children’s speech output. According to the “Competence Assumption”, children’s linguistic performance is relatively close to their linguistic competence, such that only when there is evidence for a given linguistic construction in children’s speech output, can such construction be interpreted to constitute part of their competence. According to the “Productivity Assumption”, on the other hand, a given utterance can be interpreted as rule-based only when there is evidence that the rule is productive, meaning that

there is a problem in attributing linguistic knowledge to children simply because they make use of certain forms.

A notion of productivity closer to the one adopted for present purposes defines productivity in acquisition of grammar by children's ability to apply structural operations to a set of items in a meaningful and consistent fashion (Berman, 1978b; Bowerman, 1990; Ingram, 1989; Lieven, Behrens, Speares, & Tomasello, 2003; Tomasello, Akhtar, Dodson, & Rekau, 1997). That is, productivity does not characterize either forms or operations *per se*, but rather children's **use** of linguistic forms, as reflecting their linguistic competence. From this perspective, productivity is a key psycholinguistic principle driving acquisition, since only once a grammatical category is used productively can it be said to have been acquired.

On the other hand, as observed, for example, by Ingram, identification of productive usages is challenged by the phenomenon of "rote-learning". Thus, while, as noted earlier, grammatically marked elements (e.g., inflected verbs, prepositionally marked phrases) may surface early on in child language, these may often constitute "rote-learned" strings rather than representing productive knowledge. Such occurrences have been widely noted in the literature, particularly with respect to acquisition of grammatical inflections in different languages (e.g., MacWhinney, 1975 – Hungarian; Bowerman, 1985 – English; Bassano, 2000 – French; Kilani-Schoch & Dressler, 2002 – German; Gathercole, Sebastián, & Soto, 1999 – Spanish; Vihman & Vija, 2006 – Estonian; and also, on Hebrew, Armon-Lotem & Berman, 2003; Uziel-Karl, 2001).

However, since inflection is obligatory, so that speakers (including children) have no choice but to make use of inflections in their speech (Berko, 1958), specifying what is productive is of critical importance in this domain. In order to counteract the difficulties in evaluating what is or is not "productive" in early child speech, researchers have specified a range of criteria to characterize productive use of inflectional morphology, including in quantitative terms, by counting occurrences of a given affix with different stems, or of different affixes with a given stem (Bloom, 1991; Gathercole, Sebastián & Soto, 1999; Pizzuto & Caselli, 1994). Such criteria have been considerably refined in current research paradigms on the basis of sophisticated statistical algorithms (Lieven, 2008; Tomasello & Stahl, 2004).

On the other hand, as pointed out early on by Brown (1973), and more recently by Rowland, Fletcher and Freudenthal (2008), quantitative accounts depend



critically on the nature of data-collection and sample size, and so may vary from one linguistic category to another, even from one child to the next. They may also fail to take into account that non-productive expressions common in children's speech output at a given period of time tend to be associated with particular extra-linguistic situations while, on the other hand, forms which are in fact productively constructed may be relatively infrequent when they first begin to occur. Quantitative criteria thus run the risk of either over- or under-estimating children's productive command of a given linguistic category (See, for example, Richards' 1990 discussion of this issue regarding acquisition of auxiliaries in English). Besides, counting occurrences alone may also overlook erroneous or juvenile usages that are self- rather than adult-imitated, leading Clark (2009), as noted, to distinguish between children's initial errors identified as cases of total omission versus over-generalizations of irregular items. Recent studies on the acquisition of tense and agreement have addressed these problems, by filtering out repeated uses of frequent and therefore potentially rote-learned combinations, in scoring children's use of inflectional morphemes for productivity (Hadley & Holt, 2006; Rispoli, Hadley, & Holtl, 2009, 2012).

The present study, instead, follows Brown (1973) by not measuring productivity quantitatively, but rather by how linguistic forms are used **in context**, with productivity defined as the ability to use (paradigmatically interchangeable) linguistic elements in their appropriate (syntagmatically combinatory) contexts. For Brown, grammatical context constituted a test that a child could either "pass" (by supplying the required grammatical morpheme) or "fail" (by supplying an incorrect morpheme or not supplying any morpheme in an "obligatory context"). Subject-Verb agreement in verb usage is highly appropriate as a context of this kind in Hebrew, a language in which verbs agree with their Subject nouns for Number (Singular/Plural), Gender (Masculine/Feminine) and, in Past and Future tense, Person (1st, 2nd, 3rd) (Berman, 1978a, 1990). Compare, for example, in (1):

- (1) a. *ha-xaruz mitgalgel* 'the bead rolls'  
 b. *ha-kubiya mitgalgelet* 'the block:FEMrolls:FEM'  
 c. *ha-xaruzim mitgalgelim* 'the beads roll:PLUR'  
 d. *ha-kubiyot mitgalgelot* 'the blocks: :FEM roll:PLUR:FEM'

In the two following chapters, children's early verb inflections are examined in the "obligatory context" of Subject-Verb agreement (whether in the immediate or

more distant linguistic environment), to argue for a general developmental progression from unspecified via partially to fully specified morphological structure.

### 1.3.3 Developmental Phases

The two factors of structural transparency (Section 1.3.1) and usage productivity (1.3.2) constitute the basis for delineating developmental phases in children's early verb usage in Hebrew. Reference here is to developmental phases rather than stages, where a developmental stage is defined in domain-general, across-the-board terms as exhibiting the features of: novelty, qualitative change, and distinct boundaries (Dromi, 1986) or as a stretch of time characterized by novel internal re-organization of given knowledge domains, not merely improved performance or addition of new information (Karmiloff-Smith, 1986). In the canonic Piagetian sense (Levin, 1986), the transition from one stage to the other is irreversible in the sense that once children reach a certain stage, they will normally not revert to previous, less advanced stages. Karmiloff-Smith (1986), in contrast, proposes to characterize the re-organization of knowledge— in language as in other domains – in terms of developmental “phases” as recurrent processes applied by both children and adults when confronting new problems within and across parts of different domains. That is, certain phases can occur at more than one general developmental stage, typically recursively characterizing the transition from one stage to the next. As noted earlier, this is consistent with Berman's (1986a, 2004) description of a developmental progression from pre-grammatical non-analysis to productivity in terms of five recurrent phases: (1) rote-learned unanalyzed forms, (2) initial alternation of several familiar forms, (3) application of normative rules, (4) application of normative rules with some deviations, and (5) appropriate rule application, including mastery of lexical exceptions. Although her analyses, unlike those of Karmiloff-Smith (1992) are confined to language, Berman, too, argues that phases typically recur in different domains (grammatical inflection, lexical derivation, syntactic structures, and even narrative text-construction) at different periods of development.

In considering qualitative changes and irreversibility in children's growing knowledge across time, the transition from opacity to transparency might be characterized in terms of developmental stages, as each period represents an overall more advanced level of knowledge in terms of grammatical marking (inflections and prepositions) and combinations of verbs plus NSCs. Yet a phase-based approach is

preferred for present purposes as allowing for more fine-grained observation of the sub-periods of grammatical development while also making it possible to capture not necessarily simultaneous recurrence of developmental transitions in distinct linguistic domains. Importantly in this respect, the transition from opacity to transparency is assumed to be a general and pervasive feature of development, which applies at different periods in development to various domains. This has been shown, for Hebrew, for example, in the phase-based acquisition of *binyan* derivational verb-pattern morphology (Berman, 1982) and marking of inter-clausal relations (Berman & Lustigman, in press; Dromi & Berman, 1986) – and will be further demonstrated below for use of prepositions as markers of verb-constituent relations.

Against this background, the present study identifies three developmental phases in the transition from pervasive opacity to full transparency in marking of different facets of early Hebrew clause-structure. As detailed below (Section 3.1), these proceed from an initial phase in which there is no evidence for productive marking to an intermediate phase of initial, partial productivity, and on to a third phase of increased productivity, characterized by greater variety in grammatical alternations and ending with fully transparent application of morphological markings.

#### **1.4 Linguistic Interfaces in Acquisition**

The latter two phases, when children’s grammatical usages are at least partially productive, provide the basis for examining linguistic interfaces, with the goal of demonstrating how acquisition of structural marking in one domain (verb inflection) interacts with acquisition in two other domains of simple clause structure (predicate constituency and prepositional marking).

The notion of “interface” in linguistic analysis has been used with different connotations as the meeting ground between syntax or grammar and other sensory-motor, conceptual, discursive, or pragmatic domains (Jackendoff, 2002; Reinhart, 2006), on the one hand, or between linguistic systems conceived in formal generative linguistics as independent modules, to include interfaces of syntax-phonology (e.g., Inkelas & Zec, 1990; Pullum & Zwicky, 1988), phonology-morphology (e.g., McCarthy & Prince, 1995), and morphology-syntax (e.g., Ackema & Neeleman, 2007; Embik & Noyer, 2007; Lasnik & Uriagereka, 1988). In a recent integration of such views, Rothman and Guijarro-Fuentes (2012) use the term “interface” to refer to “a particular shared understanding [...] of how mental computation, processing, and

performance of language work within a specific conceptualization of the mental architecture” (2012, p. 4), to account for both the interface between linguistic “sub-components” and between linguistic and other cognitive domains. Their definition supports the crucial distinction between interfaces that are internal to linguistic systems as against those that operate between grammar and domains external to it, like discourse and cognition (Sorace, 2011; Sorace & Serratrice, 2009; Tsimpli & Sorace, 2006, White, 2009). The present study concerns grammar-internal interfaces, as **interdependent** meeting-grounds where different grammatical systems impinge on one another, each contributing structurally relevant linguistic information to the other.

Motivating this decision is the view that interfaces constitute an integral facet of linguistic structure, with grammatically specified notions patterning in categories that in turn pattern in integrated systems (Croft, 2003; Talmy, 1978). This means that children need to attend concurrently both to elements as members of a given category paradigmatically as well as how these co-occur syntagmatically (Bates & MacWhinney, 1989; Maratsos & Chalkley, 1980; Maratsos, 1982, 1988). For example, in Hebrew, information about the noun-phrase subject of the clause is inseparable from information about agreement marking on the predicate, while the derivational morphological pattern assigned to a given verb relates to whether it occurs in the context of a clause that is syntactically transitive or intransitive. Studies on child language acquisition in various domains and different languages indicate that different linguistic domains tend to develop in tandem (Allen, 2007; Bassano, 2000; Berman, 1982; 1993a; Gathercole, 2008; Veneziano & Sinclair, 2000; Weist, Pawlak, & Carapella, 2004). Such research points to the importance of examining the interaction between different levels and types of linguistic knowledge as a source of insight into fundamental questions in language acquisition.

To this end, the present study investigates the role of interfaces in acquisition of Hebrew grammar in terms of the relationship between verb inflectional morphology and predicate constituency, on the one hand, and prepositional marking, on the other, as three separate but interconnected linguistic systems in the shared domain of simple clause structure. Specifically, it re-analyzes the idea of linguistic interfaces by demonstrating that different lexico-grammatical systems are interdependent in the sense that they manifest **convergent** patterns of acquisition (as detailed in Section 3.2).

### 1.5 Goals of Study

The goal of the study is twofold – to shed light on the development of linguistic knowledge by (1) analyzing the principles of structural transparency and usage productivity as reflected in developmental phases in the acquisition of Hebrew, and (2) examining interfaces between grammatical domains as evidence for the organization of children’s knowledge during the transitional phases between pervasive opacity and full transparency. To this end, interrelations will be examined between children’s inflectional verb forms and two other clause-internal grammatical systems: predicate constituency and NSC prepositional marking. By going beyond one restricted subsystem or domain, the study aims to provide a more comprehensive overview of early Hebrew grammar than available to date while also shedding light on general psycholinguistic issues in language acquisition and development.

The study plans to achieve these broad goals by the following means:

- providing a detailed **description** of the grammatical structures characterizing the speech output of three Hebrew-speaking children from the onset of their verb production to consolidation of simple clause structure
- combining quantitative and qualitative **analyses** of different knowledge domains both at given points in time and across stretches of time
- re-assessing the role of linguistic context in identifying **productive usage**
- delineating **developmental phases** in transition from one level of knowledge to another as a recurrent progression from opacity to transparency
- explaining the development and consolidation of grammatical structures on the basis of explicit **psycholinguistic principles** such as transparency, productivity, and between-domain convergences
- specifying **individual strategies** across the three children whose speech output is analyzed
- comparing **language-particular** facets of Hebrew child grammar compared with acquisition of relevant linguistic domains in other languages in order to identify Hebrew-specific typological challenges and to evaluate the reliability of the psycholinguistic principles underlying the analysis
- re-examining children’s linguistic structures with grammatical categories as defined in linguistic theory in order to **re-evaluate** claims with regard to such issues as Root Infinitives, the status of morphology, and the autonomy of syntax

The following patterns of findings are expected to emerge from analyses aimed at meeting these goals:

- Based on characterizations of children’s pervasive reliance on unaffixed bare stems in earlier studies on acquisition of Hebrew verbs noted above in the introduction (Armon-Lotem & Berman, 2003; Adam & Bat-El, 2008; Lustigman, 2012) (p. 27), combined with research in other languages on children’s initial favoring of unmarked forms in acquisition of prepositions (p. 24), children’s **initial use** of grammatical marking in all three domains is predicted to be uniformly either rote-learned or omitted altogether. In verb inflection, children will start out with unaffixed bare stems; predicate constituency will first take the shape of verbs in isolation; and initial occurrences of non-Subject constituents will be unmarked by prepositions.
- **Development** in each domain is expected to be protracted and piecemeal, evidenced by the gradual progress along a path from **opacity to transparency** in marking of grammatical relations
- Distinct **developmental phases** may be identified in the acquisition of grammatical knowledge.
- **Productivity** in grammatical marking is expected to apply differentially to subclasses of items rather than across the board for an entire grammatical domain (for example, various categories of verb inflections emerge at different periods in development).
- Due to possible cognitive overload in simultaneous processing of different grammatical systems, between-domain **interfaces** in grammatical marking are expected to manifest “trade-off” relations, such that transparent marking in one area (e.g., verb inflection) will co-occur with opaque usages in another area (e.g., prepositional marking of NSCs).
- While developmental phases will be shared across children, **individual preferences** will be manifested mainly in the transitional strategies they adopt in shifting between levels of grammatical knowledge.

## CHAPTER II – THE STUDY

This chapter describes and motivates the design of the study, starting with discussion of the longitudinal case-study methodology adopted for this investigation. The chapter then provides details of: the children participating in the study (Section 2.1), followed by description of the data-base of the study (2.2), and specification of the linguistic categories applied for analyzing the data (2.3).

Data were elicited by longitudinal sampling of three Hebrew-acquiring toddlers, in the form of a “triple case-study” – following the path of major researchers from the early days of developmental psycholinguistics (most particularly, Brown, 1973; and also Bloom 1970; Braine, 1963; Miller & Ervin, 1964). More recent investigations using a case-study methodology concern language acquisition of individual children in various domains and in different languages (e.g., Fletcher, 1985, Smith, 2010, and Tomasello, 1992 – for English; Abbot-Smith & Behrens, 2006 – for German; Veneziano & Sinclair, 2000 – for French). In Hebrew, case-studies have been conducted on the early lexicon by Dromi (1987, 1999) and on phonological development by Faingold (1996), with unpublished doctoral dissertations involving three or more children dealing with different aspects of early grammatical development by Armon-Lotem (1996) and Uziel-Karl (2001) and of children’s early verb-usage by Keren-Portnoy (2002).

The advantages of longitudinal sampling of a small number of children over large-scale cross-sectional (typically experimental) studies are noted in Ingram’s (1989) survey of the history of child language studies as making it possible to obtain “a more representative sample of the child’s general language ability” (1989: 22). Evidence for the claim that case-studies are indeed representative of children’s linguistic knowledge is provided from a rather different perspective in the recent study of two Hebrew-acquiring children by Ashkenazi, Gillis, Gillis, Nir, and Ravid (2012) demonstrating close correlations between morphological patterns in child directed speech (CDS) and children’s speech output. A detailed motivation of the value of a case-study approach to child language is provided by Dromi (1986, 1987), who argues that this methodology allows the researcher to delineate continuous acquisitional processes as they take place across time, so making it possible to more precisely demarcate different stages in development of the linguistic domain targeted for study. Another advantage of case-study procedures is that such recordings

represent naturalistic speech output, typically conducted in familiar communicative settings in terms of both linguistic and non-linguistic contexts.

The most important consideration in deciding to adopt longitudinal sampling for the present study was to enable in-depth, fine-grained investigation of **developmental processes** in progress, in order to trace how linguistic knowledge emerges, matures, and consolidates across time.

## 2.1 Participants

Analysis covered the speech output of three Hebrew-acquiring children (two girls, Lior and Rotem, and a boy, Shachar) at a mean age-range of from 1;4 to 2;5. All three children are from well-educated, middle-class families resident in central Israel. Shachar has a sister two years older than him; Lior is the older of two children, with (at the time) an infant brother; and Rotem was an only child at the time of recording. That is, while demographic variables of home-background were deliberately kept constant, the three children represent a mixed group in terms of siblings and family position. In order to provide independent evidence for whether all three children can be described as “typically-developing”, the MPU (Morphemes per Utterance) measure (Dromi & Berman, 1982) was applied to a sample recording for each child. As shown in Table 2, two of the children (Lior and Shachar) reached a mean MPU by age 2;0, and the third child (Rotem), by age 2;2.

**Table 2.** Age of MPU measure of 2 for the three children

Child	# utterances	MPU	
		mean	median
Shachar (2;0)	54	$125/54 = 2.3$	2
Rotem (2;2)	46	$106/46 = 2.3$	2
Lior (2;0)	44	$89/44 = 2.02$	2

The figures in Table 2 show that the MPU as a Hebrew-specific measure of grammatical development reveals the three children selected for this study to fall within the range of what Dromi and Berman documented for nearly 40 other typically developing toddlers acquiring Hebrew.

Samples of the speech output of one of the two girls participating in the present study (Lior) also served for analysis in two other doctoral dissertations concerned with different facets of early Hebrew acquisition: parameter-setting in a



Minimalist framework (Armon-Lotem, 2006) and Verb-Argument Structure (Uziel-Karl, 2006) – a data-base that has since been digitalized. Data from the speech output of the other two children in the present study, Rotem and Shachar, have also served in various studies concerned with phonological development (Bat-El, 2012b).

