Tel Aviv University

The Lester & Sally Entin Faculty of Humanities

The Shirley & Leslie Porter School of Cultural Studies

A Multidimensional Perspective on the Acquisition of Verb Argument Structure

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Sigal Uziel-Karl

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Professor Ruth A. Berman

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List of Abbreviations (in Alphabetical Order)

Abbreviation	Full Entry
1	First person
2	Second person
3	Third person
A	Adjective
ACC	Accusative
ADV	Adverb
AEH	Argument Elisibility Hierarchy
AGR	Agreement
CDI	Communicative Development Inventory
CED	CHILDES Editor
CHAT	Codes for the Human Analysis of Transcripts
CHILDES	Child Language Data Exchange System
CLAN	Computerized Language Analysis
COMP/C	Complementizer
CP	Complementizer Phrase
D	Determiner
DAT	Dative
DO	Direct Object
DP	Determiner Phrase
FCH	Full Competence Hypothesis
FI	Future Imperative
FM	Feminine
FREQ	Frequency counts
FUT	Future
GC	Governing Category
GR	Grammatical
HCDI	Hebrew version of the MacArthur Communicative Development Inventory
ILL	Unlicensed/Ungrammatical
IMP	Imperative
INF	Infinitive
INFL	Inflection
INTR	Intransitive
IO	Indirect Object
IP	Inflectional Phrase
IPL	Impersonal
LAD	Language Acquisition Device
LOC	Locative
LRS	Lexical Relational Grammar
LSH	Lexical Semantic Hypothesis
MC	Alternation of adult speech
MCDI	MacArthur Communicative Development Inventory
MLT	Mean Length of Turn
MLU	Mean Length of Utterance
MLU-W	Mean Length of Utterance in Words
MO	Imitation of Mother's/parental input
MODREP	Frequencies of word matches across tiers
MPU	Morpheme Per Utterance
MS	Masculine
N	Noun
NEG	Negation
NP	Noun Phrase
NPAH	Noun Phrase Accessibility Hierarchy
OBLQ	Oblique Object

Abbreviation	Full Entry
OI	Optional Infinitive
OV	Overt
P	Preposition
P1	*qal* pattern
P2	*nif'al* pattern
P3	*pi'el* pattern
P4	*hitpa'el* pattern
P5	*hif'il* pattern
PAS	Preferred Argument Structure
PL	Plural
PP	Prepositional Phrase
PR	Pragmatic
PR/PRES	Present
PRO	
PT	Past
R	Proper noun
RC	Relative Clause
RI	Root Infinitive
RRG	Role and Reference Grammar
SF	Self-initiated utterance
SG	Singular
SLI	Specific Language Impairment
SM	Semantic
SPEC	Specifier
SBJ	Subject
SV	Subject Verb
SVO	Subject Verb (direct) Object
SVOI	Subject Verb (direct) Object Indirect (object)
TNS/T	Tense
TP	Tense Phrase
TR	Transitive
UC	Unclear
UG	Universal Grammar
US	Unspecified
UTAH	Uniformity of Theta Assignment Hypothesis
UTTS	Utterances
V	Verb
VAS	Verb Argument Structure
VO	Verb (direct) Object
VP	Verb Phrase

Abstract

A Multidimensional Perspective on the Acquisition of Verb Argument Structure

Sigal Uziel-Karl

Verbs play a major role in numerous aspects of language structure, in linguistic form-function relations, and in processes of language acquisition and language development. The acquisition of verbs as lexical items, typically emerging during the second year of life, thus marks a crucial point in children's transition to adult-like grammatical competence.

The present study provides a detailed account of verb and verb argument structure (VAS) acquisition for Hebrew. In this account, **verb and VAS acquisition** are characterized as dynamic processes that advance to a point of mastery through constant re-organization of knowledge – from partial, item-based knowledge to the endstate command of the mother tongue. **Acquisition** is described as multi-tiered in the sense that it is shaped by a wide range of factors whose relative contribution varies across development. **Input** plays a central role in the early phases of acquisition, in the sense of how it is processed by the child in the form of "intake". **The child** is an active participant constantly engaged in selecting and processing various cues in the input. This account is anchored in a view of language acquisition as governed by two distinct developmental criteria: elementary and advanced. **Elementary** criteria are necessary for a child to have some knowledge of a particular linguistic item or construction, and serve mainly to prevent communication breakdown, while **advanced** criteria are necessary and sufficient for the child to attain an adultlike level of knowledge, and serve mainly to prevent ungrammaticality.

A three-phase **developmental** model is proposed to account for verb and VAS acquisition. The model consists of an initial *Data-Driven Phase* (Phase I), an intermediate phase of *Top-down Application of Rules* (Phase II), and a final *Integrative Phase* (Phase III). The study focuses on Phase I divided into its three sub-periods: (1) The *Training Level*, (2) *Bottom-up Construction of Generalizations*, and (3) transition *from Generalizations to Rules*. During this phase, VAS acquisition proceeds as follows. Children first hear and (presumably) store a range of verbs from the input, each in a specific morphological form. This form is initially determined by

the frequency in the input and the communicative function of specific verbs (*Training Level*). Next, children rote-learn certain [verb + complement] combinations in relation to individual verbs. During this period, they engage in distributional analyses to help them come up with approximations of argument structures for these verbs. This is marked by the formulaic use of certain [V + X] combinations in repeated contexts in the form of *Bottom-up Construction of Generalizations*. These "limited-scope formulae" pave the way for generalized, more abstract argument structure representations, i.e., meta-argument structures. From this point on, knowledge becomes increasingly top-down and constructionist, so that children associate new verbs that enter their lexicon with meta-argument structures from their established repertoire, as evidenced by the occurrence of overextensions (*from Generalizations to Rules*).

The present study addresses critical methodological questions that are often disregarded in the acquisition literature, such as: How to decide whether a particular element is an argument of a given verb, and how to measure acquisition and productivity?

The database for this study consists of longitudinal samples of naturalistic speech output collected at intervals of 10 – 14 days from four Hebrew-speaking children, 3 girls (Hagar, Smadar and Lior) and a boy (Leor), between ages 17 and 36 months. These samples were transcribed, coded and analyzed using the CHILDES methodology (MacWhinney 1995) as specially adaptated to Hebrew. These materials are supplemented by longitudinal data from five other Hebrew-speaking children for whom published data are available in the literature, and by longitudinal and cross-sectional data from other languages.

Data analyses were performed on two levels. *Word-level* analyses concerned early lexical development (Chapter 3) and various aspects of verb morphology (Chapter 4) and semantics (Chapter 5). *Sentence-level* analyses focused on acquisition of verb argument structure (Chapter 6). Two types of interactions were examined through investigation of particular linguistic phenomena: Between morphology and syntax – acquisition of argument ellipsis; and between syntax and semantics – acquisition of thematic roles (Chapter 7).

The findings reveal that a variety of factors including the particular verb acquired, the specific language of acquisition, pragmatic and communicative factors

and, subsequently, morphological and syntactic considerations combine to explain how children move into verb-argument acquisition and mastery.

Argument ellipsis is accounted for through the interaction of two hierarchies across development. One takes the form of a universal "Argument Eligibility Hierarchy" derived from Comrie and Keenan's (1979) Noun Phrase Accessibility Hierarchy (NPAH) combined with Berman's (1982) account of oblique objects in Hebrew; the other is a "Licensing Hierarchy", which represents language-specific weighting of linguistic modules. The interaction between these two hierarchies accounts for variations in the selection and relative weight of each licensing module across argument-types in a particular language and across languages.