## 2.2 Data-Base

All children were audio-recorded for one hour per week in their home environment, in natural everyday interaction with their caregivers. All investigators were family members (her mother in the case of Lior, and paternal aunts in the case of Rotem and Shachar – the latter recorded and transcribed by the author of this study). The data-base is richly contextualized in the sense of Brown (1973), since those doing the recording were instructed to provide maximally unambiguous interpretations of the children’s speech by deliberate repetitions and expansions in cases where the child’s utterances were unclear – phonetically, semantically, or contextually. All child and adult utterances were transcribed in broad phonemic transcription following the CHILDES conventions (MacWhinney, 2005), as adapted in the Berman lab to conform optimally to the non-Latinate orthography and contemporary pronunciation of Israeli Hebrew. The speech output of Shachar and Rotem was also phonetically transcribed and, where possible, a corresponding phonetic target form entered for their usages, while Lior’s speech output was checked where necessary by reference to the digitalized data-base constructed of her auditory recordings.<sup>4</sup>

Data-analysis began with the earliest occurrences of forms identifiable as verbs in each child’s speech, and continued up until the point where verb inflections no longer exhibited “structural opacity” in the sense specified below (Section 2.3.2). Adult input was taken into account as providing linguistic and pragmatic contextualization for children’s speech, for example, in order to identify instances of unanalyzed and/or non-autonomous utterances, including: direct repetitions, non-clausal completions of adult utterances, rote-learned forms, and formulaic routines – all of which were specified as such. Analysis in the present study is deliberately

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<sup>4</sup>The data for Shachar and Rotem were collected in the Child Language Project of Bat-El and Adam, Tel Aviv University, ISF Research Grant #554/04; those for Lior are taken from the Child Language Data-Base of the Berman lab at Tel Aviv University, a subset of which is available in the Berman corpus on CHILDES (<http://childes.psy.cmu.edu/data/Other/Hebre>). Thanks are due to Brian MacWhinney and Aviad Albert for digitalization of Lior’s data.

confined to child utterances, with adult construals in children's language learning (as shown for different domains by, for example, Clark & de Marneffe, 2012; Ravid et al, 2008; Diessel, 2004) considered here primarily for interpretation of children's speech output. In order to investigate the role of linguistic interfaces in children's construction of their grammar, focus here is thus on the concurrent usage of different grammatical constituents (for example, inflections and prepositions) that occur within the boundaries of a single string of autonomous child speech.

All and only children's utterances that contained a lexical verb were analyzed – from single-word utterances to clauses with several additional syntactic constituents. Excluded from consideration were copular clauses which in Hebrew are typically verbless in present tense – e.g., *híne buba* 'here (is a) doll', *ze xam* 'it (is) hot', *éfo ába* 'where (is) Daddy?' (Berman, 1985; Dromi & Berman, 1986) – as well as the associated categories of existential and possessive clauses (Berman, 1978a; Clark, 1978). While very common in early child speech, these were not regarded as relevant to the specific types of interfaces between grammatical systems analyzed in the present study. All verb-containing utterances in the children's speech output were coded for verb inflection and also, where relevant, for word order, constituent structure, and prepositional marking. In addition, immediately preceding and following adult input was specified for each coded child utterance where necessary for interpreting what the child meant or whether the output string was autonomous or not. A separate set of analyses was assigned to child output clauses in which a verb occurred with (and in Hebrew, was most typically followed by) non-subject constituents (henceforth, NSCs), including direct and prepositional objects and various kinds of adverbials. In such cases, rather than relating to children's "utterances" as behavioral units defined by intonational contours, the basic unit of analysis was specified as the **clause**, defined as a "unified predicate" following Berman and Slobin (1994, pp. 660-662). Table 3 specifies the details of the data-base for each of the three children in terms of these criteria.

**Table 3.** Data-base of the study, by age, number of sessions, number of utterances, and total number of verbs, for each child

Child	Age-range	No. of Analyzed Recordings	Total Utterances Recorded	No. of Child Utterances	Total No. of Verbs
Shachar	1;4.17 – 2;3.24	49	26,468	13,069	1,938
Rotem	1;3.20 – 2;5.29	50	34,798	14,480	2,325
Lior	1;5.19 – 2;4.08	123	40,568*	17,209	1,983

\* The transcripts of the recordings of Shachar and Rotem's include only adult utterances that either preceded or directly interacted with the children's output while those of Lior include all utterances of everyone present during recording sessions – both parents, grandparents, etc.

The figures in Table 3 reflect the relative **density** of the data-base, as follows. Shachar and Rotem were recorded for one hour at a single weekly session, following the traditions of child language sampling since the 1970's noted earlier. Recordings of the third child, Lior, represent a relatively dense data-set, of between three to five sessions, coming to an accumulative one hour per week. The data-base for the present study thus diverges from the currently accepted procedures of "dense" recording of over one hour per week – generally for only one or two children, in some cases for a relatively limited period of time (e.g., for English by Lieven, Behrens, Speares & Tomasell, 2003; Maslen, Theakston, Lieven, & Tomasello, 2004; and by Roy et al, 2006; for German – Behrens, 2006; and recently for Hebrew by Ashkenazi, et al, 2012). On the other hand, the idea that frequency of sampling needs to take into account the particular domain at issue (Tomasello & Stahl, 2004) suggests that dense recordings may be crucial mainly for examining sporadic or short-lived phenomena, to identify the precise age of emergence, or to track input-output correspondences. The present study, in contrast, aims to trace the progress of several different, interfacing target domains that are pervasive in early child Hebrew, on the one hand, and to delineate their developmental path from emergence via early acquisition to well-established knowledge, on the other. These interrelated goals required analyzing data over a relatively long period of time, comparing the developmental trajectories of three different children. As shown in Table 3, despite the difference in density of recordings, the data-base of both Shachar and Lior yielded a similar cumulative data-base of nearly 2,000 verb-containing utterances in the period considered here, an important factor in the analyses undertaken for this study.

## 2.3 Categories of Analysis

The focus of the current study is on verbs in conjunction with their associated clausal constituents (see Section 1.4 in the preceding chapter). All verb-containing utterances were coded for word-internal inflectional form and for clause-level constituents.

Three dimensions of coding were specified as criterial in the present analysis of children's speech output: Structural linguistic features – morphological, lexical, and syntactic (Section 2.3.1); and two developmentally motivated criteria relevant to children's early language usage: the distinction between opaque and transparent forms (2.3.2); and the factor of productivity in the use of verb inflections (2.3.3).

### 2.3.1 Linguistic Categories

Each verb-containing utterance was coded for each child by (1) whether and how the verb was inflected; (2) what NSCs occurred with each verb – with or without their required prepositions – as illustrated from the data-base in Tables 5-a and 5-b below, respectively; (3) Predicate Constituency values were also coded for a subset of verb lexemes shared by all three children.

#### *Verb Forms*

All verb forms produced by the children were coded in relation to the corresponding “target” or adult form for each of the following five inflectionally distinct categories: Mood (Infinitive, Imperative), Tense (Past, Present, Future), Number (Singular, Plural), Gender (Masculine, Feminine), and Person (1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>). In addition, each verb lexeme was specified for verbs that had a clear lexical target. Table 4 illustrates the linguistic categories specified for verb forms used by the children, using as the citation form of verb lexemes the morphologically simple Past Tense Masculine Singular.

**Table 4.** Examples from three children of coding of five verb-form inflections\*

Child Utterance + Age of Child	Target + Gloss	Relevant Preceding Context	Inflectional Category	Lexeme
<i>lathébet</i> [Shachar, 1;11.22]	<i>lašévet</i> 'to-sit'	INV: <i>bo, roce lašévet al ba-kise?</i> 'come, (do you) want to sit on-the-chair?' CHI: <i>ken.</i> 'yes.'	Infinitive	<i>yašav</i>
<i>kxi, íma</i> [Lior 2;3.26]	<i>kxi, íma</i> 'take, mommy'	--	Feminine Singular Imperative	<i>lakax</i>
<i>yaxx</i> [Shachar, 1;10.12]	<i>halax</i> 'went (away)'	INV: <i>ma hu ose kan?</i> 'what (is) he doing here?'	Masculine Singular Past	<i>halax</i>
<i>xina</i> [Shachar, 1;9.19]	<i>mexina</i> 'preparing'	INV: <i>ma ima osa im ha-tutim?</i> 'what (is) mommy doing with the-strawberries?'	Feminine Singular Present	<i>hexin</i>
<i>na'ale</i> [Rotem, 2;4.05]	<i>na'ale</i> '(we) will-go-up'	--	1 <sup>st</sup> Person Plural Future	<i>'ala</i>

\*All the children's forms listed in Table 4 are transparent

#### *Non-Subject Constituents (NSCs)*

Verb-containing clauses were coded for occurrence of two classes of associated NSCs in relation to their syntactic function – ones taking prepositional markers (e.g., Oblique Objects, Adverbial Phrases) and zero-marked NSCs (e.g., Lexical Adverbs, Questions, Complements). These two major categories of NSCs are illustrated from the data-base in Tables 5-a and 5-b respectively.

**Table 5-a.** Types of transparent NSC constructions marked by the Accusative marker *et* and other prepositions used in lexical and pronominal contexts

Syntactic Functions	Lexical / Pronominal	Examples	Source
Direct Objects – Definite	Lexical	<i>roce et Pu.</i> 'wants ACC Pooh'	Shachar, 2;1.11
	Pronominal	<i>ani ohévet oti.</i> 'I love ACC-me'	Lior, 2;2.02
Oblique Objects	Lexical	<i>at lo mefaxédet me-arye?</i> '(are) you not scared of-lion?'	Rotem, 2;5.15
	Pronominal	<i>hu hirbic li.</i> 'he hit to-me = 'he hit me''	Lior, 2;5.29
Indirect (Dative) Objects	Lexical	<i>le-kol yéled ani mexaléket oto, tov?</i> 'to-each child I share it, okay?'	Rotem, 2;4.19
	Pronominal	<i>tmi li sendvich</i> 'give to-me (a) sandwich'	Lior, 2;4.02
Adverbs	Lexical	<i>lir`ot ba-mar`a</i> 'to-see in-the-mirror'	Shachar, 2;1.06
	Pronominal	<i>Luki, ce mi-kan</i> 'Luki, get-out of-here'	Lior, 2;4.08

**Table 5-b.** Types of Zero-marked NSC constructions, confined to lexical contexts

Syntactic Functions	Examples	Source
Direct Objects – Indefinite	<i>ftexi tevízya!</i> 'turn-on:2 <sup>ND</sup> :FEM:SG television!'	Lior, 2;0.00
Lexical Adverbs	<i>nasim kan.</i> 'will-put:1ST:PL here = '(let's) put (it) here'	Rotem, 2;1.06
Information Questions	<i>ma 'ose ha-dag</i> 'what does the-fish = what's the fish doing?'	Shachar, 2;0.13
Complements	<i>at ro`a ma hu oxel?</i> '(do) you see what he (is) eating?'	Rotem, 2;4.12
	<i>roca še-yavo</i> 'want that (he will) come' = 'I want him to come'	Lior, 2;3.26

This analysis deliberately avoided a categorial differentiation between prepositions as marking Objects versus Adverbials (Berman, 1981b; Givón, 1993) or Arguments versus Adjuncts (Botwinik-Rotem, 2003, 2004; Radford, 1988), since the distinction between NSCs as obligatory or optional is often indeterminate in language in general, let alone in child speech. For example, it is hard to draw the line between a prepositional phrase like *al ha-kise* 'on the-chair' in Hebrew when following the verb

*tipes* ‘climb’ which, unlike its English counterpart, obligatorily governs its object in a phrase like *hu tipes al ha-kise* ‘he climbed (onto) the chair’ (cf. *hu tipes al ha-har* ‘he climbed the mountain’) and when used “adverbially” in a three-place predicate like *hu sam et ha-kadur al ha-kise* ‘he put the ball on the-chair’. Relatedly, a verb like *hirbic* ‘hit, punch’ governs the preposition *le-* ‘to’ before an NP (e.g., *hu hirbic li* ‘he hit (to)-me’, *hem hirbicu la-yeladim* ‘they hit to-the kids’), but not necessarily if it is followed by some kind of adverbial (e.g., *hu hirbic xazak ~ kol ha-zman* ‘he hit hard ~ all the time = without pause’).

### *Predicate Constituency*

In addition to inflectional and prepositional marking, a third type of structural coding was applied to a subset of 40 verb lexemes that occurred across the data-sample for all three children. Each such verb lexeme was coded for three levels of dependence in terms of whether and what kind of NSC context it requires for an utterance in which it occurs to constitute a grammatically well-formed predication. (a) “Dependent” verb lexemes (corresponding largely to canonically transitive verbs) require at least one NSC to form well-formed clauses – e.g., verbs like English *lift, peel, bring* – including when obligatorily governed by a preposition – e.g., *histakel be-* ‘look in=at’, *paxad me-* ‘be.scared from=of’, *hirbic le-* ‘hit to’ — and both two-place and three-place predicates like those meaning *give, tell, put*; (b) “non-dependent” verbs (corresponding to one-place “intransitive” predicates) that can stand alone without any supporting linguistic context, both change-of-state “unaccusatives” as well as agentive activity or stative verbs – e.g., English *fall, cry, sleep*); and (c) “optionally dependent” verbs that can either take an object or stand alone (e.g., the Hebrew equivalents of *eat, play, draw*).

### 2.3.2 Opacity/Transparency of Grammatical Forms

This heading refers to the first of two dimensions noted earlier as developmentally motivated in fleshing out the three structurally defined linguistic categories detailed in Section 2.3.1. All verb forms and prepositions in the children’s speech output were coded as opaque or transparent, with opacity applying to linguistic strings whose target form is unclear or ambiguous – even if the child’s intentions are clear from the surrounding context, linguistic or non-linguistic. Transparent items, in contrast, are grammatically and lexically informative in relation to adultlike language use, being

clearly interpretable without recourse to cues from the environment (Lustigman, 2012, 2013).

*Verbs* counted as “transparent” included both adultlike and phonologically truncated or otherwise mispronounced juvenile forms (e.g., *ca* for *roca* ‘want:FEM:SG’, *aflu* for *naflu* ‘fell:3RD:PL’, *nafala* ‘fell:FEM:SG’ for *nafla*). The major distinction between transparency/opacity in verb-structure applied to three main classes of non-affixed “bare stem” forms (see Section 1.2.1): (a) forms that are clearly interpretable in relation to non-affixed masculine singular targets, defined as transparent even in cases where they were phonologically truncated (e.g., *lax* for *halax* ‘went’, *xel* for *oxel* ‘eats/is.eating’); and (b) truncated verbs that clearly correspond to an infinitival target (e.g., *xol* for *le`exol* ‘to.eat’, *šon* for *lišon* ‘to.sleep’); and (c) truncated forms of target affixed verbs defined as “opaque” since they correspond to more than a single possible target. For example, the verb *sgor* ‘close’ is represented only by its root and *binyan* pattern value [*s-g-r*, P1], since it could stand for infinitive *lisgor*, future *yisgor*, or imperative (*ti*)*sgor*; *ber* ‘talk’ [*d-b-r*, P3] could represent infinitive *ledaber*, present tense *medaber*, past *diber*, future *yedaber*, or imperative (*te*)*daber*; and *kel* ‘look’ [*s-k-l*, P4] could stand for the target infinitive *lehistakel*, present-tense *mistakel*, past tense *histakel*, future *yistakel*. Table 6 illustrates usages of such opaque stem forms by all three children.

**Table 6.** Opaque bare verb stems formed in three different *binyan* patterns

Child’s output verb form	(Some) possible targets
<i>Pu kel xatul haze.</i> [Shachar, 1;9.19] ‘Pooh [ <i>s-k-l</i> , P5 = look] this cat’	<i>histakel</i> ‘looked:MASC:SG’ ~ <i>mistakel</i> ‘is.looking:MASC’ ~ <i>yistakel</i> ‘will.look:MASC:SG’ ~ <i>lehistakel</i> ‘to.look’ ...
<i>ani xzir hakol hakol.</i> [Rotem, 2;1.19] ‘I [ <i>x-z-r</i> , P4 = put.back] everything’	<i>axzir</i> ‘will.put.back:1ST:SG’ ~ <i>yaxzir</i> ‘will.put.back:MASC:3RD:SG’ ~ <i>taxzir</i> ‘will.put.back:FEM:3RD:SG’ ~ <i>lehaxzir</i> ‘to.put.back’ ...
<i>ima, itax lax.</i> [Lior, 2;0.20] ‘mommy, [ <i>p-t-x</i> , P1=open] to-you’	<i>tiftax</i> ‘will.open:2ND:SG/:FEM: 3RD:SG’ ~ <i>yiftax</i> ‘will.open:3RD:SG’ ~ <i>eftax</i> ‘will.open:1ST:SG’ ~ <i>niftax</i> ‘will.open:1ST:PL’ ...

Note, further, that such bare-stem forms may be not only inflectionally but also lexically opaque, in which case they were specified as such, in addition to being indicated by root plus pattern. For example, the stem *xec* not only has several inflectional targets, it is also ambiguous between the transitive P1 lexeme *roxec*



‘wash:MASC:SG’ and the reflexive P5 lexeme *mitraxec* ‘wash-oneself-MASC:SG’ from the same consonantal root (i.e., either [r-x-c, P1] or [r-x-c, P5]); while the stem form *pes* could be a truncated form of either *lexapes* ‘to-look for’ or *letapes* ‘to climb’ (i.e., either [x-p-s, P3] or [t-p-s, P3]).

*Prepositions* were defined as opaque in the following three cases: (a) **omission** of a preposition where grammatically required (e.g., *hu yošev kise* ‘he sits chair’ instead of *hu yošev al kise* ‘he sits on (a) chair’); (b) **inappropriate** prepositions (e.g., *hu yošev ba-ricpa* ‘he sits in-the-floor’ instead of well-formed *hu yošev al ha-ricpa* ‘he sits on-the-floor’); (c) use of “**fillers**”, mainly the syllable *a* in the site of a preposition (e.g., *hu yošev a-ricpa* ‘he sits FILL-floor’). These three, clearly non-adultlike, types of (non-)marking occur in the speech of all three children, representing opaque juvenile strategies for marking verb-NSC relations.

Table 7 illustrates the types of opaque NSCs marking observed in the children’s speech.