The study incorporates three methodological innovations. (1) a semi-automatic procedure for calculating Morpheme Per Utterance (MPU) as a rough measure of linguistic age; (2) an outline of a *Profile of Verb and VAS Use* as a measure of linguistic development based on the assumption that a multi-tiered evaluation of children's knowledge of **verbs** can serve as a reliable predictor of their linguistic development as a whole (Chapter 1, Section 1); and (3) an experimental design for testing the hypothesis that parental input has a differential effect at various phases of verb and VAS acquisition.

The study aims to contribute to language acquisition research by illustrating a particular approach to and procedure for the domain. It relies on in-depth analysis of a large-scale database to propose an explicit account of verb and VAS acquisition. The study examines acquisition of verbs and VAS in Hebrew, a language for which such an analysis has not yet been undertaken. On the assumption that the model I propose has crosslinguistic validity, additional crosslinguistic evidence is needed to establish its general applicability. Also, further analyses are suggested, including experiments, sophisticated statistical analyses, and structured computer simulations.

Acknowledgements

I have always been intrigued by language acquisition, and overwhelmed by how fast young children become competent speakers of their native language, but it was only after my first child began to talk, that I started studying this phenomenon myself. Needless to say, that doing this research was very rewarding, but at the same time extremely demanding. And it could not have been completed without the understanding and support of many people around me.

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❤

Part I: Background

Chapter 1: Introduction

1. Research Topic, Motivation, and Goals

In the introduction to *Language Learnability and Language Development*, Pinker (1984) describes the dangers of studying language acquisition in a piecemeal fashion by comparing them to the assembly of a computer system from various components ordered à la carte. "What looks irresistible in a single component… can crash the system when plugged in with the others" (p. *xv*). Pinker notes that his account is the first comprehensive theory of language acquisition "assembled by a single vendor responsible for the compatible functioning of all the parts". The parts are: the initial state of the child, the input to the child, the mental algorithms that turn input into bits of knowledge about language, the end state of acquisition, and the course of development.

Pinker's analogy emphasizes the fact that research should be comprehensive, and conducted from beginning to end. That is, a theory of acquisition should cover all aspects of the acquisition process rather than, say, all linguistic categories or a particular stage, such as the one-word stage. The analogy further suggests that acquisition should be accounted for developmentally. Against this background, the present research aims to provide a "single vendor" developmental account of the acquisition of verbs and Verb Argument Structure (VAS).[1]

Since the early days of developmental psycholinguistics in the 1960's, via extensive crosslinguistic research in the 70's, through to the present, surprisingly few researchers have proposed comprehensive models of acquisition within this framework, among these are L. Bloom (1993), Hirsh-Pasek and Golinkoff (1996), Karmiloff-Smith (1986), and Pinker (1984). In line with previous developmental analyses, most particularly Karmiloff-Smith's (1986, 1992, 1994) accounts of cognitive and linguistic development and Berman's (1986a, 1988a, 1998a) characterizations of linguistic development with special reference to Hebrew, I argue that verb acquisition can best be described as a PROCESS that advances to a point of mastery. This process is continuously shaped by input from various linguistic modules

(pragmatics, semantics, morphology, and syntax) whose relative influence varies across development. My view is that it is a dynamic process, which involves a constant re-organization and analysis of knowledge, leading to a continuous reconstrual of linguistic materials as the child proceeds from partial, item-based knowledge to adultlike command of the grammar of his/her native language.

The proposed account characterizes acquisition of both individual verbs and of the category VERB as a whole.[2] Two main factors motivated the choice of verbs as the subject of investigation: their importance as a lexical category, on the one hand, and the relative paucity of research on how they are acquired, on the other. The acquisition of verbs as lexical items, typically emerging during the second year of life, marks a crucial point in children's transition to adult-like grammatical competence. Verbs play a major role in numerous aspects of language structure, in linguistic form-function relations, and in processes of language acquisition and language development. They constitute a universal lexical category (Hopper & Thompson 1984, Langacker 1987, Robins 1966). Within the clause, they serve to link the various Noun Phrases (NPs), to indicate which thematic role each NP embodies, and to point to the grammatical function that it bears. Verbs provide information about the *situation* described in the sentence (event, activity, or state), as well as about its time of occurrence and duration, and so lie at the heart of any proposition. And, there is evidence that children's initial verb vocabularies are good predictors of their early grammatical competence (Bates, Bretherton & Snyder 1988). Nevertheless, it is only within the past decade that researchers concerned with language acquisition and development have considered the acquisition of verbs as a major domain of investigation (For example, Berman & Armon-Lotem 1996, Bloom 1991, Pinker 1989, Tomasello 1992, and see especially, Tomasello & Merriman 1995).

The focus of language acquisition research has been largely on the nominal system. This is true of research on the one-word stage (e.g., Clark 1973, Dromi 1987,

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1 In acquisition, the term *verb-argument structure* has been used to refer to the semantic or thematic roles associated with arguments of a particular verb together with the syntactic and lexical arguments that the verb attracts (i.e., the verb's *subcategorization frame*) [see, for example, Braine & Brooks 1995, Gleitman 1990, Pinker 1989]. This rather simplistic definition of VAS is expanded and elaborated in Chapter 6.

2 A verb in Hebrew is defined morphologically, since all and only verbs must have a verb-pattern value (*binyan*), and be inflected for tense (past, future). Also, only, but not all verbs in Hebrew take accusative case marking. Syntactically, verbs function as predicates, and have nominal arguments associated with them (as do some predicative adjectives), and semantically they typically refer to activities, events and states.

Mervis 1987, Nelson 1973) with a few exceptions (e.g., Gopnik & Choi 1990). Most of the rich research on semantic constraints and categorization has likewise focused on nouns (Markman 1989), and research on narrative development has also centered mainly on (nominal) issues of reference (Berman & Slobin 1994 are an exception). In acquisition studies motivated by generative linguistics, research is concentrated on parameters of Universal Grammar such as the null-subject parameter (Hyams 1986) and Binding (Wexler & Manzini 1987), with verbs being studied mostly with regard to the acquisition of root infinitives (Armon-Lotem 1995, Rizzi 1994, Wexler 1994).

Recent generatively oriented studies consider the acquisition of functional categories such as case marking, agreement, DP, IP, CP (Deprez & Pierce 1994, Guilfoyle & Noonan 1992). Two contrasting proposals have been made in this framework concerning the question of how and when formal grammatical categories (both functional and lexical) emerge in children's grammars. The *Full Competence Hypothesis* (Hyams 1986) assumes that both functional and lexical categories are available to children from the start (First Syntax). The *Maturation Hypothesis* (Radford 1990), in contrast, holds that the language of children younger than two, at the *lexical* stage, lacks functional categories, which mature later on in the process of acquisition (Borer & Wexler 1987).

In spite of the important role of verbs in acquisition and prior research on verb acquisition, there is place to reconsider the kind of questions the present study proposes to address: How do children acquire new verbs? Are verbs acquired individually on a verb-by-verb basis or class by class? What is the course of VAS development? Which aspects of verb/VAS acquisition are language specific and which universal? And what is the effect of input on acquisition of VAS? The present research aims to investigate these questions in order to formulate a systematic, unified account of verb and VAS acquisition.

As suggested by the title of the study, it proposes a **multi-tiered** analysis of VAS, which integrates information about syntactic form and function, morphology, lexical structure, verb semantics, thematic roles, and pragmatics. It examines the relative contribution of each of these factors in the course of acquisition and their interaction at various phases of development. The analysis thus goes beyond paired correspondences between syntactic structure and verb semantic classes, or between syntactic function and thematic roles, which have been the focus of inquiry in the field in the past decade.

Another goal of the study is to address methodological issues relevant to its research topic and to propose procedural tools for handling them. These questions include: How can knowledge of a certain verb be assessed for an individual child? What constitutes "productive" knowledge, and what is the difference between "productive" knowledge, acquisition, and mastery of a particular verb or VAS? How can the argument structure of any particular verb be determined? And how the acquisition of verbs can be used to evaluate linguistic development?

The study addresses questions such as what constitutes a "basic" verb form for the child, and what is the order of acquisition of verbs in different semantic classes and with different argument structures. Hopefully, it will have implications for linguistic analysis outside of child language, for example, in characterizing the structure of the lexicon and the nature of VAS in general.

The study focuses on early phases of development, and so on acquisition of argument structure at the level of the simple clause, in order to ensure comparability with prior work on acquisition of VAS. Accordingly, subordinate clauses and other embedded constructions are noted but not analyzed in detail. A further deliberate constraint is the focus on production, without considering the important domain of comprehension. The reason is methodological rather than principled, since the database of the study is naturalistic speech output, in contexts which make it difficult to isolate comprehension from other factors that might affect the child's behavior when hearing a particular verb or VAS construction.

The study examines acquisition of verbs and other predicates (modal expressions and predicative adjectives) by four Hebrew-speaking children between the ages 17 and 36 months. It focuses on Hebrew child language since Hebrew is typologically different from English, the only language for which large scale studies have been conducted on VAS to date (e.g., Gleitman 1990, Pinker 1984, Tomasello 1992). In Hebrew, unlike in English, a great deal of information is morphologically encoded inside the verb: tense-mood, agreement for person, number and gender, as well as valence relations (transitivity, voice, causativity, reflexivity, etc.). The study isolates language particular Hebrew phenomena as compared with crosslinguistic processes, so that in principle, findings of this research should be extendible to acquisition of other languages, too.

In characterizing verb and VAS acquisition, I rely on developmental notions such as *stage, phase,* and *level,* as defined in section (2.3.2), and on dynamical systems theory (2.3.3).

2. Conceptual Framework

This section reviews two main approaches to cognitive development (2.1) and to language acquisition as a special case of cognitive development (2.2), and outlines the developmental underpinnings of verb and VAS acquisition (2.3).

2.1 Approaches to Cognitive Development

Two main approaches to cognitive development can be identified: domain-general approaches, typified by Piaget's theory of cognitive development, and domain-specific approaches as represented in Fodor's (1983) theory of the modularity of mind. In the latter case, the mind is viewed as constructed of all-purpose central processes along with genetically specified, independently functioning, special-purpose "modules" or input systems. These modules are hard-wired or nondecomposable, and informationally encapsulated so that other parts of the mind cannot influence or have access to the internal workings of a module, only to its outputs. In this approach, development does not really exist. Rather, a built-in dichotomy is assumed between what is computed blindly by the input systems and what the organism constructs in central processing as his or her beliefs. *Central processing* is defined as a module in which the human belief system is formed by deriving top-down hypotheses about the world from the interface between the outputs of the input systems and information stored in long-term memory.

In contrast, domain-general approaches take development to involve the construction of domain-general changes in representational structures operating on all aspects of the cognitive system in a similar way. In this view, the infant has no innate structures or domain-specific knowledge. Language is merely a special case of other, domain-general structures and processes. The present study draws on this latter approach to cognitive development, since it allows a developmental account of language acquisition along the lines proposed below. The overall model is modified to accommodate the proposed account of verb and VAS acquisition, as further specified below.

2.2 Approaches to Language Acquisition

It is generally agreed that normal children all acquire a natural language without special training or carefully sequenced and selective linguistic input, and that children with different linguistic experiences succeed in acquiring a grammatical system that is equivalent to that of other children speaking the same target language. There is also a general consensus that language acquisition takes place quite rapidly and with relatively little error despite the erratic quality of the input children are exposed to in the process. Widely varying attempts have been made to account for this remarkable scenario, with various researchers adopting different divisions and terminology to characterize these diverse approaches to the process (see, for example, Berman 1984, 1986b, Pine, Lieven & Rowland 1996, Pizzuto & Caselli 1994, and Smith 1982).

For present purposes, I adopt the classification of Hirsh-Pasek and Golinkoff (1996), who divide theories of acquisition by what the child brings to the task of acquisition, what process is used to acquire language, and to what extent input is considered central for acquisition. Answers to these questions yielded two overall approaches: *Inside-out* versus *Outside-in*. Table 1.1 displays major distinctions between the two groups of approaches. It obscures certain nuances between the different views, but highlights the major theoretical cuts in the field.

Table 1.1 Distinctions among Major Theories of Language Acquisition [Hirsh-Pasek & Golinkoff 1996, p. 17]

	Theory Type	
	Inside-out	**Outside-in**
Initial structure	Linguistic	Cognitive or Social
Mechanism	Domain specific	Domain general
Source of structure	Innate	Learning procedures

Theories grouped under the heading *Inside-out* contend that language acquisition occupies its own separate module in the brain and has its own unique mechanisms (Chomsky 1981, Fodor 1975). In this view, language acquisition is the process of finding in the linguistic environment instantiations of the considerable innate linguistic knowledge that children possess. Thus, *Inside-out* theories attribute

to children domain-specific linguistic knowledge and emphasize grammar *discovery* rather than grammar construction.

Two subtypes of Inside-out theories can be identified: *structure-oriented* versus *process oriented*. *Structure-oriented* theories emphasize the content of the grammar to be acquired, as in the work of generative linguists like Goodluck (1991), Hyams (1986), Rizzi (1994), Roeper (1988) and others. In general, these theories presuppose that children are endowed with considerable explicit, domain-specific, linguistic knowledge prior to their entry into the linguistic system. Children are born with an innate mechanism, the Language Acquisition Device (LAD), designated for language acquisition. This mechanism consists of principles and parameters of Universal Grammar (UG).[3] Parameter values are set through experience, and as the process proceeds, children move from the "initial state" to the grammar of their native tongue. This approach emphasizes the acquisition of a formal system of rules and principles which includes knowledge of restrictions on the meanings that can be mapped into sentences as well as restrictions on the utterances that can be used to express meanings (Crain 1991). The environment in this case provides children with raw material that triggers the development or "maturation" of their innate forms (Borer & Wexler 1987). On this account, inter-language variation is explained by positing language particular parameters in the modules that constitute grammar. A given parameter controls a cluster of properties that languages may or may not exhibit, and the child's task is to set the appropriate values for each particular parameter.[4]

Process-oriented theories assume the child to be innately endowed with domain-specific linguistic knowledge, but differ from *structure-oriented* theories in their emphasis on uncovering the mechanisms children use to break into language, and acquire it. Their main concern is with how initial linguistic representations are formed and how acquisition proceeds once children produce their first words, and so

3 Principles of UG determine the operations that hold universally, whereas parameters are principled ways in which languages differ with respect to the application of one or another universal. For example, Binding Principle A is a principle of UG that deals with restrictions on coreference of anaphoric elements such as reflexive pronouns. This principle requires, for example, that in *John criticized himself* the anaphor **himself** be bound by the antecedent, **John**, in its Governing Category (GC) for the sentence to be grammatical. A GC is defined as the minimal category containing the anaphor and a subject. In this case the GC is the entire clause. Wexler and Manzini (1987) have shown this principle to be parametrized with respect to what constitutes a GC in different languages. In English, the GC was shown to be the minimal category containing the anaphor and the **subject** of the sentence, whereas in Icelandic it was shown to be the minimal category containing the anaphor and **indicative tense**.

process-oriented theories focus on the mapping between form and function. This overall approach to acquisition is identified mainly with the work of Gleitman and her associates (Gleitman & Wanner 1988, Gleitman 1990, Lederer, Gleitman & Gleitman 1995, Naigles 1990, and Fisher, Hall, Rakowitz & Gleitman 1994), on the one hand, and with the work of Pinker (1984, 1989), on the other.