**Table 7.** Three types of opaque (non)marking of NSC-requiring case-marker *et* or prepositions

Category	Examples	Source
Omission of Accusative Marker <i>et</i>	<i>lirot Avishay</i> ‘to-see Avishay’ cf: <i>lirot et Avishay</i>	Lior, 2;0.06
Omission of Other Prepositions	<i>édetyá’ar.</i> ‘[y-r-d, P1] go-down woods’ cf: <i>laredet la-ya’ar</i> ‘go-down <u>to-the</u> woods’	Shachar, 1;8.24
Inappropriate use of Prepositions	<i>koev lax ba, ba-šulxan</i> ‘hurts to-you <u>in-the</u> -table’ cf: <i>koev lax me- ~ biglal ha-shulxan</i>	Lior, 2;0.11 (child’s intention is unclear)
Fillers	<i>ikanes a-máim</i> ‘[k-n-s, P2] get-inside <u>FILL</u> -water’ cf: <i>lehikanes la-máyim</i> ‘to-go <u>into</u> -the-water’	Shachar, 1;10.07

Importantly, the criterion for defining a construction as either transparent or opaque refers here purely to structural cues provided by the linguistic string itself. That is, a string in the child’s linguistic output was defined as transparent if and only if it had a single unequivocal target, even in cases of non-adultlike pronunciation (e.g., *láxti* could only be interpreted as standing for the verb *haláxti* ‘walked:1ST:SG’). This also means, as noted earlier, that strings were identified as opaque even in cases where the child’s intentions could be derived from the linguistic and/or non-linguistic surrounding context. For example, when the child uses a filler syllable to produce a

string like *a-tik* ‘FILL-bag’ in reply to the question *éfo ha-kadur?* ‘where (is) the-ball?’, it is clear from the context that the target of the child’s string is *ba-tik* ‘in-the-bag’. However, it would be identified as opaque, since the child’s utterance *a-tik* in itself contains no **structural** cues to this particular target, so that it could stand for any of the following: *la-tik* ‘to-the-bag’, *ha-tik* ‘the-bag’, *me-ha-tik* ‘from-the-bag’, and so on.

### 2.3.3 Productivity in Use of Grammatical Forms

A third and final dimension in coding the children’s speech output relates to the issue of productivity, contextually motivated for present purposes in relation to inflectional affixation of verbs. To this end, the study proposes an adapted version of Brown’s (1973) “obligatory contexts” criterion. For Brown, grammatical context constitutes a test that a child can either “pass” (by supplying the required grammatical morpheme) or “fail” (by supplying an incorrect morpheme or not supplying any morpheme). The present analysis adopts the idea of relating to grammatical context as a key criterion for productive use of inflectional morphemes, but departs from Brown’s analysis in the following sense: productive affixation is identified once the child uses inflectional affixes only when and where they are required. During the productive period, the children **may still use** bare stems where affixed forms are required (i.e., they may still omit obligatory inflections), but they no longer rely on unanalyzed “amalgams” (i.e., they no longer use inflectional affixes ungrammatically). In other words, grammatical context constitutes a key criterion for productive use of inflectional morphemes, not as a “test” to be passed, but as indicative of the productivity of grammatical forms **when they occur**. This decision is particularly relevant to acquisition of Hebrew verb inflection, since Hebrew-acquiring children, unlike their English-acquiring counterparts, have no recourse to morphologically unmarked forms of verbs that **may appear** grammatical in a range of syntactic environments. Unlike English base-verb forms, Hebrew bare-stem verbs are clearly non-adultlike in most contexts. Yet the very fact that bare-stem verb forms occur at a given period in development does not mean that morphologically affixed forms that are used in the same period are necessarily also non-productive (see Section 3.1.2 in the next chapter).

The utterances in (2) illustrate, for each of the three children, use of such rote-learned, hence unanalyzed affixed forms of verbs, clearly grammatically erroneous in the contexts in which they occur.

(2) (a) *kélev ráca* [Shachar (1;7.02)]

‘dog(MASC) is.running:FEM’

(b) *macat* [Rotem (1;11.25)]

‘found:2ND:FEM:SG’ (when referring to herself)

(c) *boxa* [Lior (1;7.16)]

‘is.crying:FEM:SG’ (when referring to her baby brother)

The criterion taken here as indicative of productivity in use of verb inflections is that, at a given period of development, instances like those in (2) no longer occur in the child’s speech. By this criterion, such rote-learned and repetition-based instances were coded as “unanalyzed”, with special note being made of the session in which productive affixation, as so defined, was first identified for each of the three children.

The lexically specific character of *prepositions* made it harder to identify the point where children shifted into productive use. Nonetheless, several instances of unanalyzed prepositional usage were clearly identifiable, particularly though not only for Lior. These included two main cases: immediate repetition of an utterance (e.g., Mother: *at crixa liš'ol, mi natan li?* ‘you need to ask, “who gave (it) to-me?”’ Child: *mi natan li?* ‘who gave (it) to-me?’ [Lior, 2;0.11]) and rote-learned use of dative-marked pronouns that were clearly ungrammatical in a given context (e.g., *Luki, koev lax* ‘Luki(MASC), (it) hurts to-you:FEM’ [Lior, 2;0.03]). Such cases were coded as ‘unanalyzed’ for prepositional marking, in line with specification of unanalyzed verb inflectional affixes.

It follows that unanalyzed use of grammatical markers (here, inflectional affixes and prepositions) can be considered “opaque” in the sense specified in the preceding section (2.3.2) since, although they are adultlike in surface form, they fail to provide clear indication of the child’s knowledge. Consequently, such unanalyzed occurrences are specified throughout as “unanalyzed”, hence as representing another category of **non-transparent** structures.

## CHAPTER III – FINDINGS

Findings derived from analyses of the structural and psycholinguistic categories detailed in Section 2.3 of the preceding chapter are presented below, each accompanied by a brief discussion. Developmental patterns that emerged are described in terms of three phases of early Hebrew grammar identified for all three children (Section 3.1), as the basis for analysis of between-domain convergences in acquisition of Hebrew clause structure (3.2).

### 3.1 Developmental Patterns

As noted in Section 2.2 above, all verb-containing utterances of the three children were analyzed, with the predicate construed as the core element in developing clause structure. Application of the analytical criteria of transparency and productivity (as described and motivated in Section 2.3 above) to the children's verb usage yielded three consecutive developmental phases. These phases, shared by all three children, are outlined below (Section 3.1.1), and subsequently detailed for the distribution of children's verb-forms (Section 3.1.2) and prepositional usage (Section 3.1.3) across the data-base.

#### 3.1.1 Developmental Phases

Different levels of grammatical knowledge are identifiable in Hebrew child language by the surface shape of the verbs they use from the very start. On the one hand, since Hebrew verbs can stand alone in constructing well-formed clauses (e.g., *haláxti* 'went:1ST:SG = I went, I left'), realization or omission of subjects or other clausal constituents cannot be taken as syntagmatic evidence for demarcating developmental phases. On the other hand, in paradigmatic terms, since Hebrew-acquiring children lack access to a single unequivocal basic or neutral form of verbs (Section 2.3.3), inflectional markers are criterial of the state of their grammar. In other words, verb inflectional morphology serves to reflect both paradigmatic and syntagmatic levels of grammatical acquisition, while the typological properties of their grammar leave Hebrew-acquiring children with three logical alternatives for constructing verbs: (1) omission of required inflectional affixes, (2) unanalyzed rote-learned or repetitional forms, or (3) productive use of inflections.

Analysis of these types of verb-usage as measured by the criteria of productive of usage (Section 2.3.3) and opacity/transparency of form (Section 2.3.2) yielded three developmental phases for all three children, as follows:

- **Phase I:** initial verb usage – from the earliest verb form documented for each child, up until productive verb inflection is identified;
- **Phase II:** early productivity in verb usage – from the onset of productive affixation until person-marking appears to consolidate;
- **Phase III:** diversity in verb inflection – consolidation of person-marking leading up to the disappearance of all verb forms defined as “opaque”

Details of the distribution of verb-forms in each of these developmental phases are provided below for all three children.

### 3.1.2 Verb Inflection across Phases

The age-range and distribution of different structural classes of verb forms in Phase I for all three children are presented in Table 8, divided between unanalyzed affixed forms (rote-learned or repetitive) and two different types of bare stems: (a) forms with clearly interpretable non-affixed **masculine singular** targets (e.g., *fal* for *nafal* ‘fell:3RD’MASC:SG’) and (b) two other types of typically juvenile **truncated** forms of target affixed verbs: (i) opaque stems that do not correspond to a single target (e.g., *sgor* [*s-g-r*, P1] ‘close’ [Rotem, 1;9.18]) and (ii) infinitival stems that have a clear infinitival target (e.g., *tóax* for *liftóax* ‘to.open’ [Shachar, 1;5.21]).

**Table 8.** Breakdown of structural classes of verb-forms used by each child in Phase I

Child	Age-range	Total Verb Forms	Bare Stems			Total Bare Stems	Unanalyzed
			Past/Present Stems	Truncated			
				Opaque	Infinitival		
Shachar	1;4.17 – 1;8.10	<b>184</b>	75	77	11	<b>163</b>	21
Rotem	1;3.20 – 2;0.16	<b>415</b>	43	245	47	<b>335</b>	80
Lior	1;5.19 – 1;11.14	<b>674</b>	130	248	44	<b>422</b>	252

Table 8 shows that, from the start of Phase I, and for a period of several months, the children’s verb forms consisted mainly of non-affixed bare stems –

primarily of the opaque type – along with some unanalyzed affixed forms. That is, none of the verbs used in this period could be characterized as exhibiting productive use of inflectional morphology.

It can be seen from Table 8 that Phase I differed in length from one child to the next – four months for Shachar, six months for Lior, and as long as nine months for Rotem – so that the total verb output of the two girls is well over double or more than that of Shachar. Yet the proportion of bare-stem forms used by the children is not dissimilar (89% for Shachar, 81% for Rotem), while the fact that these came to rather less (63%) for Lior is evidently because she resorted to rote-learned constructions far more than the other two children. Not only do the bulk of the verbs produced by all three children take the form of bare stems, for the two less “rote-learning” children, around half of their total verb forms are definable as opaque (Shachar – 42%, Rotem – 59%). That is, there is no evidence for productive inflectional affixation in the verb usage of any of the three children in Phase I, indicating that, despite the differences in its duration, the relevant period of time in fact reflects a parallel developmental phase for all three children. As noted by Adam and Bat-El (2008), the pervasive use of bare (typically opaque) verb forms is morphologically motivated rather than arising from purely phonological constraints nor, more particularly, can such forms be attributed to omission of unstressed inflectional affixes, since (i) children also omit stressed suffixes on verbs (e.g., *boxa* ‘is.crying:fm’; *noflim* ‘are.falling:ms’) and (b) during the same developmental periods (including Phase I), children produce many di- and even trisyllabic (non-verbal) forms that correspond to the relevant target words, some of which include unstressed inflectional affixes (e.g., *táktorim* for the plural noun *tráktorim* ‘tractors’ [Shachar, 1;7]; *šišáfa* for *djiráfa* ‘giraffe’ [Rotem, 1;9]); *ugiyá* ‘cookie’ [Lior, 1;9].

Phase II begins, as noted, when productive verb affixation is identified, and so includes productively inflected verbs alongside unaffixed stems. Productive verb inflection in this phase is limited largely to non-person-marked categories, in the form of Infinitives and Present-Tense forms, as illustrated in (3) and (4) respectively.

(3) (a) *lo liftóax!* [Shachar, 1;9.27]

‘not to.open! = do not open!’

(b) *la'asot bacek* [Rotem, 2;1.06]

‘to.make play-doh’

(c) *roca lir`ot televízya* [Lior, 2;0.01]

‘want:FEM:SG to-watch television’

(4) (a) *mesaxkim ba-xol* [Shachar, 1;10.26]

‘are.playing:MASC:PL in-the-sand’

(b) *ani holéxet* [Rotem, 2;1.12]

‘I am.going:FEM:SG’

(c) *íma lo boráxat* [Lior, 2;0.12]

‘mommy (is) not running.away:FEM:SG’

Other inflectional categories include mainly Past tense, and some uses of Future tense and prefixed Imperatives. Table 9 details the Phase II distribution of inflectional categories, including bare stems, for the three children.

**Table 9.** Distribution of verb forms during Phase II, for each child, by inflectional category

Child	Age	Total Verb Forms	Bare Stems				Affixed Forms			
			Past/Present /Imperative Stems	Truncated		Total Bare Stems	Inf <sup>a</sup>	<i>Benoni</i>	Past	Other
				Opaque	Infinitival					
Shachar	1;8.17 – 2;0.00	<b>521</b>	146	151	13	<b>310</b>	<b>107</b>	<b>67</b>	26	11
Rotem	2;0.30 – 2;03.29	<b>1063</b>	106	252	64	<b>422</b>	<b>116</b>	<b>273</b>	165 <sup>b</sup>	87
Lior	1;11.15 – 2;2.30	<b>811</b>	134	101	7	<b>242</b>	<b>161</b>	<b>229</b>	81	98 <sup>c</sup>

Notes: (a) Use of the ubiquitous modal operator, the present-tense verb *roce/roca* ‘want(MASC/FEM)’ followed by an infinitival, was not counted with other *benoni*-form verbs, to avoid inflation. (b) Most of Rotem’s past-tense forms were 1<sup>st</sup> Person Singular with accomplishment-type verbs (e.g., *siyámti* ‘finished:1ST:SG = I’m done, I’ve finished’). (c) Including 76 feminine imperative.

Table 9 shows that bare stems, and in particular opaque stems, still constitute a large portion of the verb forms produced by the children in Phase II. Sixty percent (=310/521) of Shachar’s verbs were in the form of stems, half of which (49%=151/310) are opaque. In the case of Rotem, 40% (=422/1063) of her forms were stems, with 60% (=252/422) opaque. Lior’s use of stems reached 30% (=242/811) of her verb production, out of which 42% (=101/242) are opaque. That is, during this period of early productivity the children still make relatively wide use of stem-like forms, and a considerable proportion (between 12% to 29%) of their total verb forms still exhibit opacity.

As noted, productively affixed forms included mainly the two inflectional categories of Infinitive and *benoni*, which accounted for the bulk of the total productively affixed forms for all three children: 82% (=174/211) for Shachar, 61% (=389/641) for Rotem, and 69% (=390/569) in the case of Lior. This preference for Infinitival and *benoni* forms is attributed to their “neutral” status, as non-person-marked inflectional categories. The role of these two inflectionally less marked categories as means of “bridging” for children in the transition to fully specified inflectional forms is discussed further in the next chapter (see Section 4.2.1).

Phase III begins for all three children with a marked drop in proportion of opaque bare stems and an accompanying rise in variety of inflectional categories taking productively affixed forms. Table 10 details the breakdown of verb forms for all three children during Phase III.

**Table 10.** Distribution of verb forms during Phase III, for each child, by inflectional category

Child	Age	Total Verb Forms	Bare Stems			Affixed Forms				
			Past/Present/Imperative Stems	Truncated		Total Bare Stems	Infinitive <sup>i</sup>	Benoni Affixed Forms	Past Tense Affixed Forms	Future /affixed Imperative
Opaque	Infinitival									
Shachar	2;00.05 – 2;3.24	<b>1234</b>	519	84	10	<b>613</b>	<b>201</b>	<b>180</b>	160	80
Rotem	2;04.05 – 2;05.29	<b>843</b>	106	88	17	<b>211</b>	<b>94</b>	<b>222</b>	115	201
Lior	2;3.00 – 2;4.08	<b>494</b>	68	23	3	<b>94</b>	<b>114</b>	<b>146</b>	61	79

Table 10 shows that the percentage of opaque verbs out of total verb forms decreases for all three children from Phase II to III: Shachar– from nearly one-third (29%) down to under 7%, Rotem – from one-quarter (24%) to 10%, Lior – from 12% to only 5%. At the same time, the proportion of person-marked verbs out of total affixed forms rises for all children, compared to Phase II (Shachar – from 18% to 39%, Rotem – from 39% to 50%, and Lior – from 32% to 35%). These two concurrent trends of diminishing opacity coupled with increasing variety of person-marking combine to define Phase III as a more advanced phase in children’s verb usage.



### 3.1.3 Prepositional Marking across Developmental Phases

The three phases defined for verb inflection were further analyzed in terms of the children's use of prepositions in relation to their associated NSCs. As described in Section 2.3.1, these were divided between (1) NSCs explicitly marked by accusative or other prepositions; (2) adultlike zero-marked NSCs; and (3) opaquely (non-)marked. Tables 10 to 13 below detail the distribution of NSC types used by the three children for each developmental phase respectively. Table 11 presents the breakdown of clausal elements in combinations with verbs during Phase I for each of the children.

**Table 11.** Distributions of verbs combined with other clausal elements in Phase I for each child, by type of NSC marking

Child	Age	Total Verbal Utterances	No. of Non-Isolated Verbs*	Clausal Constituents Combined with Verbs								
				Sbj	NSC							Unanalyzed Preposition
					Indefinite DO	Lexical Adverb	Acc. Pronoun	Fillers	Omissions	"WH"		
Sha	1;4.17 – 1;8.10	<b>184</b>	<b>9</b>	8	1	-	-	-	-	-	-	
Rot	1;3.20 – 2;0.16	<b>415</b>	<b>17</b>	4	7	1	1	1	-	-	3	
Lio	1;5.19 – 1;11.14	<b>674</b>	<b>178</b>	37	30	10	2	-	12	13	97	

\* Some of the combinations included more than one NSC (e.g., *simkos et-ze* 'put cup ACC-this' [Lior, 1;11.09]).

Table 11 shows that Phase I verbs are typically not accompanied by an additional clausal element: as low as 4% or 5% for two of the children, and around one-quarter for Lior, whose relatively extensive use of additional, non-verb element can be attributed to her heavy reliance on rote-learned strings of speech output.

The children made no self-initiated use of prepositions in Phase I. Verb-containing strings include subject-like elements (e.g., *ába halax* 'daddy went away' [Shachar, 1;7.23]) that are unmarked for case in Hebrew, and/or NSCs used without explicit prepositional marking. These included: verbs followed by indefinite, hence grammatically non-marked direct objects (e.g., *isgor délet* '[s-g-r, P1] close door', [Shachar, 1;7.17]), lexical adverbs (e.g., *isim lemála* '[s-y-m, P1] put up' [Rotem, 2;0.16]), an occasional deictic pronoun *etze* 'this~that~it', question-words (e.g., *ma ata ose?* 'what (are) you doing?' [Lior, 1;10.12]), or a filler-marked element (e.g., *iftax a-délet* '[p-t-x, P1] open FILL-door' [Rotem, 2;0.16]). Lior alone also produced

strings that omitted an obligatory preposition (e.g., *holex brexa* ‘is-going:MASC:SG pool’ [Lior, 1;11.07]), and she also used more unanalyzed prepositional markings than the other two children, either as repetitions of input (e.g., *tnuli* ‘let:2ND:PL to-me’ [Lior, 1;10.08], after her mother told her how to say it: *axšav tagídi lahem, tnu li le'exol bešéket* ‘now tell them, let me eat quietly’) or as rote-learned strings (e.g., *zor lax* [‘-z-r, P1] help to-you:FEM:SG’ = ‘should I help you?’ [Lior, 1;11.07], when the child wants to be helped, cf. *la'azor li* ‘to-help me’). In sum, where Phase I verbs occur with some other element, this generally lacks any overt case-marking. If a preposition is used, it is typically unanalyzed, either rote-learned or repetition-based.