Theories grouped under the heading *Outside-in* hold that language structure exists in the environment, and that children attend to salient objects, events and actions around them and *construct* language. Children's hypotheses about data relevant to language are derived from and constrained by the social environment or by their inherent cognitive capabilities, rather than by specifically linguistic knowledge. Language learning is carried out by domain-general learning procedures that allow the child to analyze the environment into ongoing events composed of actions and objects. *Outside-in* theories focus on the process of language acquisition since they do not presuppose that children are endowed with any *a priori* language structure. They identify language learning as a bottom-up process, no different in principle from learning in other domains.

Two main sub-types of *Outside-in* theories can be identified: *social-interactional* and *cognitive*. *Social-interactional theories* emphasize the communicative aspect of language acquisition. For them, the social interactions that the child is part of provide the route into language acquisition by highlighting those aspects of events that will be translated into linguistic forms. For this basically behaviorist type of approach, language must be understood in terms of the way it is used, and a satisfactory theory of language acquisition needs to account for children's learning of the linguistic system by explaining how they learn to use it. The child's knowledge of language is viewed as evolving through interaction with others as part of a socialization process based on general communicative skills. Such approaches are associated with pragmatically oriented researchers like Bruner (1983), Ninio (1988), and Ninio and Snow (1988).

Cognitive theories emphasize the role of children's prior understanding of events and relations in the nonlinguistic world together with children's cognitive processing capabilities. Children use language to label the cognitive categories (e.g., agent, action) that they have constructed, and then to use distributional evidence or

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4 For example, the so-called *pro-drop* parameter (Hyams 1983, 1986) controls subject-AUX inversion and use of expletive subjects.

general pattern detection strategies to match cognitive categories with linguistic ones like “Noun Phrase” and “subject of sentence”. These theories consider language acquisition in terms of form-function relations, where “form” refers to overt linguistic devices (morphological, lexical, and syntactic elements and constructions) and “function” can apply to syntactic relations, semantic content, role in discourse, and/or communicative intent. In this view, language constitutes a particular kind of cognitive domain, which can best be accounted for in terms of general processes of cognitive development and of information processing, reflecting both uniquely linguistic structural knowledge and general cognitive underpinnings.

This group includes several different perspectives on the problem. Berman (1986a) and Karmiloff-Smith (1986) take a developmentalist stand that emphasizes the transitions from partial knowledge to full knowledge of the various modules involved in the acquisition of linguistic competence (phonology, morphology, semantics, syntax, and discourse). Researchers such as Bowerman (1982, 1994, 1996a,b) and Schlesinger (1982, 1988) emphasize semantic facets of language acquisition. Bowerman analyzes children’s expression of semantic content (for example, causativeness) in relation to conceptual and linguistic development and acquisition of spatial semantic categories across languages. For Schlesinger, the child acquires syntactic forms on the basis of semantic categories such as agent, action, location, etc. through a process of semantic assimilation. Other researchers within this same broad framework consider the role of psycholinguistic principles that guide children’s acquisition of linguistic form-function correspondences. Clark (1993) delineates acquisitional principles such as formal simplicity, contrast and conversion, mainly in the domain of lexical development. Slobin (1973, 1985) emphasizes the impact of crosslinguistic differences and of language typology in shaping the operating principles which play a role in children’s application of the “language making capacity” to different target languages. Finally, researchers like Maratsos and Chalkley (1981) and Bates and MacWhinney (1987, 1989) argue for a domain-general view of language-learning in which minimal language structure is given from the start, and acquisition is conducted by general principles of pattern detection and distributional learning.

Hirsh-Pasek and Golinkoff argue that the central assumptions of the two groups of approaches can be described as continua rather than as dichotomies. Thus, all theories of language acquisition require some kinds of linguistic, cognitive, and social

categories, all require a learner who has access to both domain-specific and domain-general learning procedures, and all assume innate knowledge along with learning. Hirsh-Pasek and Golinkoff argue that the differences between the two families of approaches lie in the degree to which, for each criterion, they approach one end of the scale or the other.

In line with this view, the present account is integrative, aiming to combine features of various accounts of acquisition, and of various linguistic modules. It is close in orientation to the cognitive sub-type of an *Outside-in* approach in relating to partial knowledge (Berman, Karmiloff-Smith), integrating both form and meaning (Bowerman, Clark), and taking into account the impact of language typology (Slobin). However, in keeping with its integrative perspective, the present study incorporates *Inside-out* and social-interactional approaches. In so doing, I rely, on the one hand, on insights from generative linguistics in the syntactic analysis of the data and in accounting for syntactic-semantic correspondences; but I also take into account pragmatic factors of the communicative setting in which verbs are acquired.

The conceptual framework outlined above provides a starting point for my study. Data analysis aims to support an approach of "convergent mechanisms" according to which children rely concurrently on semantic, syntactic, lexical, and pragmatic clues to bootstrap into and move across, the acquisition of VAS. This is in line with several previous proposals. For example, Maratsos and Chalkley (1981) claim that grammatical constructions draw flexibly and easily from all kinds of analyses – distributional, semantic, pragmatic and phonological. Berman (1993a, 1994) proposes a "confluence of cues" to account for the acquisition of transitivity in Hebrew. To her, language acquisition and development are initially triggered into "emergence" and subsequently driven via reorganizations of partial knowledge along the path from "acquisition" to "mastery" by means of a "confluence of cues". These means include perceptual processing, lexical learning, and internalization of structure-dependent symbolic rules of combination, and formal alternations. Shatz (1987) proposes a "multiple bootstrapping" characterization of the language acquisition process where children use different kinds of

knowledge that they already possess in order to "learn more". Relatedly, Hirsh-Pasek and Golinkoff (1996) propose a "coalition of cues" phase-based model of how children develop comprehension of language input and linguistic structure.

Underlying the present study is the view that since children need to acquire a complex array of communicative knowledge on various levels, it makes sense that they will use bits of whatever they know about linguistic form and language use to learn more. From my perspective, the language learner is an active participant in the acquisition process, so the bootsrapping mechanisms which help him or her move into new knowledge function as mechanisms of acquisition for all sorts of knowledge about verbal communication, not just for syntax as held by Gleitman's (1990) and Pinker's (1984) theories of syntactic and semantic bootstrapping.

2.3 Developmental Underpinnings

A central question for the study of acquisition is how to account for children's transition from the initial state to adult-like knowledge of language. In the case in point, the question is how they move from the initial state of no verbs and no arguments to a large and varied verb vocabulary and to mastery of VAS for a range of verb classes. This study relates to acquisition as a continuous and dynamic *process*, which involves a large number of transitions and changes and is affected by multiple factors. It thus contrasts with linguistic theories like generative grammar that describe static models of language and fail to include any metric for describing developmental changes (see Clark 1993 for a discussion). This section accordingly considers various aspects of development in terms of three main issues: the initial state (2.3.1), developmental models (2.3.2) – stage-based accounts, phase-based accounts (2.3.2.1 – 2.3.2.2), and the notion of *change* across development (2.3.3).

2.3.1 The Initial State

There are two main approaches to the initial state: the continuity and discontinuity hypotheses. Proponents of continuity assume that children possess knowledge of grammatical categories from the onset of linguistic development (Bloom 1970, Pinker 1984, Valian 1986). As such, adult grammars are natural developments of early child grammars since the principles the child possesses remain

the same throughout acquisition. Children are equally subject to UG at all ages; their grammar will always conform to UG even if concealed from us by the shortness of the their sentences, etc. Weissenborn, Goodluck and Roeper (1992) divide this concept into strong and weak continuity. The "Strong Continuity" Hypothesis states that all principles and constructs of universal grammar are available at the outset and each grammar formed by the child is a correct (partial) grammar for the language to which the child is exposed. The "Weak Continuity" Hypothesis states that all principles and constructs of universal grammar are available at the outset, so that all children's grammars are "possible human grammars", in the sense that they observe the constraints of adult grammars (either observed or allowed under the theory). Children's grammars may, however, deviate from that of the language they are acquiring. Thus, under the strong continuity approach, children are said to possess all the functional categories required in their language (e.g., Poeppel & Wexler's [1993] Full Competence Hypothesis). But even strong continuity theories like Chomsky's (1981) "principles and parameters" theory recognize that initially, children's grammars are not fully compatible with adult grammars. To account for this discrepancy, researchers proposed that a process of maturation initially blocks access to certain principles (Borer & Wexler 1987, Guilfoyle & Noonan 1992, Radford 1990).

In contrast, proponents of a discontinuity view assume that children's early word combinations are not governed by adult-like grammatical rules. Rather, children gradually acquire grammatical competence through revision and extension of non-grammatical representations. In this view, adult grammar and early child grammar bear little relationship to one another, and their principles differ across development. One type of discontinuous theory suggests that children start out with rules governing conceptual categories such as "object word" and "action word", which at a later point in development get transformed into the appropriate syntactic ones (e.g., Bowerman 1976, Schlesinger 1988). A different approach to discontinuity theory holds that children initially categorize parts of speech according to their "distributional properties", for example, what words they go together with, what words they precede or follow, etc., and subsequently extract generalizations based on these properties (e.g., Braine 1976, Maratsos 1982, Brent 1994).

What do these two types of approaches imply for the acquisition of verbs and VAS? The continuity approach suggests that adult and child grammars are alike with

respect to knowledge of verbs and VAS in the sense that both share the same structures (syntactic trees), and utilize the same principles (e.g., the thematic hierarchy) throughout acquisition. In contrast, discontinuity suggests that the initial knowledge children have of verbs and VAS and the principles they use to extend this knowledge are completely different from those of adults. The position that I argue for below lies somewhere between nativist claims for strong continuity and a fully learning-based discontinuity. I assume weak continuity, in the sense that children's grammars will always be consistent with the grammar of some possible natural language, and that, with age, the grammar they adopt will increasingly approximate that of the target language.

2.3.2 Developmental Models

Karmiloff-Smith (1986, 1992, 1994) distinguishes three types of qualitatively different periods in cognitive development: a *stage*, a *phase* and a *level*. The Piagetian notion of ***stage*** designates an age-related stretch of time that is characterized by a qualitative change (a new internal organization). In contrast, the term she adopts, of ***phase***, refers to a general process within a domain, which is recurrent and not age-related, and which applies similarly across domains; that is, children go through the same phases both within various parts of particular domains and across different domains.[5] The notion of ***level*** (Berman's [1986a] analogous *step*) refers to specific changes within a particular domain. A level is not recurrent, and does not allow retreat to previous levels.

To illustrate these distinctions, consider the following. (1) A bakery has to distribute all bread products to the stores by 9:30 a.m. As a result, the dough for all products must be prepared by 8:00 a.m., it has to rise by 8:30 a.m., and be baked by 9:00 o'clock. Each of these activities can be said to represent a distinct stage, since it involves a time-dependent, qualitative change across different domains (products). (2) Baking, cooking, and preparing a hot drink all involve the mixing of ingredients. In this sense, **mixing** can be considered a phase in the preparation of different kinds of food. This phase occurs in different domains (baking, cooking, making a drink), and within a domain (e.g., when baking a loaf of bread, a cake or cookies). A baker can be at phase 1 for some products, and at phase 2 for others, and having to bake a new

5 In line with Karmiloff-Smith (1992), a domain is defined as the set of representations underlying a specific area of knowledge, whereas a module is defined as an information-processing unit that encapsulates that knowledge and the computations on it.

product, he will again implement the same phases, and the ingredients will undergo the same phases until they make a product. (3) As for levels, within the mixing phase one can distinguish the **mixing of dry ingredients**, for example, flour, salt and caraway seeds (level 1), from the **mixing of these with liquids**, for example, milk, oil (level 2) into a batter.

2.3.2.1 Stage Models

In order to evaluate stage models, consider various uses of the term "stage" in acquisition research. Ingram (1989, pp. 32-58) discusses several uses of this term as: (a) a point on a continuum; (b) a plateau; (c) a transition period; and (d) a period of rapid acceleration in development. Ingram notes that the *continuity stage* (a) does not tell us much about the child's organization. It only indicates what the child's condition is with respect to a given phenomenon at different points along a continuum. This information can be used for measuring behavior that is either on the increase or decrease. Ingram illustrates this by a situation when a one-year-old uses one-word utterances such as 'mama' or 'bye-bye' in 100% of its meaningful vocalizations. At 18 months, the same child may use one-word utterances as 70% of its meaningful vocalizations, since s/he is now also using two-word utterances. From these facts, one can conclude that the child at 1;0 is at the 'one-word' stage, but not at 1;6. As a plateau (b), *stage* refers to a behavior that is permanently stopped at a point on a continuum. The transition requirement restricts *stage* to cases where the behavior that has stabilized is expected to change again at some later time. In learning, there are times when certain changes occur more rapidly than others (e.g., the vocabulary spurt), so that there is a sudden increase in use that then remains constant. A *stage* is thus defined as a period of rapid acceleration in the development of a linguistic ability that will end in a steady rate of use afterwards. Some researchers go beyond such individual behaviors, and refer to a *stage* as a relation between behaviors. By their definition, the existence of a distinct stage requires at least two behaviors to co-occur. When the occurrence of one behavior necessarily implies the occurrence of another, the stage is defined an implicational.