In Phase II, all three children begin to use prepositional marking in connecting verbs to NSCs. Table 12 shows the distributions of NSC marking for each child in this period, divided by the coding categories specified in Section 2.3.1. Accusative and Dative markers with pronoun suffixes (e.g., *oti* ACC+1ST:SG = ‘me’, *li* ‘to-me’) were so common that they are presented separately from all other Prep or Acc marked NSCs. Results for all types of prepositionally marked constituents listed in Table 5-a in the preceding chapter are presented together here (under heading of “PP Adverbs”), since in many cases no clear-cut criteria could be established for whether a given NSC was in fact functioning as an oblique or indirect object and/or as an adverbial.

**Table 12.** NSC in combination with verbs during Phase II for each child, by NSC type

Child	Age	No. of Comb.	Total NSC	Explicit Marking				Adultlike Non-marked			Juvenile		"WH" and Complements	
				PP Adv.	Def. DO	Acc. Pro.	Dat Pro.	Lex. Adv.	Indef. DO	Filler	Ungram. Prep.	Omission of obligatory Prep.		Unanalyzed Prepositions
Sha	1;8.17 – 2;0.00	238	244	13	--	27	17	32	53	43	4	50	--	5
Rot	2;0.30 – 2;3.29	543	626	53	3	45	66	112	233	29	6	48	2	29
Lio	1;11.1 5 – 2;2.30	469	538	94	39	15	71	40	168	8	21	15	36	31

NSC (non-)marking in Phase II still exhibits opacity, but to a lesser degree than in Phase I. Nearly 40% of Shachar’s were juvenile forms – 40% (=97/244), compared with only 14% (=85/626) for Rotem, and 15% (=80/538) for Lior. Such juvenile constructions include use of filler syllables (e.g., *barax a-délet*

‘ran.away:3RD:MASC:SG FILL-door’ [Shachar, 1;9.12]), inappropriate uses of prepositions (e.g., *gamárti la-gan* ‘finished:1ST:SG to-the-kindergarten’ [Lior, 2;1.14]), omission of obligatory prepositions (e.g., *hitlaxláxti varod* ‘got.dirty:1ST:SG pink(crayon)’ [Rotem, 2;2.11]) and, in the case of Lior, unanalyzed (rote or repetition) uses of dative pronouns (e.g., *zor lax ába* ‘[-z-r, P1] help to-you:FEM daddy’, when asking for help [Lior, 2;0.00]). All children make extensive use of adultlike non-marked NSCs –around one-third of the time for Shachar and Lior (35% and 39% respectively) and over half for Rotem (55%). These take the form of indefinite Direct Objects (e.g., *oxel daysa šelo* ‘is.eating:MASC his porridge’ [Shachar, 1;9.09]) or simplex adverbs (e.g., *roca po* ‘wants:FEM here’ [Rotem, 2;0.03]). Explicit prepositional marking occurs around a fifth to one-third of the time for Shachar (23%) and Rotem (27%), and 41% for Lior – in the form of definite direct objects (e.g., *ani mecalémet et Mixali* ‘I photograph:FEM:SG ACC Michali’ [Rotem, 2;2.11]), PP adverbs (e.g., *holéxet la-avoda* ‘is.going:FEM to-work-place’ [Shachar, 1;11.16]), accusative pronouns (e.g., *ani lo makira oto* ‘I do-not know:FEM:SG ACC-him’ [Rotem, 2;3.01]), and dative pronouns (e.g., *tni li mixnasáyim* ‘give:FEM:SG to-me pants’ [Lior, 2;0.12]).

Phase II thus demonstrates considerable variety in partial marking of Verb-NSC relations for all three children. These divided up between a relatively large proportion of unmarked (indefinite Direct Objects and lexical adverbs) NSCs, rather fewer adultlike uses of prepositions, and lower proportions of preposition omission and use of fillers – with the two latter categories dependent on individual preferences of the different children.

Phase III reveals more Verb plus NSC constructions out of total verb-containing utterances for all three children (between 52% to 75.5%, compared with 47% to 58% in Phase II) together with greater explicitness of prepositional case-marking. Table 13 presents the distribution of NSC types in Phase III for the three children.

**Table 13.** NSC in combination with verbs during Phase III for each child, by NSC type

Child	Age	No. of Comb.	Total NSC	Explicit Marking				Adultlike Non-marked			Juvenile			"WH" and Comp.
				PP Adv.	Def. DO	Acc. Pro.	Dat Pro.	Lex. Adv.	Ind. DO	Filler	Ungram. Prep.	Omission of obligatory prep.	Unanalyzed PP (Clearly Rote-learned/repetition)	
Sha	2;0.05 – 2;3.24	<b>643</b>	<b>708</b>	119	69	146	53	108	139	15	15	25	--	19
Rot	2;4.05 – 2;5.29	<b>569</b>	<b>695</b>	83	13	55	120	124	164	20	5	13	1	97
Lio	2;3.00 – 2;4.08	<b>373</b>	<b>420</b>	80	43	27	47	40	146	3	8	2	1	23

Table 13 shows a marked decrease compared with Phase II in proportion of juvenile (non-)marking of NSC (8% for Shachar, 6% for Rotem, and 3% for Lior).

Further, while non-marked, but adultlike indefinite direct objects and simplex adverbials still account for as high as one-third to nearly half of the children's NSCs (Shachar – 35%; Rotem – 41%; Lior – 44%), each child also relies far more than before on explicitly marked NSCs (Shachar – 55%; Rotem – 39%; Lior – 47%).

NSC-marking in Phase III thus combines with the findings for verb inflection as revealing a clearly more advanced level in consolidation of the grammar of simple-clause structure for each of the three children. The next sections examine whether the two domains of inflections and case-marking can be found to interact with each other in acquisition of Hebrew.

### 3.2 Inter-Domain Convergences

This section analyzes interfaces in acquisition of three domains of early clause structure – verb inflection, predicate constituency, and case or adverb marking – as defined by converging patterns of grammatical opacity/transparency. Here, the notion of “convergence” refers to patterns of co-occurrence within a single utterance of opaque versus transparent marking of items from two apparently independent linguistic systems. Analysis of convergence is confined to Phases II and III, as periods when the children's grammar revealed both opacity and transparency concurrently, since Phase I – as shown in the previous section – was defined by pervasive opacity. Two patterns of “convergence” emerged: between opaque verb forms and their

syntagmatic environment (Section 3.2.1) and between transparent verb forms and transparent prepositions (Section 3.2.2).

### 3.2.1 Verb Inflection and Predicate Constituency

The first set of interface analyses examines the interrelations between verb usage on the paradigmatic axis in terms of morphological opacity, on the one hand, and as syntagmatically isolated or elaborated in terms of predicate constituency, on the other. To this end, an item-based analysis was conducted on a subset of 40 of the children's shared verb lexemes. The verbs selected for this analysis occurred in the speech of all three children across the three phases defined above, so allowing for comparability throughout the data-base. Importantly, these 40 items represent three lexico-syntactic classes in terms of their associated predicate constituency (see Section 1.2.2): (1) “dependent” verb lexemes (e.g., *lift*, *peel*, *bring*) that require at least one NSC to form a clause that is acceptable without further context, either linguistic or non-linguistic; and “non-dependent” lexemes of two kinds: (2) “optionally dependent” lexemes (e.g., *eat*, *play*, *draw*) that can occur either with or without an object constituent; and (3) canonically intransitive “independent” lexemes (e.g., *fall*, *cry*, *sleep*) that can stand alone as a clause without any additional context. Table 14 lists the forty verb lexemes in terms of their morphological *binyan* pattern and their associated predicate constituency.

**Table 14.** Forty verb lexemes selected for analysis of predicate constituency, by lexico-syntactic category, morphological pattern, and required constituents

Lexico-Syntactic Category	Lexeme <sup>(a)</sup>	<i>binyan</i> Pattern	Required Constituent(s) <sup>(b)</sup>
Dependent	<i>asaf</i> ‘collect’	P1 <i>qal</i>	D(irect) O(bject)
	<i>herim</i> ‘lift’	P4 <i>hif’il</i>	DO
	<i>hexin</i> ‘prepare’	P4 <i>hif’il</i>	DO
	<i>hirbic</i> ‘hit’	P4 <i>hif’il</i>	DO
	<i>hoci</i> ‘take.out’	P4 <i>hif’il</i>	DO
	<i>horid</i> ‘take.down’	P4 <i>hif’il</i>	DO
	<i>kilef</i> ‘peel’	P3 <i>pi’el</i>	DO
	<i>nigev</i> ‘wipe’	P3 <i>pi’el</i>	DO
	<i>patax</i> ‘open’	P1 <i>qal</i>	DO
	<i>sagar</i> ‘close’	P1 <i>qal</i>	DO
	<i>šataf</i> ‘wash (Trans.)’	P1 <i>qal</i>	DO
	<i>šavar</i> ‘break (Trans.)’	P1 <i>qal</i>	DO
	<i>sider</i> ‘tidy’	P3 <i>pi’el</i>	DO

	<i>hevi</i> ‘bring’	P4 <i>hif’il</i>	DO, I(ndirect) [= Dative] O(bject)
	<i>natan</i> ‘give’	P1 <i>qal</i>	DO, IO
	<i>siper</i> ‘tell’	P3 <i>pi’el</i>	DO, IO
	<i>zarak</i> ‘throw’	P1 <i>qal</i>	DO, IO
	<i>kibel</i> ‘get’	P3 <i>pi’el</i>	DO, A(blative) O(bject)
	<i>lakax</i> ‘take’	P1 <i>qal</i>	DO, AO
	<i>tipes</i> ‘climb’ <sup>(c)</sup>	P3 <i>pi’el</i>	OBL(ique Object)
Optionally Independent	<i>axal</i> ‘eat’	P1 <i>qal</i>	DO
	<i>ciyer</i> ‘draw’	P3 <i>pi’el</i>	DO
	<i>sixek</i> ‘play (a game)’	P3 <i>pi’el</i>	DO / OBL
	<i>nizhar</i> ‘be.careful’	P2 <i>nif’al</i>	OBL
	<i>kam</i> ‘get up’	P1 <i>qal</i>	Source and Goal Adverbs
	<i>kafac</i> ‘jump’	P1 <i>qal</i>	
	<i>nasa’</i> ‘ride, drive’	P1 <i>qal</i>	
Fully Independent	<i>amad</i> ‘stand (up)’	P1 <i>qal</i>	--
	<i>baxa</i> ‘cry’	P1 <i>qal</i>	--
	<i>hišta’el</i> ‘cough’	P5 <i>hitpa’el</i>	--
	<i>hitgalesh</i> ‘slide’	P5 <i>hitpa’el</i>	--
	<i>hitorer</i> ‘wake up’	P5 <i>hitpa’el</i>	--
	<i>nafal</i> ‘fall’	P1 <i>qal</i>	--
	<i>niftax</i> ‘open (Intrans.)’	P2 <i>nif’al</i>	--
	<i>nishbar</i> ‘break (Intrans.)’	P2 <i>nif’al</i>	--
	<i>nishpax</i> ‘spill’	P2 <i>nif’al</i>	--
	<i>rakad</i> ‘dance’	P1 <i>qal</i>	--
	<i>shaxav</i> ‘lie.down’	P1 <i>qal</i>	--
	<i>yashan</i> ‘sleep’	P1 <i>qal</i>	--
<i>yashav</i> ‘sit’	P1 <i>qal</i>	--	

Note: (a) Verb lexemes are represented in the morphologically simplex form of past tense, masculine singular.

(b) Adverbials expressing relations such as location, time, reason, purpose, manner that can be added relatively freely to all lexemes are not specified here, except for the three motion verbs *kam* ‘get-up’, *kafac* ‘jump’, and *nasa’* ‘ride, drive’ that occur with goal and source locatives.

(c) The lexeme *tipes* ‘climb’ obligatorily takes an oblique object with the preposition *al* ‘on’, so that Hebrew has no equivalent of, say, English ‘climb down, climb through’.

The item-based analysis of predicate constituency was conducted on all occurrences of these 40 lexemes in the speech of the three children – a total of 2,255 verb-containing utterances. These excluded two high-frequency verbs with variant values in terms of their predicate-constituency: *raca* ‘want’ and *ra’a* ‘see’, which occur in both child and adult Hebrew with numerous different senses, and so can be classified as “dependent” in some cases and as “optional” in other. For example, *raca* ‘want’ is both the most basic type of modal verb analogous to English *wanna* and also stands alone in early expression of rejection or refusal, as *lo roce* ‘not want = don’t want = won’t’, while *ra’a* can be used both as a verb of perception meaning ‘see’ and in future-imperative form as an attention-getter analogous to English *lookit*, and also

as a tag-question (*a)tro'a* ‘you-see = see?’ The two basic motion verbs *ba* ‘come’ and *halax* ‘go’ were also excluded from analysis since they, too, are multifunctional, serving both as grammaticized markers of hortative mood analogous to English *let’s* (Berman & Lustigman, in press) or as lative aspectual verbs similar to English *gonna* (Berman & Slobin, 1994) as well as in fixed collocations such as ‘come home’, ‘go to sleep’.

Each of the remaining over two thousand verb-containing utterances was coded for verb form and predicate constituency (as defined in Section 2.3.1). Verbs that occurred without any associated NSC were coded as “isolated” (irrespective of whether used with or without a Subject). For example, Rotem’s production *cayer* ‘[c-y-r, P3=draw]’ [1;11.18] was coded as isolated, compared with *cayer máim* ‘[c-y-r, P3=draw] water’ [Rotem, 2;0.09] that was coded as non-isolated. As background, recall that in Phase I, when the children’s verb forms were by and large non-inflected, the bulk of the verbs they used also occurred in isolation without any associated predicate constituent (see Section 3.1.2 above). The first finding from analysis of the 40 target lexemes at issue here, as shown in Table 15 below, is that they, too, were not only inflectionally opaque, but they were also lexico-syntactically “isolated”.

**Table 15.** Proportion of verbs used in isolation out of total occurrences of 40 targeted verbs in Phase I, by lexico-syntactic category, for each child

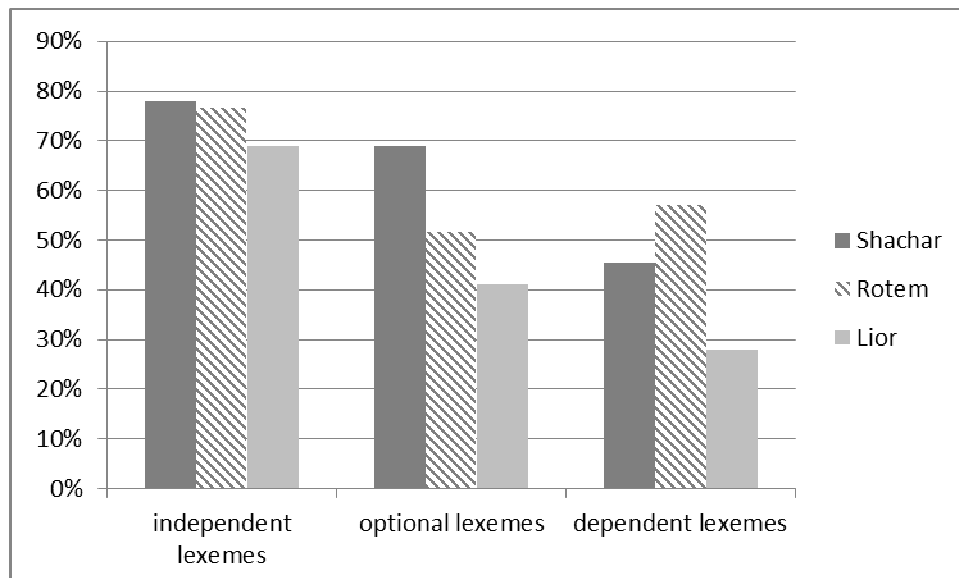
	Shachar	Rotem	Lior
Dependent	97% (=28/29)	98% (=157/161)	62% (=84/135)
Optionally Independent	100% (=18/18)	80% (16/20)	76% (=29/38)
Fully Independent	100% (=42/42)	100% (=67/67)	93% (=115/123)

During Phase I, not only is there no productive use of verb affixation, children also tend to avoid syntagmatic predicate elaboration – a finding which shows, as was to be expected, that the 40 verbs targeted for analysis conform to what was found for the children’s verb usage in general (see Table 8). Table 15 also reveals that even when the children use verbs defined as “dependent” in terms of their required predicate constituency, they tend to use them in isolation no less than in the case of independent or canonically intransitive verbs – most markedly in the case of Shachar (97%) and Rotem (98%) less so for Lior, whose reliance on rote-learned strings is

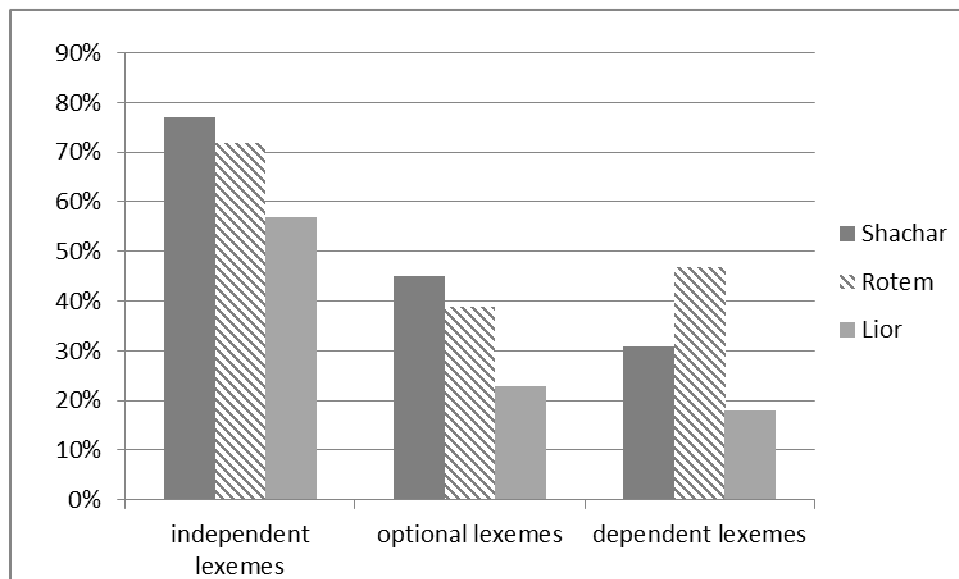
reflected in the fact that only two-thirds (62%) of her dependent targeted verb lexemes were used in isolation as compared to slightly under 100% (93%) of her independent lexemes. In sum, Phase I verbs are pervasively used in isolation from additional NSC elements, regardless of their lexico-syntactic category.