There are relatively few proposals that account for language acquisition using a stage-model. Perhaps the earliest proposal is documented in Stern (1924), who distinguishes a stage and four periods of language acquisition. Stern's first stage, *the preliminary stage*, characterizes the first year of life and consists of three types of

behavior: babbling, unintelligible imitation, and preliminary understanding. The next stage, *the first period*, begins when the child consciously produces a word with meaning, around age one year, once there is active production. The main behavior of this period is the slow growth of one-word utterances or one-word sentences, which convey a whole idea or even several ideas but lack grammatical structure. Rather, they are the inseparable union of the expression of a concept and the child's internal needs. They are not members of classes since children are not yet cognitively able to generalize from their experiences, and the use of one-word utterances is mainly determined by associative reactions to some present experience. In Stern's *second period*, the child realizes that everything has a name, with a subsequent spurt in word acquisition characterized by an initial increase in nouns, and ending with an increase in qualifying and relational words. In this period, children begin to ask questions about the names of things, followed by the first multi-word utterances. The first major gains in syntax occur during Stern's *third period* around age two years, when two major grammatical changes occur: the onset of inflections and combination of words by syntactic rules. In Stern's *fourth period* (from age 2;6 on) the simple juxtaposition of words in syntax is replaced by hierarchical structure and the acquisition of embedded or subordinate sentences takes place. The acquisition of grammatical morphemes still continues, and children's questions now include time and causality.

Unlike Stern, who based his acquisitional stages on longitudinal data, Nice (1925) based her stage model on cross-sectional data from several children. Hers is a descriptive work with emphasis on the development of measures of superficial linguistic behaviors. Nice distinguishes five stages: the first stage is *the single-word stage* that begins around the first year of life and lasts for about six months. The second stage is *the early sentence stage*, beginning at around 1;6, initially with mostly single word utterances, mainly nouns – about 65%, with some multiword utterances. During the third stage, *the short sentence stage,* the child begins to develop inflections and grammatical words, and the ratio between the various word classes stabilizes, with nouns 50%-60% and verbs 20%-24% of the vocabulary. The fourth, *transition stage,* is a period of change where the child moves from incomplete to complete sentences. Finally, during the fifth stage, *the complete sentence stage,* most sentences are complete and well-formed.

Perhaps the best-known stage-model of language acquisition is Brown's (1973), based on the early acquisition of English. Like Nice, Brown used the average length

of utterances to divide up the developmental continuum counting the number of morphemes in utterances as a more sensitive measure of grammatical knowledge than number of words do. Brown distinguished five stages of acquisition, as outlined in Table 1.2.

Table 1.2 Brown's (1973) Target Values and Approximations Attained for MLU and Upper Bounds [adapted from Ingram 1989, p. 50]

Stage	Range of MLU (morphemes)	Upper Bound	Midpoint	Stage Name and Description
	1			*The period of single-word utterances* The use of single words without any grammatical knowledge
I	1 - 1.99	5	1.75	*Semantic roles and syntactic relations* The onset and the acquisition of the basic semantic relations used in language like Agent, Patient. Word order is the first syntactic device acquired.
II	2 - 2.49	7	2.25	*Modulation of meaning* The child begins to acquire inflections and grammatical morphemes. Most are actually acquired in subsequent stages.
III	2.5 - 2.99	9	2.75	*Modalities of the simple sentence* The active acquisition of the English auxiliary as it appears in yes-no questions, wh-questions, imperatives, and negative questions.
IV	3 - 3.99	11	3.5	*Embedding of one sentence within another* Complex sentences appear with object noun phrase complements, embedded wh-questions, and relative clauses.
V	4 and up	13	4	*Coordination of simple sentences and propositional relations* The active development of sentence, noun phrase and verb phrase coordination with the use of conjunctions.

In Table 1.2, the leftmost column lists stage numbers. The next column specifies the range of MLU scores that comprise each stage. The next two columns specify the upper bound and average number of morphemes for each stage, and the rightmost column describes the linguistic development characterizing each stage. As this Table illustrates, Brown's stages are not stages in the Piagetian sense, since they do not necessarily involve qualitative changes of organization. Rather, this division into stages is based on an external structural criterion – equally spaced MLU scores, and is adopted for purposes of data sampling. This division is thus arbitrary and represents, as Brown admits, "a discontinuous sampling imposed upon more continuous data. My divisions I to V were rather like a sociologist's imposition of arbitrary dividing points on a continuous distribution of incomes" (Brown 1973, p. 58).

The one-word stage appears to be a particularly significant stage in language acquisition (Peters 1983), in which children produce their first words (approximately between 0;9 - 1;3 months). These words are characterized by two main features: their pronunciation is very different from adult pronunciation of the same words, probably due to articulatory and auditory constraints. And a certain proportion of children's first words tend to have nonconventional reference, being over- or underextended (Clark 1993, Anglin 1977).

Dromi (1987) takes the single-unit period as a test case for the notion STAGE in linguistic development, in the strong Piagetian sense. She characterizes this period as a distinct developmental stage in which the child is preoccupied with the unique task of learning how to correctly map words into their conventional meanings. For her, the single-unit period should be considered a stage since it spans over a recognizable stretch of time and has distinct boundaries. The emergent behaviors during this period both constitute a novelty, and show a considerable degree of uniformity. Further, toward the end of the single-unit period there is a distinct qualitative change in that the intelligibility of words improves considerably and so does the match between words and their meanings (see Clark [1993] for an opposing view).

The stage models outlined above appear to disregard the very idea of a stage as representing domain-general development, since they use the notion to describe domain-specific models of acquisition, namely, to account for qualitative changes in the linguistic ability of the child. In my view, verb acquisition cannot be accounted for by a stage-model, nor by exclusive reliance on "stages" in the restricted sense of linguistic development. First, the notion *stage* in the Piagetian sense refers to an across-domain, discontinuous, qualitatively distinct change in behavior. My analysis confirms findings from other studies (e.g., Tomasello 1992) which show that the acquisition of verbs is a continuous, recurrent PROCESS, which initially applies to individual verbs, and subsequently to verb classes. Second, a *stage* in the strict sense is defined as age-dependent, while the process of verb acquisition is not strictly age-related. Thus, one cannot say that by age two the child has acquired all verbs, or else, all transitive or intransitive verbs, all possible argument structures which characterize one's verb inventory and so on. Third, verb acquisition is affected by qualitative changes in different linguistic modules (semantics, morphology, and syntax) and subdomains (e.g., the morpho-syntactic categories of number, gender, person, and tense) throughout acquisition. Linguistic modules like morphology or semantics affect

the acquisition of verbs as they are realized in the surface form of verbs. For example, number or gender acquisition cannot mark a stage in the acquisition of verbs, since these inflectional categories may not be acquired at the same time. Besides, children might be acquiring different linguistic systems concurrently, each at a different level of complexity (Berman 1986a, 1997). Thus, an attempt to account for verb acquisition by stage-models like those of Stern, Nice, or Brown would appear inadequate.

2.3.2.2 Phase Models

Phase-models proposed to account for cognitive and linguistic development include Karmiloff-Smith's (1992) model of cognitive and linguistic development, Berman's (1986a, 1998a) model of language acquisition and language development, and Golinkoff and Hirsh-Pasek's (1996) model of the development of sentence comprehension.

Hirsh-Pasek and Golinkoff (1996) propose a three-phased developmental model of children's comprehension of language input and linguistic structure that consists of acoustic packaging, segmentation and linguistic mapping, and complex syntactic analysis. The first phase is characterized by acoustic rather than by linguistic processing of language, when children use perceived acoustic units as a guide to segmenting and processing nonlinguistic events. The second phase is characterized by segmentation of the acoustic units extracted in Phase I into clause-internal propositions and mapping them onto objects, actions and events. The third phase is characterized by a decline in children's reliance on cues in the input along with increased ability to perform relatively unsupported syntactic analyses.

Karmiloff-Smith's (1986, 1992, 1994) model addresses the way children's representations become progressively more manipulable and flexible, for the emergence of conscious access to knowledge and for theory building. This involves a cyclical process by which information already implicitly present in the mind becomes explicit to the mind via redescriptive processes, first within a domain and then sometimes across domains. Karmiloff-Smith argues that during the first phase (the procedural phase) the child focuses mainly on information from the environment, and so initial learning is "data driven". During this phase, for any microdomain, the child focuses on external data to create "representational adjunctions", that is, new, isolated, representations which are simply added to the existing stock with minimal effect on it. Phase I culminates in consistently successful performance to a point of **behavioral**

mastery. In Phase II, children work on their earlier (successful) procedural representations as problem spaces in their own right. In this phase, behavioral output is generated predominantly by an internal top-down control mechanism which is imposed on the environment and which constrains particular behavioral manifestations. In phase III (the conceptual phase) the child uses a subtle control mechanism to reconcile external stimuli and internal representations.

Along similar lines, Berman (1986a, 1998a) characterizes the process of language acquisition and language development by three distinct phases, as shown in Table 1.3.

Table 1.3 Berman's (1986a) Three-Phase Developmental Model of Language Acquisition

	Developmental Phase	**Step**	**Description**
I	Pregrammatical	**Rote knowledge**	Initial acquisition of individual items as unanalyzed amalgams
		Early alternations	Initial alternations, a few very familiar items are modified contrastively
II	Grammatical	**Interim schemata**	Transitional, non-normative but partly productive rule application
		Rule knowledge	Grammaticization, with strict adherence to rules plus some inadequate command of structural and lexical constraints.
III	Conventionalized	**Mature usage**	Rules constrained by adult norms and conventions, with variation in style and register reflecting individual background and specific discourse context.

The **pre-grammatical phase** is characterized as item-based, unanalyzed rote learning, involving few structural alternations, and mostly affected by pragmatic and contextual cues. The **grammatical phase** is characterized as being structure-dependent and rule-bound. At this phase, rules are applied productively across items, and these, in turn, are interrelated within more general systems and paradigms. The **conventionalized, discourse-oriented phase** integrates the two previous phases, as in Karmiloff-Smith's model above. It is characterized as being usage-appropriate, since at this phase the rules and forms acquired previously are used with increasing skill, taking into account norms of usage, lexical conventions, and so on.

A phase-based model of acquisition has several advantages. It allows for a description of continuously developing processes. Also, since it is recurrent, and non-age related, the same phases can be used to account for processes within domains and microdomains as well as across domains. In the case in point, the same process can be used to account for particular verbs or verb classes. Finally, it can account for

individual variations between learners. Consequently, I propose a developmental phase-based model to account for verb and VAS acquisition (see Section 3 below).

2.3.3 Accounts of Change

What initiates change? What motivates the transition from one developmental phase to the next? These questions are also central to the proposed model of verb and VAS acquisition. An account of change must explain what makes children advance from a state of poor inflection to a state of fully inflected verbs, from a state of no arguments to a state of complete argument structure, or why a particular course of VAS development emerges from the data.

This section reviews several accounts of change, primarily the principles of *dynamical systems theory* (Behrend 1994, Elman 1990, Thelen 1989, Tucker & Hirsh-Pasek 1993). These accounts will be used to explain transitions in acquisition of verbs and VAS.

2.3.3.1 Dynamical Systems Theory

Gathercole, Sebastián and Soto (in press) compare the early acquisition of Spanish verbal morphology to drops of water falling down, eventually to form a river. Each drop adds to the previous ones, until there is a substantial, critical mass to establish a whole, which both functions as a stable unit in itself, and at the same time continually changes as new drops fall and old ones dry up or roll away. At no point is it possible to say that before that point there was no river, while after it there is. This idea is consistent with dynamical systems theory (Thelen & Smith 1995, Smith & Thelen 1993), by which dynamical systems are self-organizing and capable of generating stable patterns of enormous complexity, without preexisting programs or prescribed processes. Behrnes (1994) uses a dynamical systems approach to account for the acquisition of verb meaning, since semantic development, with its bursts, pauses, and shifts in focus, seems to qualify as one of those "difficult-to-predict" phenomena that a dynamical systems theory is well suited to account for.

Dynamical systems theory originated in the physical and biological sciences, where it has been used to study developmental phenomena characterized by nonlinear, often unpredictable, course of development. Dynamical systems are organized collections of components or subsystems, that make no attempt to appeal to the existence of information either in the environment or in the individual to account for development. This self-organizing property of systems allows the beginning of the

acquisition process to proceed with little complex structure. Structure or form (information) is constructed in the course of development, and arises through the successive organizational adaptation of systems components to a specific context, containing properties that are qualitatively different and novel when compared with earlier organizations.

Dynamical systems are characterized by inherent organization, interdependence of systems components, and the progression from lower to higher, more complex levels of organization in development. This internal organization is characterized by an initial undifferentiated state, in which the system's "learning potential" is much greater than in subsequent developmental periods, followed by successive organizations which are more complex, hierarchically arranged, integrated and differentiated. The natural state of the system is defined as a dynamic adaptedness to a specific context. Development is typified by discrete phase shifts from one dynamic steady state to another, engendered by the changing values of certain organizational components or contextual variables termed *control parameters*, or "agents of change" (Thelen 1989). The point of transition between phases is marked by increased behavioral variability, by an apparent disorganization, and by greater sensitivity to disruption. Following this brief variable period, the system will reorganize, and the "missing" behaviors may spontaneously reemerge. Usually, they will be more stable and reliable, and more complex than before the reorganization. With each successive shift, the systems behavior becomes more complex, less flexible, and less adaptable to varying contexts, dedicated to one function in an immensely complex way.

Tucker and Hirsh-Pasek (1993) apply the principles of dynamical systems theory to language acquisition, providing a skeletal outline of an acquisition model consistent with principles of dynamical systems. In their model, the initial conditions for grammar are predispositions to attend to certain kinds of input over others. They assume that linguistic input represents the context to which the developing linguistic system adapts, with the context and system mutually informing since contextual components have an equal likelihood of affecting major systemic changes as do intersystemic components. Tucker and Hirsh-Pasek assume that the linguistic subsystems are highly correlated, and interact with one another in ways that help children in the acquisition task. Each subsystem has a differential weight or impact on the process of acquisition throughout development. What drives the language system forward through successive reorganization is some discrepancy between what the

system expects and what the context provides. Discrepancies constitute the control parameters that motivate a system-wide change, or reorganization. The theory predicts that as the language system continues to develop and differentiate, there will be fewer similarities between linguistic structure and the general cognitive structure that originally composed the system. The system eventually takes on its own properties, which become qualitatively different from the parts that helped compose it.

2.3.3.2 Other Accounts of Change

Several other proposals have been made to motivate developmental changes. Bloom (1991) notes that change may be motivated by discrepancies between what children want to say and what they are able to produce. Where children fail to communicate the intended meaning, this failure can be a cue that the form used was inappropriate. This resembles Piaget's notion of *equilibration* – before a new stage of thought can be reached, the child must face the inadequacy of the current one, and experience cognitive conflict or uncertainty.

In a generative framework, Borer and Wexler (1987) proposed the "Maturation Hypothesis", by which movement from one developmental stage to another is not necessarily driven by a trigger in the linguistic environment, but by maturation processes through which a parameter emerges only when biologically programmed to do so. The order of maturation of UG principles and parameters reflects what the child "needs" and uses at a given stage in development.