Phase II marks not only the onset of productive verb affixation, this is also accompanied by increasing use of verbs in combination with other NSC elements. The decrease in proportion of verbs that are “isolated” in terms of their predicate constituency in Phase II and III is shown in Figures 1 and 2, respectively (for raw scores and exact percentages, see Appendix – Table A).

**Figure 1.** Isolated verbs in Phase II, for each child, by lexeme type



**Figure 2.** Isolated verbs in Phase III, for each child, by lexeme type

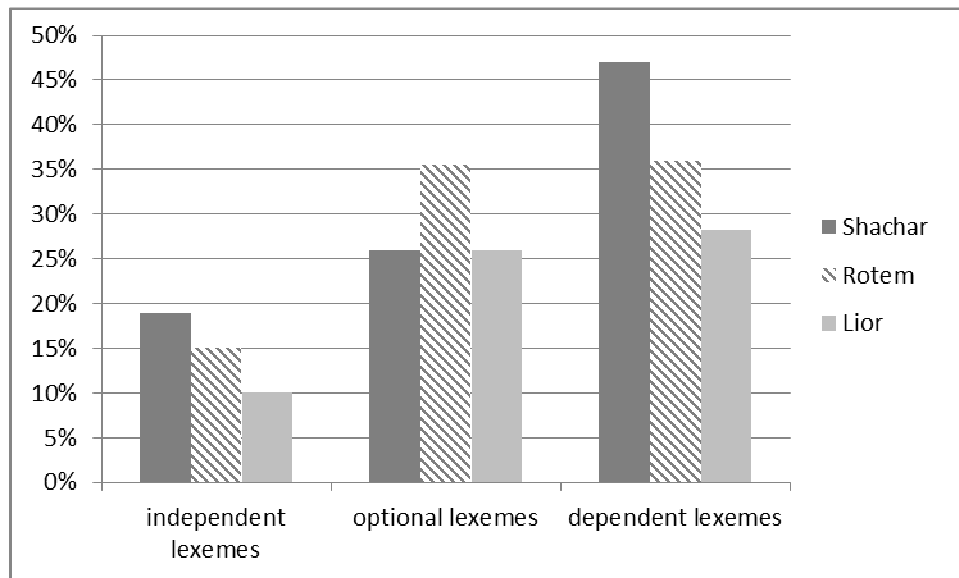


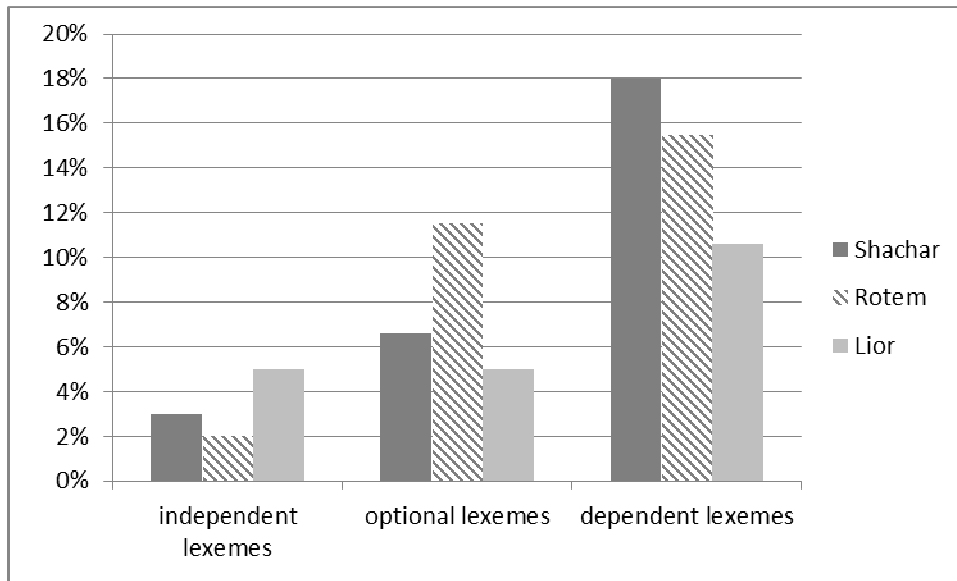


Figures 1 and 2 show that all three children manifest a decrease in use of isolated verb forms from Phase I to Phase II and from Phase II to III, across all three lexico-syntactic classes of verbs. In both Phases II and III, “dependent” verbs show the lowest proportion of isolated usage and “independent” verbs the highest, with “optionally independent” verbs lying between them. Isolated verb usage decreases proportionately for both dependent and optionally independent verbs, with this decrease relatively more marked in the latter (optional) group for Shachar and Lior. In contrast, and as is to be expected, verbs that are grammatically independent (canonic intransitives) stay at much the same level of isolated usage across Phases II and III.

Against the background of this analysis of verb usage as syntagmatically isolated or elaborated, Figures 3 and 4 present the breakdown of the 40 targeted verbs in Phases II and III in terms of inflectional opacity (for raw figures and exact percentages, see Appendix – Table B).

**Figure 3.** Opaque verbs in Phase II, for each child, by lexeme type



**Figure 4.** Opaque verbs in Phase III, for each child, by lexeme type

Figures 3 and 4 show a decrease in verb-form opacity from Phase II to III for all three children – in keeping with the developmental trends specified earlier for each of the three phases (Section 3.1.2). Less predictable was the finding that, for each child, “independent” intransitive verbs show relatively the lowest levels of inflectional opacity for both Phases II and III (19%-3% respectively for Shachar, 15%-2% for Rotem, 10%-5% for Lior), while “dependent” verbs show the highest (47% – 18% for Shachar, 34% – 15% for Rotem, and 28% – 11% for Lior). Taken together, the findings presented in Figures 1 to 4 combine to suggest that “independent” canonically intransitive verbs not only tend to occur – as expected – more in isolation than other types of verbs, they also tend to be most transparent in whether and how they are morphologically inflected. This unpredicted state of affairs was largely what motivated me to investigate a possible convergence between inflectional opacity and syntactic environment.

A more fine-grained, context-sensitive analysis was necessary to confirm the hypothesis of a correlation between syntagmatic isolation and inflectional transparency in early child grammar. To this end, statistical analysis was performed of the “convergence” between these two domains of verb usage in the children’s speech output in Phases II and III. This analysis was applied to all 40 targeted verbs irrespective of their lexico-syntactic predicate constituency of the verbs in question since, on the one hand, isolated use of dependent verbs is acceptable in interactive communicative settings, where ellipsis of required predicate constituents can be

interpretable in context (e.g., Adult: *ma ani osa?* ‘what (am) I doing:FEM:SG?’ Child: *menagévet* ‘wipe:FEM:SG’ = ‘(you) are.wiping’ [Rotem, 2;4.12]). And, conversely, non-dependent verbs may also be elaborated by adverbials (e.g., *káxa la'amod* ‘so to.stand’ = ‘stand like this!’ [Shachar, 2;0.00]). Figure 5 shows the proportion of inflectionally opaque verbs occurring in isolation out of total opaque usages compared to the overall proportion of isolated verbs in Phases II and III combined (for raw scores and exact percentages, see Appendix – Table C).

**Figure 5.** Proportion of isolated verbs out of total verbs compared with proportion of isolated opaque verbs out of total opaque verbs, across Phases II and III, by child

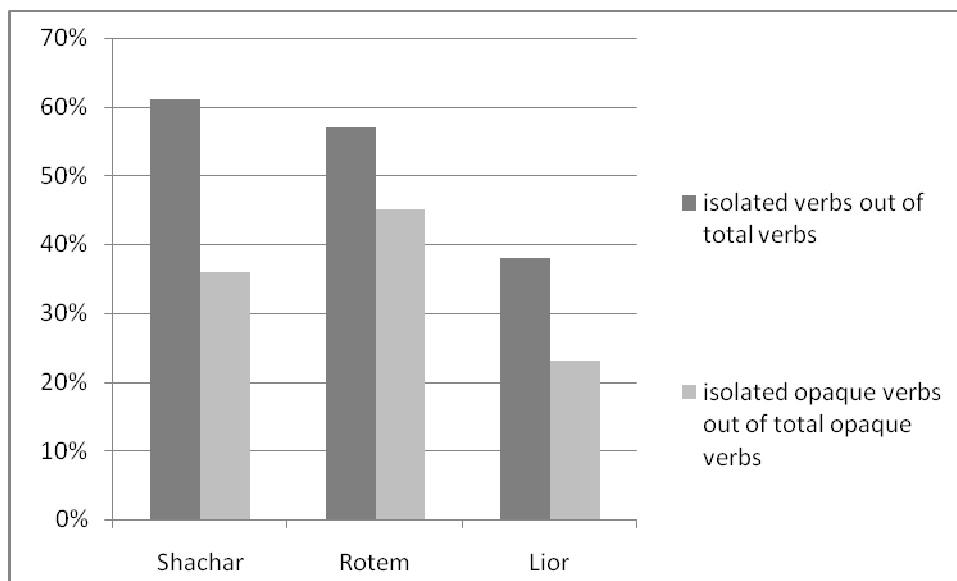


Figure 5 shows that the proportion of isolated opaque verb forms out of total opaque verb forms is consistently lower than the proportion of isolated verb forms in general, for all three children (36% compared with 61% for Shachar, 45% compared with 57% for Rotem, and 23% compared with 38% for Lior). A single-proportion Z-test reveals a one-tailed significant effect for the differences between these distributions (for Shachar:  $Z=5.399592$ ,  $p<.0001$ ; for Rotem:  $Z=2.881616$ ,  $p=.002$ ; for Lior:  $Z=3.345301$ ,  $p=.0004$ ).

These significant correlations between opaque verbs and elaborated syntactic environments indicate that, in the early phases of grammatical affixation, when opaquely uninflected stems occur side by side with productively inflected verb forms (Phase II and III), the distribution of opaque versus transparent verb usage is not entirely random. Rather, it appears that opaque verb forms are generally “reserved”

for more elaborated, non-isolated predicative environments. Recall that in Phase I, most verb forms, including opaque stems, occurred in isolation (Table 14), suggesting that before, but not subsequently to, the emergence of productive inflection, opaque verbs tend to appear in isolated syntactic contexts. In other words, once children apply verb inflection productively, inflectional opacity and elaborated syntagmatic environment will be interconnected in their language use.

To summarize this section, it turns out that, at first, children do not distinguish between predicates as dependent or not, since the verbs they produce in both syntactic categories (including inflectionally opaque forms) initially occur in isolation, without associated NSCs, even when required by the ambient language. Subsequently, when productive inflection occurs alongside inflectional opacity, use of lexical verbs in conjunction with NSCs demonstrates the following trends. Independent verb lexemes manifest lower percentages of opacity and higher proportions of isolated verb-productions compared with dependent lexemes. Moreover, the significant correlation that was found for all occurrences of the 40 verb lexemes between inflectional opacity and NSC realization strongly suggests that opaque verb forms are more likely to occur in non-isolated environments.

### 3.2.2 Verb Inflection and Prepositional Marking

This section examines clause-internal relations from another perspective, focusing on the possible impact of grammatical marking in one domain (verb inflection) on another (prepositional marking). As specified earlier (Section 3.1.2 and 3.1.3), the three children's use of these two systems shows development throughout the course of three developmental phases. Both verb inflections and prepositions were found to manifest a gradual transition from pervasive opacity to largely transparent use of grammatical marking. The goal of this section is to examine the possibility of interrelations between these two domains, in the form of convergence along the axis of opacity/transparency. For this purpose, all combinations of verb plus one or more NSCs occurring in the speech of each child during Phases II and III were coded both for type of verb form (opaque or transparently inflected) and for NSC marking (opaque, adultlike non-marked, or transparently explicit). Note that Phase I was excluded from this analysis, as a period that exhibits hardly any combinations of verb+NSC, and no evidence of transparent verb inflections or prepositional marking.

The notion of “convergence” is used here to describe patterns of co-occurrence along the dimension of opacity/transparency, as referring to co-occurrence of transparent marking within a single utterance of items from two apparently independent linguistic systems – verb inflections and prepositions. The following patterns were found for all three children in co-occurrence of verb inflections and prepositions: **transparent pairing** – unambiguous verb forms plus explicit prepositional marking (example (5) below); **opaque pairing** – ambiguous verb forms plus juvenile NSC (non-)marking (example (6)); and **mixed pairing** – opaque NSC marking with transparent inflection (7a) or vice versa, opaque inflection with explicit NSC marking (7b).<sup>5</sup>

(5) Transparent Pairings

(a) *gam ani sixákti ba-gan* [Rotem, 2;2.11]

‘also I played:1ST:SG at-the-nursery-school’

(b) *holxim la-rxov* [Lior, 2;3.18]

‘going:MASC:PL to-the-street’

(6) Opaque Pairings<sup>6</sup>

(a) *ikanes Hodaya a-ze'ev* [Shachar, 1;10.07]

‘[*k-n-s*, P2] enter Hodaya(= a girl’s proper name) FILL-wolf’

(Apparent target: ‘Hodaya came (to visit) at the wolf’s house’)

(b) *zor lax et ha-agala númi* [Lior, 2;0.21]

‘[*-z-r*, P1] help you:FEM:SGACC the-buggy ankie’

(Apparent target: ‘I want you to help me with the buggy and the blanket’ --

with an opaque bare-stem verb-form *zor* plus an unanalyzed dative pronoun, *lax* ‘to-you’, to refer to herself, plus preposition substitution of *et* ‘ACC’ instead of *im* ‘with’, and preposition omission of *im* ‘with’ before *numi* – ‘ankie, security blanket’).

(7) Mixed Pairings:

(a) *laruc argaz-xol* [Shachar, 1;11.07]

‘to.run sandbox’

(lacking the obligatory preposition *le-* ~ *el* ‘to ~ towards’)

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<sup>5</sup> Combinations with adultlike non-marked NSCs (specified in Table 5-b) do not fall into any of these categories, since they are neither explicitly marked, nor opaque. As such, these NSCs are excluded from the convergence analysis.

<sup>6</sup> Adult targets could not be specified in cases of opaque child forms.

(b) *ani cayer be-ze* [Rotem, 2;1.09]

‘I [*c-y-r*, P3] draw in-this’

Mixed pairings (Examples 6a and 6b) appeared to be less common than “homogeneous” transparent (4) or opaque (5) pairings for all three children. Figure 6 shows the distributions of mixed versus homogeneous pairings for all three children during Phases II and III.

**Figure 6.** Distributions of mixed versus homogeneous pairings during Phase II and III, by child

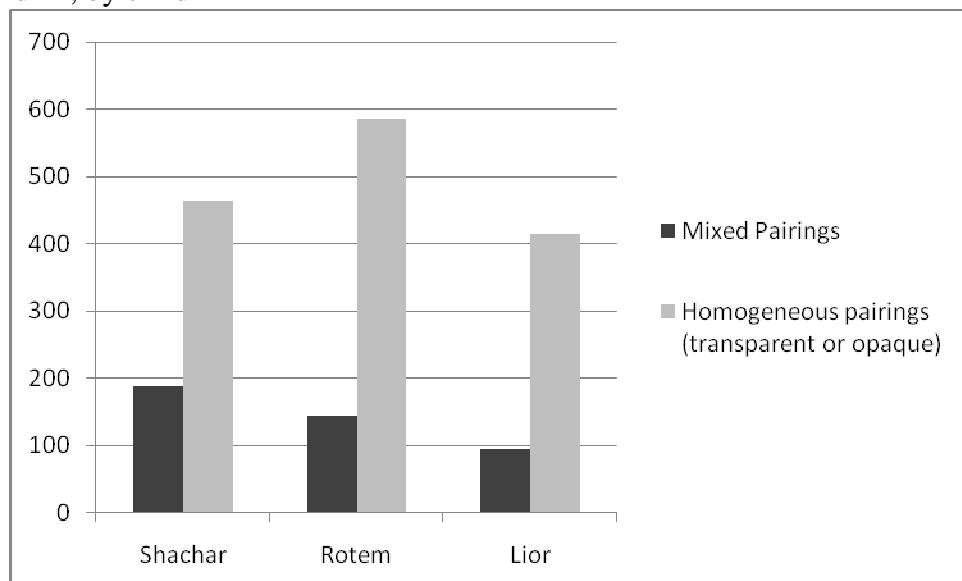


Figure 6 shows that all three children used far more homogeneous than mixed pairings: Shachar uses only 188 mixed pairings compared with 464 homogeneous pairings during Phase II and III. Rotem uses 144 mixed pairings, compared with 585 homogenous pairings, and Lior uses 96 mixed pairings, compared with 414 homogeneous pairings.

Statistical analysis by means of a chi-squared test was conducted on these Verb+NSC combinations (a total of 1,668 pairings), to ascertain whether and how the variable of inflectional transparency has an effect on its co-occurrence in the same utterance with transparent versus opaquely marked NSCs. Figure 7 shows the distributions of transparent and opaque verb forms in co-occurrence in the same utterance with transparent versus opaque prepositional marking, for all three children.

**Figure 7.** Distributions of transparent and opaque verb forms in co-occurrence with transparent versus opaque prepositional marking, during Phases II and III, by child

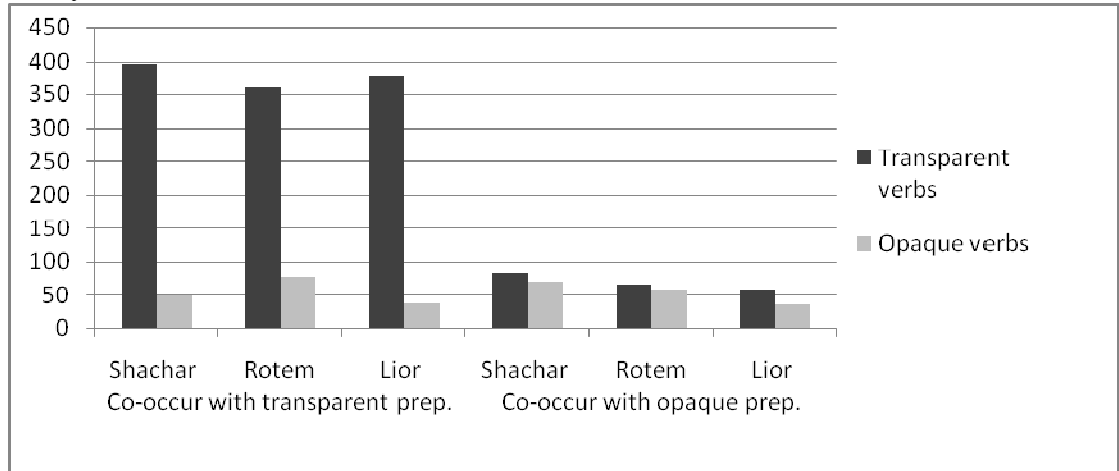


Figure 7 depicts a similar picture for all three children, such that the proportion of transparent verb forms in co-occurrence with transparent prepositional marking is much higher than in co-occurrence with opaque prepositional (non-)marking: 89% (=395/444) compared with 55% (=83/152) for Shachar; 82% (=360/438) compared with 53% (=66/124) for Rotem; and 91% (=379/416) compared with 63% (=59/94) for Lior. A chi-squared test reveals a significant effect for transparency of prepositional marking for all three children (for Shachar:  $\chi^2(1, N=596) = 84.185, p < .0001$ ; for Rotem:  $\chi^2(1, N=562) = 44.204, p < .0001$ ; and for Lior:  $\chi^2(1, N=510) = 50.79, p < .0001$ ).

In sum, findings from this analysis of convergences reveal a consistent pattern for all three children, in which transparent prepositions are significantly more likely to co-occur in the same utterance with transparent rather than with opaque verb forms. These results are discussed in the next chapter as reflecting between-domain interfaces in the acquisition of early Hebrew clause structure.

## CHAPTER IV – DISCUSSION

This concluding chapter opens by summarizing the findings presented in Chapter III for the developmental patterning of the grammatical systems considered in the study – verb inflection, predicate constituency, NSC marking (Section 4.1). The implications of these results are then discussed in terms of the impact of the psycholinguistic factors of productivity and transparency and the typology of Hebrew on early grammatical development (Section 4.2), insights derived from analysis of between-domain interrelations in the acquisition of simple-clause structure (4.3); and the role of linguistic interfaces in child language as reflected in children’s naturalistic speech output (4.4). The chapter concludes by commenting on directions for further research arising out of the study (4.5).

### 4.1 Summary of Findings

The language usage of three Hebrew-acquiring children sampled between ages 1;4 to 2;5 showed a gradual transition from pervasive opacity via initial productivity to full transparency in verb inflection across three developmental phases. These phases also revealed a concurrent gradual transition between pervasive non-marking of non-subject verb-associated constituents (NSCs) via juvenile partial marking to fully explicit marking of verb-NSC relations. Phase I differed from the two subsequent phases in that it gave no evidence for productive usage of either inflectional morphology or verb-NSC combinations. Productive inflections and verb-NSC combinations, first identified in Phase II, provided the basis for two further analyses of within-clause interdependencies, both of which revealed statistically significant correlations for all three children. One such analysis – conducted on forty lexemes shared by the three children – revealed that morphologically opaque verb forms were significantly less likely to occur in syntactically isolated environments, that is, without accompanying NSCs, than was the total proportion of verb-forms occurring in such environments. A second inter-domain analysis on all verb-containing utterances in syntactically non-isolated environments, that is, that included at least one NSC, revealed that transparent NSC-marking prepositions co-occurred in the same utterance at consistently higher rates with morphologically transparent than with opaque verb forms, again, significantly for all three children.



The developmental trajectories revealed by the study are discussed below in relation to the more general notion of phases in acquisition and of consolidation of linguistic knowledge across time, while implications of the inter-domain dependencies emerging from the data are considered in relation to the role of linguistic interfaces in early child grammar.

## **4.2 Psycholinguistic Facets of Early Grammatical Development**

As noted in the Introduction (Chapter I), research on the acquisition of verb inflection and case-marking in various languages reveals a gradual developmental progression in these as in other domains, with some grammatical categories emerging and consolidating earlier than others (on inflections – Dressler & Karpf, 1995, Christofidou & Stephany, 2003; on NSC marking – Tomasello, 1987; Wittek & Tomasello, 2005). A key source of controversy in this connection is the relative weight attributed to innate knowledge as against the impact of target-language input (Bowerman & Choi, 2001; Slobin & Bowerman, 2007). In what follows, it is argued that, while in some respects the order of acquisition of grammatical categories is shared across children and languages, it will in many cases be shaped by factors particular to the typology of a given ambient language – as demonstrated in the present instance by the domains of Hebrew verb-inflection and prepositional case- and adverb-marking.

Below, the notion of bridging categories is presented as a means for children's breaking into grammatical systems in general (Section 4.1.1), with specific reference to the status of particular subsystems in specifying developmental phases in early Hebrew acquisition (4.1.2), and individual differences in the strategies favored by children in the transition from one level of grammatical knowledge to another (4.1.3).

### **4.2.1 Bridging Categories**

The notion of “bridging categories” emerging from this study is presented here as characterizing the forms children select as their preferred means for breaking into a particular grammatical system. Typically the most neutral or least marked items in a given linguistic category, which elements can or will serve as “bridges” in language acquisition depend on the interrelated factors of: ambient language typology, the repertoire of forms available in a particular grammatical subsystem, and children’s current state of knowledge. Consequently, what children select as bridging forms may

take the shape of unmarked, non-adultlike forms (such as truncated bare verb-stems or filler-syllable prepositions) or else conventional forms that are the least marked within a given subsystem of the grammar (e.g., *benoni* intermediate forms of Hebrew verbs and conventionally unmarked NSCs). Instances that emerged as “bridging categories” in the current study are discussed below for verb inflection (Section 4.1.2.1) and NSC marking (4.1.2.2).

#### *4.2.2.1 Non-Finite Verb Usage*

Research has shown acquisition of Hebrew verb-inflection to demonstrate a gradual developmental route, with children consistently preferring some categories over others in their early grammars (Berman & Dromi, 1984, Armon-Lotem, 2006, Ninio, 1999b). The present study went beyond such analyses to identify children’s initial verb usage as falling into three well-defined phases. Importantly, the first two of these phases (Tables 8 and 9 in the preceding chapter) can be seen to reflect two consecutive levels of “**non-finiteness**” – in the sense of verb-forms that are not marked for tense (Lustigman, 2012). Initially, children employ non-affixed stem-like forms, with choice of what constitutes a “verb stem” governed by the structural options of the ambient language. In a richly inflected language like Hebrew (in contrast to English or French, for example) these are typically not forms that occur as verbs in the adult language, yet they are not a mere epiphenomenon, either, but a robust feature of early child Hebrew (Berman & Armon-Lotem, 1996; Adam & Bat-El, 2008). As non-adultlike in surface shape, these uniquely “child-constructed” forms constitute powerful evidence for early emerging typologically conditioned knowledge of language. As noted above (Section 3.1.2), the construction of bare verb stems is morphologically rather than phonologically motivated, as both stressed and unstressed affixes are omitted; and, during the same developmental period, children produce many di- and even trisyllabic (non-verbal) forms (Adam & Bat-El, 2008). A further important attribute of such items – explicitly observed for the first time in the present study – is that, since their target forms are often ambiguous or unclear, they are eligible for use in a variety of word-combining syntactic contexts. These properties mean that bare-stem verbs provide Hebrew-acquiring children with a “bridge” for breaking into verb production at a stage when they do not yet possess the required command of inflectional morphology to mark verbs more explicitly for tense/mood as well as for agreement in number, gender, and/or person (see Table 1 in Chapter I).

Bare stems do, however, reveal sensitivity to structural facets of verb-formation in Hebrew: They typically conform to the syllabic structure of one of the five prosodic templates of the *binyan* system of verb-pattern morphology; and they consistently involve truncation of external affixes (both prefixes and suffixes), while preserving the stem consonants, so revealing sensitivity to morpheme boundaries (Adam & Bat-El, 2008). That is, although the verb-stems of early Hebrew do not involve paradigmatic inflection they are consistent with structural constraints on verb-formation in the language.

The second phase in verb usage demonstrates initial productive use of inflectional affixes, gradually (but not completely) replacing bare stems, in the form mainly of Infinitives and *benoni* verbs, which at this stage of development far exceed Past Tense and Imperative/Future forms in distribution (Table 9 in the previous chapter). This preference for infinitival and *benoni* forms can be attributed to the “neutral” status of these two categories in both grammatical and pragmatic terms. Thus, Infinitives are morphologically invariant and semantically multifunctional forms that serve a range of irrealis functions (imperatives, prohibitions, conditionals, subjunctives) which enable Hebrew-acquiring children to express various non-reportative communicative purposes (Berman & Nir-Sagiv, 2004). Similarly, the Hebrew-specific *benoni* ‘intermediate’ category is structurally neutral; it is inflected like Nouns and Adjectives for Number and Gender but, unlike verbs in Past and Future, not for Person; in terms of finiteness, it thus contrast with the person-marked “plus tense” categories of Past and Future, having the special status of a “zero tense” category of verbs (Berman, 1978a); and semantically, the *benoni* expresses both immediate and extended Present as well as a range of adverbial and complement-type participial functions (Berman & Neeman, 1994; Gordon, 1982). Taken together, Infinitives and *benoni* forms thus provide Hebrew-acquiring children with typologically well-motivated means of transition from unspecified non-affixed bare-stems via these two partially specified categories and on to fully finite verb inflection, specified for tense as well as person (Lustigman, 2013).

In cross-linguistic perspective, generalizations derived from this Hebrew-based study are suggestive for how non-finite verb forms are integrated into early grammar in general. On the one hand, language-specific properties account for initial non-finite stem forms in Hebrew, both those that mirror and those that diverge from target forms. On the other hand, Hebrew is not the only language that lacks an

unequivocally unmarked base form of verbs like English *cry*, *eat*, or *open*. As noted in the Introduction (Section 1.2.1), some so-called “root infinitive” (RI) analyses propose that children acquiring such languages rely heavily on infinitival forms in their early verb usage in “RI languages” like Dutch or German (e.g., Wijnen, 1998), or else they skip a non-finite RI stage, using inflected forms right from the start, as in Spanish or Italian (e.g., Rizzi, 1993/1994). Preliminary examination of relevant samples in other languages – based on phonetically transcribed and morphologically coded data from Spanish, Italian, and Dutch (MacWhinney, 2005) supplemented by analyses from published articles on Arabic and Greek – suggests that, in fact, children acquiring both types of languages, like their Hebrew-acquiring peers, rely on stem-like forms in their initial verb output. Interestingly, two of the most well-studied languages, English and French, fail to provide relevant evidence for or against the notion of non-finiteness in early verb usage argued for below. **English** constitutes a special case in this respect, since it provides children with an unequivocal adultlike stem form in the base form of verbs, as a readily accessible “neutral” option. On the other hand, since adults’ English also includes numerous non-inflected verbs, reliance on the base forms of verbs in itself fails to provide evidence for or against children’s developing knowledge of inflection. And early verbs in **French** also emerge as non-relevant in this respect, since the fact that the Infinitive-marking final *-r* is not pronounced makes it unclear whether and which of the verb-forms produced by French-acquiring children are or are not inflectionally affixed at all.

Examination of early **Spanish** verb forms from the Ornat and Aguirre corpora on CHILDES (<http://chil提高.psy.cmu.edu/data>) indicates that many forms in children’s speech analyzed as Infinitival (on the %mor tier) were in fact truncated stem-like forms lacking the adult infinitival *r*-final suffix (e.g., *bubí* for *subír* ‘go down’; *tomá* for *tomar* ‘take’). In two months (ages 1;7 – 1;9 ) of verb productions by the girl Maria in the Ornat corpus, 30 out of 43 verb forms (70%) took the form of non-affixed stems, ambiguous between (at least) 3rd Person Singular and infinitival forms without the infinitival *-r* suffix. For example, *apa* [Maria, 1;8] could stand for either *tapar* ‘to-cover’ or *tapa* ‘covers’; *aca* [Maria, 1;7] for either *secar* ‘to-dry’ or *seca* ‘dries’; while the form *ven* [Maria, 1;8] could be the stem of several paradigms of the verb *venire* ‘to-arrive’. The same pattern of preference for non-fully affixed stems could be observed for **Italian** verbs in the Antelmi corpus on CHILDES: Out of 49 verb forms of the girl Dian, between ages 1;8 – 1;10, 14 appeared rote-learned

(e.g., *vóio* for *vóglío* ‘want:1ST:SG’ [Dian, 1;8]), another 8 appeared to be inflectionally affixed (e.g., *levo* ‘take-off:1ST:SG’; *puscisce* for *pulísce* ‘cleans’), while over half (27 =55%) were ambiguous truncated stems (e.g., *tude* for *chiúdere* ‘to-close’ or *chiúde* ‘closes’ [Dian, 1;8]; *mangia* for either *mangiáre* ‘to-eat’ or *mángia* ‘eats’ [Dian, 1;10]; *piange* for either *piángere* ‘to-cry’ or *piángo* ‘cries’ [Dian, 1;10]). Relatedly, a look at early **Dutch** verbs from the Schaerlaekens’ corpus on CHILDES revealed that 11 of the 12 verbs used in a single session [Arnold, 1;10] were either in the form of truncated Infinitives, without the infinitival suffix *-en* (e.g., *insteke* for *instéken* ‘insert’; *pele* for *spélen* ‘play’; *ompappe* for *omláppen* ‘lap’) or of adultlike stems (e.g., *bijt* ‘bite’, *pak* ‘take’)

As for children acquiring **Greek**, a language that has no infinitival form, Hyams (2005) suggests that they use “bare perfective” forms as their early verbs (e.g., *pezi* ‘play’, *kupisi* ‘wipe’), which she interprets as ambiguous between bare participles (lacking a required auxiliary) and bare 3rd Person Singular perfective verbs (lacking the obligatory Tense/Modal morphology). As such, these may also be considered juvenile stem-like forms that are not fully specified in terms of their inflectional features.

Consider, finally, evidence for use of nonfinite verb forms in **Arabic**– whose verbal paradigm is similar to that of Hebrew, since Arabic verbs are also formed in a set of similarly constrained morphological verb-patterns or prosodic templates – but which differs from Hebrew and many European languages since it lacks a form corresponding to the infinitive. In her study of three children acquiring Kuwaiti Arabic, Aljenaie (2010) shows that they all used what she termed a “default form” in the shape of a truncated imperfective bare stem (e.g., *tiih* instead of *it-tiih* ‘falls/will-fall’) along with the non-affixed 3rd Person Masculine Singular Past form (e.g., *raaħ* ‘went’). The few examples provided in her study closely resemble the bare stems documented in this and other studies for Hebrew-acquiring children’s early verb usage.

These cross-linguistic observations together with the Hebrew analyses of the present study shed fresh light on the general issue of **non-finiteness** in early child language. Evidence from different sources indicates that in their early verb usage, children acquiring quite different languages are guided by an initial preference for stem-like forms, with the particular type of stem they adopt dependent on the target language. In English, where stems are available in the input, children will use them

“as is” as their early non-finite forms. In languages like Spanish, Italian, Greek, Arabic, or Hebrew and, to some extent, Dutch, children will use truncated bare stems along with available adultlike non-affixed stem-forms (typically 3rd Person Masculine Singular).

Hebrew’s rich system of verb inflections makes the task of language-acquiring children more similar to that of their peers in languages like Spanish or Italian than English or Dutch. However, since Hebrew lacks auxiliary verbs, children are not exposed to stem-like forms in “compound finite” strings resulting from Aux-inversion, such as (*will*) *daddy go*, (*does*) *it work* (Freudenthal, Pine, & Gobet, 2006, 2010). The fact that Hebrew-acquiring children rely on non-finite forms over a relatively long period thus cannot be accounted for by statistical learning based on the input language or parameter-setting, as suggested, for example, by Yang (Legate & Yang, 2007). Rather, Hebrew nonfinite verb usage and verb acquisition in general represents a special instance of a more general pattern of acquisition in which children’s command of grammatical structures proceeds along a lengthy developmental route from emergence to mastery of linguistic knowledge in various domains (Berman, 1986a, 2004; Berman & Slobin, 1994). In the case at issue here, the typology of the ambient language affords Hebrew-acquiring children a variety of options in selecting non-finite verb forms, even though – or possibly just because – its verb-system is so inflectionally rich. In the absence of a single unequivocal base form of verbs, children construct their own system of typologically well-motivated, though non-conventional bare-stem forms that they can use in a variety of syntactic environments. As a result, Hebrew emerges as a language where children’s use of forms defined as “non-finite” (in that they lack tense-marking) involves a more gradual and fine-grained process of acquisition than in languages with clearly “basic” or unmarked forms of verbs. In both language-particular and cross-linguistic terms, then, L1 learners’ Hebrew constitutes an interesting test-case for non-finiteness, in proceeding from initial reliance on bare stems reflecting sensitivity to target-language morpho-phonological structure (in Phase I) to paradigmatically-based preference for the more conventional, yet inflectionally neutral categories of *benoni* and infinitives (in Phase II), before progressing to fully specified verb inflection.

Developmentally, use of stem-like forms as a strategy for breaking into the verb system in different languages reflects the more general transition from “child-speaker” to “native speaker” (Berman, 1993a; Slobin, 1990). Reliance on stem forms

constitutes a juvenile feature of early language use that interacts with children's concurrent attentiveness to the structural specifics of the ambient language, such as types of stems, stem allomorphy, and location of affixes. Moreover, as shown by the Hebrew data in this study, stem forms from early on occur not only in isolation, but also in combination with other clausal elements. The fact that syntagmatic combination precedes productive paradigmatic inflection indicates that non-finiteness plays a role not only in breaking into verb-internal morphology, but also in early phrase- and clause-structure. The structural, and often also semantic, non-distinctiveness of non-finites (here, bare stems, infinitives, and present-tense forms) qualifies them uniquely for use in a range of syntactic contexts, conferring on non-finite verb forms a bridging function in acquisition, and making non-finiteness a typologically constrained, possibly necessary feature of early child language.

#### 4.2.2.2 *Non-Marking of Syntactic Relations*

Similarly to acquisition of verb-inflection, development of verb-NSC relations exhibited reliance on two main types of partial or non-marking strategies en route to adultlike use of prepositions (Section 3.1.3): Juvenile usages – in the form of omissions of obligatory prepositions, ungrammatical use of prepositions, and filler syllables – and conventionally unmarked NSCs – in the shape of simplex adverbs or indefinite direct objects. Juvenile prepositional usages are opaque since they lack a clear, unambiguous structural target, analogously to the child-constructed opaque bare stems. Conventionally non-marked NSCs, in contrast, provide children with an adultlike means of using NSCs, available “as is” in the target language, and as such, they correspond partially to the neutral, inflectionally relatively unmarked *benoni* and infinitival verb forms.

Recall that Phase I included mainly verbs occurring in isolation (Section 3.1.2). The few instances that did involve some accompanying NSCs were typically opaque, with only three cases of explicit prepositional marking by accusative-marked pronouns, all in the uniquely non-inflected pronominal context of *et ze* ‘ACC this ~ it’ (cf. *et hu* ACC he = *oto* ‘him’, *et ani* ACC I = me’). In other words, non-marking of NSCs by prepositions during this initial phase can be seen as analogous to non-marking of verb stems by inflectional affixes during the same period of development. Phase II manifested wider use of verb-accompanying NSCs, in all three categories – explicitly marked, conventional unmarked, and juvenile – with unmarked adverbs and indefinite

Direct Objects predominating (Table 12). Subsequently, Phase III shows a sharp drop in opaquely juvenile usages in clause-level syntax accompanied by a less marked decrease in use of unmarked NSCs (simplex Adverbs and Direct Objects), and a concurrent favoring of explicitly marked NSCs (Table 13).

Similarly to what emerged for word-level verb inflection, lexico-syntactic marking of clause-level verb-NSC relations reveal two favored **bridging categories** in the transition from isolated verbs to fully specified verb-NSC syntax. Initially, Phase I juvenile usages like filler syllables or omission of prepositions serve this purpose, similarly to, although far less pervasively than the opaque truncated forms of verbs. This is followed, in Phase II, by simplex adverbs and indefinite Direct Objects as a favored, unmarked but adultlike means for performing an intermediate, transitional function in marking verb-NSC relations, analogously to the neutral non-tensed *benoni* and infinitive forms of verbs. That is, in both domains, two consecutive strategies – the first, juvenile, the second conventional but restricted – serve as bridges between the non-specification of pervasive non-marking in Phase I and the full specification of transparently explicit marking in Phase III.

Verb-inflection and prepositional NSC marking in Hebrew can thus be seen as following analogous developmental routes in terms of bridging strategies. Acquisition of the two domains differs, however, in the shift from opacity in Phase I to full transparency in Phase III – defined as such by verb-form usage (Section 3.1). Lexico-syntactic NSC marking, in contrast, does not achieve full transparency even in Phase III, although it is far less common and more sporadic at this point in development for all three children. The relative “lag” in attainment of mastery in NSC-marking compared with inflection appears surprising, given the paradigmatic complexity and rich variation in form and distribution of Hebrew verb inflections (Section 2.3.1). On the other hand, the system is typically transparent and quite regular in terms of the grammatical categories of tense and agreement which it involves (Berman, 1985; Dromi et al, 1999; Schwarzwald, 2002). In contrast, prepositions – in Hebrew as in other languages – tend to be syntactically and semantically multifunctional, often having quite idiosyncratic senses. That is, taking into account the three dimensions noted by Peters (1995) involved in the acquisition of grammatical morphemes – phonological shape, distribution, and function – prepositions constitute a particular challenge for children from the point of view of their often idiosyncratic, highly varied, and semantically unmotivated **uses** in a given language. This is particularly so



in the case of the highly multifunctional and fused “basic” prepositions of Hebrew – *be-* ‘in, at’, *le-* ‘to, for’, *me-* ‘from, of’, *ke-* ‘as, like’ (Nir & Berman, 2010), while the pervasive, but largely unpredictable prepositional marking of oblique objects in the language constitutes a heavy learning burden for young children and in part, unlike inflections, depends on lexically specific knowledge and accumulation of a “critical mass” of verbs as items of vocabulary (Berman, 1985; Marchman & Bates, 1994).

In spite of this essential difference between the nature of grammatical inflection, on the one hand, and of lexico-syntactic NSC marking, on the other, these two major means of specifying clause-internal grammatical relations in Hebrew reflect largely similar overall developmental underpinnings. In both cases, children start by relying almost exclusively on juvenile non-marked elements (truncated verb forms, filler syllables, omissions, or substitution of preposition) for initially breaking into the grammar. Subsequently, at a period when opaque juvenile forms continue to be used while transparently marked forms first emerge, both domains reveal a shift to major reliance on “neutral” less marked categories (*benoni* and infinitival verb forms / simplex adverbs and indefinite direct objects) as more advanced bridges to fully specified grammatical marking. Each of these bridging strategies shows a particular sensitivity to target language typology – initially structural and subsequently categorial. At first, in acquiring **combinatorial structure**, children identify morpheme boundaries by distinguishing stems from affixes in constructing bare-verb forms and by specifying prepositional slots through omitting prepositions or using fillers NSC syntactic contexts. In fact, extensive prior reliance on non-marking may be necessary to pave the way for acquisition of grammatical structures, serving to delineate the core elements that need to be elaborated (verb stems and noun phrases) and helping locate the slots by which they are elaborated (inflectional affixes and prepositional markers). Further, the fact that bare verb stems that are not available as such in CDS are highly consistent across children and across morphological classes of verbs provides evidence that children arrive at generalized knowledge of the linguistic structure of the ambient language early on in their grammatical development (Bowerman & Choi, 2001). This phenomenon in Hebrew child language points to the combined impact in acquisition of usage-based principles, on the one hand, and of sensitivity to structurally motivated “typological imperatives”, on the other (Berman, 1986b). Interestingly, the type of truncation applied in the case of Hebrew “bare stems” does not occur in children’s use of other classes of lexical items at this

developmental stage. As such, the “bare stems” phenomenon can be taken to reflect the morphological distinctiveness of verbs compared with other major lexical classes in the language (Berman, 1988; in press). Subsequently, in acquiring **paradigmatic categories**, children will prefer the least marked, most neutral categories available in their language – non-tensed verbs and non-prepositionally marked NSCs – as a bridge to fully specified systems of morphological and lexical alternations respectively.

These cross-domain transitions from opaque (non-)marking to transparent specification of grammatical categories provide the basis for re-evaluation of the notion of phases in early language development.

#### 4.2.2 Developmental Phases

Three developmental phases were defined in the children’s speech output on the basis of the two related psycholinguistic principles of structural transparency and productivity of use. All verbs and prepositions in the data-base – the linguistic forms selected for this study as critical for realizing clause-internal grammatical relations – were designated as **transparent** just in case they were identified as having a single, unambiguous grammatical target (Section 2.3.2). Usages were defined as **productive** just in case they were grammatically required by the linguistic context in which they occurred, by criteria defined specifically for this purpose (Section 2.3.3).

The transitions from opacity to transparency and from non-marking to productive usage emerged as consistent across the three children. This robust finding indicates that these are related processes which apply to the issue of how children approach the task of acquiring new grammatical systems in general. For example, in the present context, the criteria of transparency and productivity, which at first were confined to the domain of verb-inflection in stipulating developmental phases, turned out to constitute a developmental yardstick with regard to the ostensibly unrelated issue of children’s use of prepositions for NSC marking. Acquisition of prepositions, too, reflected clear-cut developmental shifts, parallel to what had been found for verb-inflections – both quantitatively, in number of explicitly marked NSCs, and qualitatively, in lexical diversity and appropriateness. Taken together, these findings suggest that developmental phases in other domains than those considered in this study, as well as later-developing facets of linguistic knowledge might usefully be re-analyzed in terms of the transition from opacity to transparency. Three examples from the very different domains of derivational morphology, clause-combining, and

narrative syntax are noted here in relation to prior research on later developments in acquisition of Hebrew. First, in the domain of derivational *binyan* **verb-pattern morphology** in Hebrew as described by Berman (1980, 1982, 1993a,b; and see, too, Raz-Zalberg, 2009), children's initial verb usage is fully opaque, with no alternation of a given consonantal root from one morphological pattern to another; subsequently, *binyan* patterns are partially specified by means of a bridging strategy of alternations across pairs of several high-frequency verbs (e.g., from the root *š-b-r* both Intransitive, change-of-state *nišbar* and Transitive *šavar* 'broke', from the root *`-k-l* *axal* 'ate' and Causative *he'exil* 'fed') coupled with a leveling of transitivity values in inappropriate syntactic contexts; only rather later, beyond age 3 years, the shift to productive knowledge is manifested by children's "creative errors" by alternating *binyan* patterns in structurally appropriate but lexically unconventional ways (e.g., Causative *\*kiten* in place of *hiktin* 'make small' from the root *q-t-n* in the adjective *katan* 'small') or by combining verb roots and *binyan* patterns to coin lexically innovative but structurally well-formed items (e.g., Causative *\*le-hošin* 'put-to-sleep' from Intransitive *lišon* 'to-sleep'); fully productive and transparent usage is established only by late preschool age, around age 5 years, evidenced by appropriate use of verb root plus *binyan* pattern combinations in all and only required syntactic as well as lexico-semantic contexts. A very different domain that is also acquired rather later than the topics considered here is that of syntactic **clause combining**, where at first, children omit obligatory connectivity markers or use opaque general purpose connectives, en route to fully transparent specification of inter-clausal relations (Berman & Lustigman, in press). As a third example, it has been observed that in formulating inter-clause relations as a function of developing **narrative** abilities, young preschool children's usage is typically opaque, since at first they fail to employ overt markers of temporal or causal relations between events; once they begin to use lexical connectors for this purpose, a particular form (typically marking temporal sequentiality, such as Hebrew *ve-az* 'and then', *axrey ze* 'after that') tends to be preferred as a default, transitional means for connecting events; this is only subsequently replaced by a more varied array of connectors; and it takes well into school-age until children can organize their narratives around a top-down global "action structure" required for using lexical connectives in order to organize the flow of ongoing information to meet the function of narrative syntactic packaging (Berman, 1995; Berman & Neeman, 1994; Shen & Berman, 1997).

Such findings from diverse areas in the development of linguistic structure and language use in Hebrew are consistent with observations from different grammatical domains in other languages. For example, acquisition of auxiliaries in English (a clause-internal system that has nothing analogous in Hebrew grammar), as detailed by Richards (1990) and elaborated by Lieven (2008), is shown to progress from initial total omission of auxiliaries, via unanalyzed amalgam-like use of such elements, followed by a relatively lengthy period of productive use concurrently with frequent omissions but without “errors of commission” (and see, too, Bloom, Lightbown, & Hood, 1975; Klima & Bellugi, 1966; Pinker, 1984; Valian, 1991). These corresponding trends from vastly different areas of linguistic structure and use point to a shared cross-domain developmental route of recurrent phases in language acquisition. Each time anew, children start out their entry into a system by resorting to use of largely opaque unmarked forms – either child-constructed or selected from the available repertoire in the ambient language; as development proceeds, at an intermediate stage of knowledge, children supplement opaque usages by transparently marked constructions, with a preference for conventional, but more structurally neutral forms; eventually, the forms they use manifest full transparency, hence representing command of a given domain in the target language. Adapting for present purposes how Slobin (1980) characterized the changing nature of form-function relations in human language in general, the present analysis can thus be seen as highlighting “the repeated transition from opacity to transparency” in child language acquisition.

#### 4.2.3 Individual Differences

The three children in the study demonstrated broadly shared developmental trajectories. Yet they also reflected individual differences in the strategies they preferred in moving from non-marking to full transparency in acquisition of simple-clause grammar. The phenomenon of individual differences in children’s use of transitional strategies as noted in the literature (Bates et al, 1994; Lieven, 1997; Lieven, Pine, & Dresner-Barnes, 1992; Peters, 1977) is relevant to the notion of opacity, as a feature of child language that is by definition juvenile and hence transitional. As noted, children breaking into new systems of knowledge will rely on different strategies – typically yielding “opaque” output forms – in order to make use of linguistic constructions before their grammatical knowledge is fully established. In

the case in point, well-formed Hebrew clause-construction involves choice of verb forms – typically by inflections – and combining verbs with non-subject constituents (NSCs) – typically by prepositions. Lacking the paradigmatic and syntagmatic means necessary for appropriate marking in these two domains, children resort to two main types of interim strategies: “creative” use of non-adultlike constructions with partial or no marking, and “rote-learned” use of unanalyzed adultlike amalgams. The creative versus rote-learned distinction in a sense reflects the contrast between “analytic” and “holistic” or “Gestalt” styles of acquisition defined for other domains, such as vocabulary acquisition (Bates, Dale, & Thal, 1995) and the transition from single- to multi-word utterances (Nelson, 1981; Peters, 1983).

All three children in the present study employed both options, in line with what has been shown for use of transitional strategies in similar combinatorial domains in acquisition of English (Bloom, 1970; Peters, 1977; Pine & Lieven, 1993). Yet each child selected one of the two strategies as predominant across both inflectional and prepositional usage. Thus Shachar and Rotem tended to rely markedly more on “creative” (mis)usages while Lior made far heavier use of rote-learned constructions. For verbs, Shachar and Rotem used more non-adultlike, so “creative” bare stems, while Lior used more rote-learned affixed forms; for prepositions, Shachar and Rotem used relatively more “creative” fillers and omissions, while Lior used more rote-learned preposition plus fused pronoun forms or else substitute prepositions. Rote-learned usages are often hard to identify, since they appear to be appropriate in certain contexts, so that some of Lior’s rote-learned forms may have been over-interpreted as “transparent” usages. Besides, Lior evidently relies relatively heavily on rote learning in general, since in her strategies for clause-combining, she also tended to use connectives like those meaning ‘and’, ‘that’, and ‘because’ in an unanalyzed fashion (Berman & Lustigman, in press). Children’s favoring of a particular transitional strategy across different domains (inflectional morphology, prepositions and, possibly, clause-combining) suggest that they may indeed adopt across-the-board individual preferences in shifting from one level of linguistic knowledge to another, regardless of the grammatical system and even of the developmental period at issue.

### 4.3 Inter-Domain Convergences

The developmental trends in moving from opaque to transparent marking formed the basis for two further analyses of inter-domain convergences, between verb inflection on the one hand, and the two domains of predicate constituency and prepositional NSC marking, on the other. Since fully transparent grammatical marking is interpreted here as the hallmark of consolidated linguistic knowledge, and verbs are the core element around which clause-structure revolves, the variable of inflectional opacity/transparency in constructing verbs was taken as a pivotal factor in acquisition of early clause structure. This is particularly the case in a language like Hebrew, in which verbs are richly inflected for a variety of grammatical categories and which, moreover, allows numerous impersonal subjectless constructions (Berman, 1990, 2011). As such, verb-inflection constitutes a well-motivated pivot for analysis of between-domain linguistic interfaces in this study, discussed below in terms of the relation between opaquely truncated verb stems and their associated NSCs (Section 4.2.1) and between verb inflection and prepositional marking (4.2.2).

#### 4.3.1 Verb Inflection and Predicate Constituency

The syntactic environment of opaque verb forms was analyzed in terms of their associated NSCs on the assumption that verbs and NSCs together constitute the clausal predicate (see Section 1.2.2). As noted in the introduction, the co-existence of inflected alongside non-finite forms of verbs, sometimes even of the same lexeme, is accounted for in Root Infinitive (RI) analyses by the “optionality” of functional categories in child language, as represented in their grammar or as realized on the surface (e.g., Wexler, 1993; Wijnen, 1998). This period corresponds to Phase II and III in the present analysis, in which transparent marking occurred side by side with opaque usages. Distribution of non-finite verbs during this “optional” period, specified by occurrences of 40 verb lexemes shared by the three children, revealed the following trends: In Phase I, almost all opaque verbs occurred in isolation, without associated NSCs, (Table 15); whereas from Phase II and on to Phase III, all three children used opaque verbs at significantly lower rates in isolation compared with their overall use of syntactically isolated verbs (Figure 5).

From the point of view of predicate constituency in children’s early clause structure, these differences in the distributional trends of opaque verbs before and after the onset of Phase II suggest that once productive verb-inflection emerges in

children's speech, opaque verb forms become "reserved" for more elaborated predicate environments. As discussed above (Section 4.1.1), opaque forms are uniquely flexible and neutral in character, since they are indistinguishable between several possible targets. The developmental function of opaque verbs appears, however, to change once productive morphology emerges. While initially, use of forms that are inflectionally opaque enables children in Phase I to start producing verbs before they have otherwise necessary paradigmatic knowledge, subsequently, in Phases II and III, these same opaque items alter their role as a flexible means of breaking into early clause structure. In other words, inflectional opacity turns out to be **functionally vague** not only in terms of the paradigmatic form of verbs, but also in relation to possible clause-based syntagmatic combinations. The fact that opaque verb forms occur relatively more in combination with NSCs than do their transparent counterparts suggests that, syntactically, opaque verbs serve to mediate Subject-NSC relations. This is because, as long as they fail to specify Subject-Verb Agreement by inflection, children are free to associate verbs more flexibly with other, non-subject clause constituents. In other words, in the transitional stage of **optionality** in marking grammatical relations, inflectionally opaque verb forms constitute a useful means of "gluing" together parts of a clause, analogously, say, to vague uses of the connective 'and' in early child discourse (Berman, 1996; Peterson & McCabe, 1988). More generally, the co-occurrence of inflected and uninflected verbs during the so-called "optional infinitive" stage (Sections 1.2.1 and 4.2.2.1) can be interpreted as an interim period in children's grammatical acquisition in different languages. In the corresponding period of Phases II and III of the present study, the tendency of children who use both inflected verbs and opaque "bare-stems" to employ the latter significantly more in "non-bare" syntagmatic environments – that is, followed by overt NSCs – points strongly to a differential distribution of inflected versus uninflected verbs in early Hebrew. This in turn suggests that, with the onset of productive inflection, opaque non-finiteness may, in general, not be random but sensitive to syntactic clause contexts.

#### 4.3.2 Verb Inflection and NSC Marking

The second interface – between verb inflection and prepositional marking of NSCs – sheds further light on children's progress in grammatical marking of clause-internal relations. Relevant analyses of the correlation between transparent inflectional

marking on verbs and transparent prepositional marking on NSCs (Section 3.2.2) took into account three categories of NSC markers: (1) explicitly marked NSCs (Table 5-a), (2) non-marked but adultlike NSCs with indefinite Direct Objects or simplex adverbs (Table 5-b); and (3) inappropriately juvenile (non-)marked NSCs including preposition omission or substitution and filler syllables (Table 7). These are taken to represent three levels of transparency, as follows. The first type of constructions are interpreted as “transparent”, since they provide clear, unambiguous evidence of the child’s knowledge; the second are “vague” since the fact that they conform with conventional adult usage may but need not be based on grammatical knowledge; while the third group are “opaque” since their target forms are ambiguous. The analysis of convergence between NSC prepositional marking and Verb-inflection, took into account only clearly transparent and clearly opaque forms as indicative of either full or partial knowledge of NSC marking, with the second group of conventionally non-marked items discounted as not providing criterial evidence in this respect. The finding which emerged was that children’s use of transparent prepositional marking correlated significantly with their use of transparent verb forms since, once a given utterance contained transparent NSC marking, it was significantly more likely to also contain a transparent verb inflection than if it contained a juvenile NSC (non-)marking, on the one hand, while the latter tended to occur more with opaque verb forms, on the other (Figure 7).

This clause-internal correlation between transparency in the two domains of verb inflection and NSC marking suggests that transparency in one domain may promote concurrent transparent marking in the other domain as well. This convergence is not *a priori* obvious since, in terms of cognitive load, a converse pattern could have been predicted (see the predictions in Section 1.5 above): In situations where one domain is marked explicitly (say, by use of transparent NSC marking), children might be expected to attend less to the other (in this case, by leaving verbs unmarked inflectionally). It appears, however, that in contrast to the prediction in Section 1.5 the lack of opaque+transparent pairings indicates that there is in fact no “trade-off” between verb inflection and prepositional marking. On the contrary, the statistically significant finding of the study was that transparent prepositions “prefer” transparent inflections and vice versa. That is, transparent marking in one domain appears to actually facilitate transparent marking in the other. The convergences uncovered here thus indicate that lack of structural specificity



(opacity) in one area of marking of verb-constituent relations contributes to a pervasive “instability” in the status of the other clausal constituents in a given utterance, since their grammatical function remains ambiguous. In Hebrew, when verb inflectional agreement is opaque, Subjectness remains grammatically unspecified, and this in turn destabilizes the syntactic function of other constituents as well, as reflected in opacity of prepositional marking of Non-Subject constituents. Moreover, while these across-the-board convergences do not entail a clear unidirectional cause-effect relationship between the two systems of signaling clause-internal relations, the nature of the verb as the pivotal core around which other clausal elements revolve suggests that transparent marking of Subject-Verb relations will facilitate overt marking of other clause constituents rather than the other way around.

This analysis of convergences, in sum, shows that not only is opacity a pervasive phenomenon in grammatical development, but that opacity/transparency in one domain is sensitive to opacity/transparency in another. Such communication between ostensibly distinct domains that are typically treated separately in linguistic analysis and in child language research points to the impact of interfaces between grammatical structures in acquisition. In fact, the interfacing between paradigmatic and syntagmatic abilities such as those analyzed here might well underlie acquisition of simple-clause structure in general, since children need to compute several aspects of clause-internal relations **concurrently** every time they produce combinations of a verb with other clausal constituents. From this perspective, each fresh level of knowledge progresses from opaque combinations to transparent inter-dependent grammatical markings, so consolidating the interfaces between gradually more fully-fledged systems of the ambient language. The conclusion is that, throughout the process of acquisition, grammatical systems do not (perhaps cannot) develop in isolation, but are crucially dependent on one another for consolidation across development.

#### **4.4 Implications of the Study**

This concluding section considers certain general implications of the study for child language research in relation to type of evidence (Section 4.3.1), the phenomenon of opacity in early grammar (4.3.2), and the role of interfaces in acquisition (4.3.4).

#### 4.4.1 Evidence in Acquisitional Research

Generalizations concerning both developmental patterns and inter-domain convergences discussed earlier in this chapter are based on contextualized analyses of longitudinal speech samples from natural child-adult interactions. The evidence provided by such corpora has certain clear advantages for an investigation such as the present, due to the combination of longitudinal sampling and of naturalistic interactional settings which they involve.

As noted in Chapter II, case-studies in the form of longitudinal speech samplings have provided a rich source of evidence for tracking processes in language development, from the early days of psycholinguistic development (most particularly, Brown, 1973; and also Bloom 1970; Braine, 1963; Miller & Ervin, 1964), as cogently discussed in a recent paper by Demuth (2008). True, reliance on this methodology encounters certain practical as well as principled problems for analysis of children's speech, such as the lengthy and labor-intensive effort required for collecting, transcribing, and coding of the data, on the one hand (MacWhinney, 1995), and the questionable reliability of the data in terms of sample size and density, on the other (Rowland, Fletcher & Freudenthal, 2008). Yet longitudinal naturalistic corpora have certain substantial advantages of a kind essential for the analysis undertaken for present purposes.

The first such advantage, as pointed out over twenty years ago by Ingram (1989), is that using such samples enables the researcher to document and detail children's acquisition of one or more grammatical systems at successive points in time across an extended developmental path. As a result, any given linguistic form that children produce can be richly interpreted from the perspective of the particular developmental phase at which it is used. In the present case, longitudinal analysis of the history of each verb form that the children produced in the period under study – taking into account the linguistic context in which verbs occurred, their overall repertoire, and the (dis)similarities between various forms of verbs – yields a functionally well-motivated developmental portrayal. For example, children's opaque verb forms were observed to behave differently in terms of their syntactic environment with the emergence of productive inflectional morphology (from Phase II on). In other words, taking “opaque verbs” in Hebrew as an instance of a given (childlike) grammatical system, while these retained the same surface shape across all three developmental phases, the fact that they behaved differently in relation to other

facets of clause-structure from one phase to the next sheds important light on the level of grammatical knowledge that they represent. Initially, such forms reflect non-paradigmatic verb usage at the one-word or single-unit stage of development (Dromi, 1986; Peters, 1983); subsequently, they function as a pivotal means for elaboration of other clausal elements; and eventually, they are replaced by all and only inflected forms of verbs. Such developmental chronologies are possible only on the basis of suitably contextualized data recorded over relatively lengthy periods of time.

A second advantage of using longitudinal samples is the importance of naturalistic data as a source of evidence for interfaces in child language acquisition. Ecologically valid naturalistic settings of children's speech output – in the sense noted by Karmiloff-Smith (1979) – facilitate concurrent observation of the emergence and subsequent development of several grammatical systems (verb inflection, predicate constituency, prepositional marking). The data-base of the present study, made up of copious longitudinal samples of children's spontaneous speech output recorded in their natural communicative environments with familiar adult interlocutors, formed a solid basis for its two major prongs of investigation: developmental transitions from one level of linguistic knowledge to another, on the one hand, and the role of between-domain interfaces in language acquisition, on the other.

To meet these goals, analysis focused on features of the children's own self-initiated utterances. While recognizing the important contribution of child directed speech to children's learning of language (as discussed, for example, by Clark & de Marneffe, 2012; Ravid et al, 2008; Diessel, 2004), the present analysis deliberately focuses on children's language production in order to analyze how they themselves **construct** linguistic knowledge (Karmiloff-Smith, 1992) – as reflected, in the case in point, by clause-internal grammatical interfaces through concurrent realization of verb morphology, predicate constituency, and prepositional marking in their speech output. Adult input was, however, taken into careful account from several complementary perspectives. First, preceding adult utterances combined with the situational non-linguistic context, on the one hand, and the child's subsequent utterances, on the other (Bloom, 1970), provided the basis for linguistic and pragmatic contextualization of the children's speech output across the data-base. Here, interpretation of the children's speech output was considerably facilitated by the fact that the adults who recorded the conversational interactions in the sample (a mother in the case of Lior, and an aunt with Shachar and Rotem) were explicitly

instructed to provide “rich semantic context” (Brown, 1973), so that they consistently offered expansions and/or clarifications of children’s utterances which were not clearly interpretable phonetically or contextually. Importantly, too, since analysis was confined to children’s clause-like utterances specified as autonomous in the sense of being self-initiated, child-directed adult input was inspected in careful detail in order to identify amalgam-like instances of direct repetitions, non-clausal completions of adult utterances, and rote-learned routines.

In consequence, the longitudinal and naturalistically contextualized design of the present study served to detect as well as to illuminate developmental processes in children’s acquisition both of different facets of clause-internal structure and the interrelationships between them.

#### 4.4.2 The Role of Opacity in Developing Grammar

In the present context, as detailed earlier, “transparency” – in contrast to “opacity” – characterizes all and only **structural** elements in children’s speech output that have a clear and unambiguous target form (Sections 2.3.2). The results of the study show that children’s early grammatical usages are typically lacking in transparency, hence pervasively opaque; that systematic opacity in “bridging” categories reflects some sensitivity to the grammar of the ambient language, representing partial rather than non-knowledge; and that the opacity/transparency distinction plays a pivotal role in early between-domain convergences. Recall that inflectionally opaque verb-forms were found to favor syntactically elaborated clausal constructions (Section 3.2.1) and opaque verbs to occur more with opaque prepositional marking while transparent use of prepositions prefers transparent verb-forms (Section 3.2.2). Such distributional trends for opaque versus transparent marking help the researcher evaluate children’s knowledge when their marking of grammatical distinctions is only partial. These periods of transition – corresponding to Phases II and III in the present analysis – are quite lengthy and may last several months, hence are not simply brief phenomenon, but a robust facet of the gradual developmental route of language acquisition. The present study demonstrates, moreover, that opaque forms used in these transitional periods are neither distributionally nor structurally merely random, so providing further information regarding how children approach the organization (and probably re-organization) of their grammatical knowledge across development.

One such insight derives from the trade-off that emerged between clause-level elaboration by NSCs and word-level non-specification of verb inflections. This suggests that consolidation of grammatical knowledge is not a mere matter of a linear progression from smaller to larger units. Rather, language development operates on several levels concurrently, so that “higher” levels of linguistic structure (here, Verb + NSC) may be deployed before “lower” levels (Verb Inflections) are fully specified. Given the compositional nature of language in general, it could well be that non-specification (opacity) of smaller units like verbs in fact paves the way for combinations of larger units like elaborated clauses, so facilitating their early acquisition.

Second, the convergence between transparency of verb inflection and NSC prepositional marking indicates that any instance of transparency or opacity in a given grammatical system (at the level of simple clause structure at all events) may be indicative of knowledge beyond that particular domain, and that this will be reflected by relative transparency or opacity in other domains. More generally, children’s acquisition of grammatical marking appears sensitive to the surrounding structural environment, hence developing as part of a constant communication between ostensibly distinct linguistic systems. Further study is required to ascertain whether and how this pervasive process is characterized by directionality or reciprocity.

#### 4.4.3 Interfaces in Acquisition

A key claim of this study is that between-domain interfaces intrinsically characterize grammatical development, possibly linguistic structure in general. Analysis here focused on clause-internal interfacing relations, with verb inflections – specifically, their structural transparency value – as the pivot of these inter-relations. These findings are consistent with other research indicative of certain patterns of between-domain interactions in various grammatical domains in different languages. For example, Allen (2000) shows that argument realization in child-Inuktitut is affected by features of discourse-pragmatic informativeness, such as the newness of a given referent or the contrast between referents; Brown (2008) points to verb-meaning specificity as promoting argument ellipsis in transitive clauses in the usage of adult as well as child speakers of Tzeltal; while Thordardottir, Weismer, and Evans (2002) argue for an interrelation between lexicon and grammar as reflected by the fact that children acquiring Icelandic require a larger “critical mass” of vocabulary (Marchman

& Bates, 1994) in order to achieve grammatical regularity in verb inflection compared with their English-speaking peers in acquiring a less richly inflected language. Such studies in different domains of grammar and in languages differing markedly in their typologies as well as from that of Hebrew provide interesting and relevant lines of research pointing to the role played by between-domain interfaces in early child grammar.

Furthermore, the interplay between the paradigmatic and syntagmatic dimensions of linguistic structure revealed by the present study for children's acquisition of specific domains of simple-clause grammar highlights the value of investigating interfaces as a general strategy for child language research. The study revealed patterns of co-occurrence of two types of early usages in grammatical acquisition of Hebrew-speaking children – distribution of opaque verb forms in terms of their accompanying NSCs and of opaque prepositional markings in relation the inflectional opacity or transparency of verbs. Importantly, the generalizations proposed to account for these findings (Section 4.3) rely not only on overall distributional patterns, but also refer to the concurrent realization of grammatical (non-)markings within a given clause. Such insights into “online” interfacing trends in acquisition of grammar was made possible by examining each and every child-output utterance in its specific linguistic context, often also taking into account the extra-linguistic context in which it appeared. This combination of overall distributional analyses with attention to individual occurrences of the phenomena under consideration proved particularly appropriate for investigating converging patterns of grammatical development. It is to be hoped that analysis along these lines of the topic of interfaces, the motivation for the present study, may help shed new light on the organization and re-organization of children's linguistic knowledge across different periods in their development beyond the domains of current concern.

#### **4.5 Directions for Further Research**

Further directions for subsequent study include extending the data-base of the present research in various ways. First, adding more children to the sample could provide additional support for its findings and make it possible to examine individual differences between children in relation to other features of their linguistic development (Bates, Dale & Thal, 1995). The present findings might also be validated by in-depth examination of other paradigmatic/syntagmatic interfaces in Hebrew child

grammar, such as the interrelations between simple-clause structure and clause-combining, inflectional and derivational morphology in the Hebrew verb system (Berman, 1993b), and acquisition of inflectional morphology across other lexical classes. With respect to this last issue, preliminary findings from examination of the noun and adjective inflections during Phase II for one of the children in this study indicate some relationship between inflectional morphology in all three lexical classes of verbs, nouns, and adjectives (Lustigman, 2013) such that, for example, the boy's most favored suffixes on *benoni*-form verbs (*-im* for plural and *-a* for feminine marking) were also commonest in his nouns and adjectives. Further investigation of interfaces in early grammatical acquisition might also require structured, cross-sectional experimental elicitations – possibly, given the young age of the children involved, aided by use of the preferential-looking paradigm (Hirsh-Pasek & Golinkoff, 1996). Such an undertaking would need to take into account Karmiloff-Smith's (1979) precautionary comments on “the experimental dilemma” and Slobin's (1988) observation that “The most essential research tool remains exhaustive longitudinal case-studies of strategically selected languages, supplemented by artificial probes [...] of dimensions of children's knowledge and use of language”.

Another possible direction for further study of child language, in particular, of between-domain interfaces, concerns the role of interaction in language acquisition. Child-interlocutor interactional supportive contexts have been shown to contribute to children's consolidation of grammatical knowledge in several domains, including verb inflection (Clark & de Marneffe, 2012), stringing of successive single-word utterances (Scollon, 1976; Veneziano, 1999), and clause-combining (Berman & Lustigman, in press). Research on a wider range of grammatical domains and in different discourse settings– including for example, caretaker-child conversations (Clark, 2007), investigator-child interview type settings (Dromi & Berman, 1986), as well as early narrative usage (Berman & Slobin, 1994) – could shed interesting light on the role of interaction in language development.

Finally, the present study was inspired by a rich tradition of child language research demonstrating that major insights in the domain derive in the first place from detailed, in-depth examination of data from a single language – as shown, for example, by studies such as Brown (1973) on the acquisition of early grammar in English; Veneziano (2003) on the emergence of noun and verb categories in French; Weist & Buczowska (1987) – on the development of Polish temporal adverbs; Aksu-

Koç, (1988) – on the acquisition of aspect and modality in Turkish. A range of Hebrew-specific research on different topics in early child language has also provided rich background to the present study including, for example, Berman (1987) on complex nominal constructions, Berman (1990) on subjectless sentences; Dromi, (1987) on the early lexicon; Levy (1983a) on acquisition of gender marking in nouns and adjectives; Ninio (1998) on early multi-word combinations; and Ravid's (1995) experimental study of inflectional categories from age 3 to adulthood. Yet it is also clear that detailed cross-linguistic examination of the developmental patterns observed in the present study would help to validate generalizations proposed here for Hebrew. Such studies could follow in the lines of typologically-motivated research of Slobin and his associates (e.g., Slobin, 1982; Slobin, 1985 – 1997), using longitudinal naturalistic samples of the kind advocated here supplemented by more structured experimental elicitations. Topics that such comparative research might address would include, for example: the question of what constitute “unspecified” or “neutral” categories in children's verb usage in different languages; what underlies children's choices of adultlike versus juvenile usages during transitional periods such as the Optional Infinitive stage; and, perhaps most importantly, how general rather than language-particular are between-domain convergences in early grammatical marking.



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## APPENDIX

**Table A.** Proportion of verbs used in isolation out of total occurrences of 40 targeted verbs in Phases II and III, by lexico-syntactic category, for each child

		Shachar	Rotem	Lior
Dependent	Phase II	45% (=35/77)	57% (=103/181)	28% (=42/152)
	Phase III	31% (=29/94)	46% (=33/71)	18% (=12/66)
Optional	Phase II	69% (=56/81)	52% (=32/62)	41% (=24/58)
	Phase III	45% (=48/106)	39% (=24/61)	23% (=13/57)
Independent	Phase II	78% (=75/96)	76% (=52/68)	69% (=54/78)
	Phase III	77% (=160/209)	72% (=31/43)	56% (=35/62)

**Table B.** Proportion of opaque verbs out of total occurrences of 40 targeted verbs in Phases II and III, by lexico-syntactic category, for each child

		Shachar	Rotem	Lior
Dependent	Phase II	47% (=36/77)	36% (=65/181)	28% (=43/152)
	Phase III	18% (=17/94)	15% (=11/71)	11% (=7/66)
Optional	Phase II	26% (=21/81)	35% (=22/62)	26% (15/58)
	Phase III	7% (=7/106)	11% (=7/61)	5% (3/57)
Independent	Phase II	19% (=18/96)	15% (=10/68)	10% (=8/78)
	Phase III	3% (=7/209)	2% (=1/43)	5% (=3/62)

**Table C.** Proportion of isolated verbs and of opaque isolated verbs out of targeted 40 verbs across Phases II and III, by child

Phase II + Phase III	Shachar	Rotem	Lior
% isolated verbs out of total verbs	61% (=403/663)	57% (=275/486)	38% (=181/473)
% isolated opaque out of total opaque	36% (=38/106)	45% (=52/116)	23% (=18/79)