Bates and MacWhinney (1987) refer to the notion of *competition* between linguistic cues as a generator of change. Their "Competition Model" is based on connectionist-type learning mechanisms by which the child looks for form-function mappings through the use of constructs such as "cue validity" and "cue strength". "Cue validity" describes the extent to which a particular cue for how a language works is available (i.e., is present in the surface structure) and reliable (i.e., leads to the same outcome when it is available). It can be evaluated through examining the grammatical devices languages employ to mark certain meanings. "Cue strength" is how much weight the learner gives to units of linguistic information. A particular cue will be weighted more heavily if it has high cue validity. Thus, for English, preverbal position tends to be a highly reliable and often available cue for agency. It will therefore be assigned greater cue strength than it would in a language like Italian,

where word order is less rigidly constrained and semantic roles are marked in other ways.

Plunkett and Marchman (1993) and Marchman and Bates (1994) consider the "Critical Mass Effect" as a trigger for shifting a connectionist network from rote learning to the application of general patterns. The idea is that children must acquire a sufficient number of exemplars (i.e., a sufficient amount of input data) before abstracting general patterns that lead to productivity.

Finally, Karmiloff-Smith (1994) discusses the role of feedback and success as motivating change. She shows that negative feedback plays an important role in generating representational change *within* phases (i.e., adding representations), while positive feedback plays a role in the transition *between* phases (i.e., it is essential to the onset of representational redescription). She notes that many studies discussed in *Beyond Modularity* as well as data from Siegler and Crowley (1991) show that change often follows success, not only failure. In other words, children explore domain-specific environments beyond their successful interaction with them.

I will argue that there is no single generator of change that accounts for transitions in acquisition of verbs and VAS. Rather, these transitions are affected by a range of different change generators across development.

3. A Developmental Model of Verb and VAS Acquisition

Like other aspects of language, knowledge of verbs and VAS develops over time. In this section, I propose a developmental phase-based model to account for verb and VAS acquisition. The use of *phase* is motivated as follows. First, certain verbs are acquired earlier than others, so they may undergo certain processes earlier than others. In this case, each transitional period must be recurrent and sufficiently flexible to apply to verbs acquired later. Second, there are individual differences between children in the onset of verb usage, and in the pace at which they acquire various aspects of verb and VAS. Such differences cannot be accounted for by a stage model that is age dependent. The model is developmental in the sense that it describes acquisition as a PROCESS that proceeds from an initial state through intermediate states to a point of mastery.

This process consists of many totally or partially overlapping micro-processes that interact and affect each other in different ways. Specifically, verb and VAS

acquisition proceeds simultaneously along two dimensions: paradigmatic and syntagmatic. For any given verb, verb-class, or verb-inventory of a particular child, development occurs paradigmatically in various linguistic modules (e.g., semantics, morphology, syntax), and syntagmatically, at different phases within each module. The relative influence of each module on the acquisition of verb and VAS changes across development and so does the extent to which input affects this process.

Table 1.4 illustrates that the proposed model consists of three qualitatively different phases (discussed in detail in sections 3.1 – 3.3).

Table 1.4 A Phase-Based Developmental Model of Verb and VAS Acquisition

Phase I	**Training Level**
	Bottom-up Construction of Generalizations
	From Generalizations to Rules
Phase II	**Top-Down Application of Rules**
Phase III	**Integrative Phase**

Phase I is mostly data-driven, and involves a transition from rote learning to rule-formation. It is cumulative, since during this phase, early input is accumulated to serve as the basis for generalizations of subsequent knowledge. The processes that take place at Phase I are centered on the verb, and relate to its form, semantics, morphology and initial argument structure. In this sense Phase I is "verb-bound". Phase II is characterized by the top-down application of rules, and as such relates both to the verb itself and to the acquisition of VAS. Finally, Phase III is characterized by the integration of internal rules with contextual and situational factors, and as such it is centered mostly around VAS in the broad sense of the term, i.e., the discourse appropriateness of certain VAS configurations. This phase model draws on the models proposed by Karmiloff-Smith (1986) and Berman (1986a), as discussed in section 2.3.2.2.

The three developmental phases correspond to five levels or, rather, degrees of productivity, as shown in Table 1.5.

Table 1.5 Levels of Productivity in Acquisition of Verbs and VAS

	Step	**Phase**	**Process**
I	**No productivity**	Training Level	Rote
II	**Non-productivity (one-to-one)**	Construction of generalizations	Rote
III	**Partial Productivity (Many-to-one)**	From generalizations to Rules	Rule

IV	**Full Productivity**	Top-down Application of Rules	Rule
V	**Mastery**	Integrative Phase	Rule

The five levels of productivity form a continuum from an initial state of no productivity to a state of full productivity, or mastery. Initially, children show no productivity in the use of verbs and VAS. This is followed by a non-productive use of verbs – use of individual verbs in a particular morphological form, or argument configuration. Next, children show partial productivity as when they use a number of inflectional variations of a particular inflectional category with individual verbs. Following is a period of full productivity in verb and VAS use, and finally, once discourse appropriateness is achieved, children get to a level of mastery. Initially, these levels relate to individual verbs, and later they expand to the entire verb vocabulary of a particular child.

Thus, levels I and II constitute the pre-acquisition period. Levels IV and V constitute the period of acquisition, and level III constitutes a transitional period between the earlier and subsequent periods. The period of levels I and II does not involve any rule-formation processes, and is bound by MLU. Verbs that enter the child's lexicon prior to MLU 2 go through a pre-acquisition period and then proceed to steps III-V. In contrast, verbs entering the child's lexicon after MLU 2 do not undergo this period, and exhibit development characteristic of subsequent periods. In this sense, level III represents a "critical period" for acquisition.

3.1 Phase I

Phase I is made up of three developmental periods: the *training level*, the period of *bottom-up construction of generalizations*, and the period of *transition from generalizations to rules*. These periods differ from each other mainly in the quality of input analysis that they involve. Thus, the *training level* involves very little and very basic analysis of data, while the period of transition from *generalizations to rules* involves extensive analysis of data as well as more complicated forms of analysis.

3.1.1 The Training Level

The initial period of verb and VAS acquisition lays the foundations for later development. I characterize it as a **training** period, since during this period children absorb input from various sources, and "learn" about the use of verbs and VAS. They are not engaged in rule formation as yet. Rather, they rote-learn certain verb forms,

and at the same time perform distributional analyses on the received input. In this sense, the *training level* can be described as a pre-acquisition period. This is consistent with connectionist accounts (e.g., Elman 1990), which demonstrate that a long initial period is essential to learning since at first, a network's predictions are random, but with time it learns to predict. The network moves progressively from processing mere surface regularities to representing something more abstract. Thus, *training* is used quantitatively to suggest that children need a certain amount of input to get started on the acquisition process, but it is also used qualitatively to indicate that children react to the input they receive. I adopt Karmiloff-Smith's (1986) notion of ***level*** (analogous to Berman's 1986a *step*), to refer to this period. By definition, a *level* is non-recurrent, and applies to specific changes within a particular domain. Likewise, the *training level* is nonrecurrent. It applies across modules within the linguistic domain, but not across domains. It is bound by linguistic age with an upper bound of MLU 2, as will be shown in chapters 3 and 6.

3.1.2 Bottom-up Construction of Generalizations

Following the *training level* is a period of *bottom-up construction of generalizations*. I use the term *generalizations* to suggest that during this period children organize data in a variety of formats (formulae, schemes), but do not yet formulate rules. The emphasis in this period is on the **bottom-up** construction of generalizations (see, too, Berman 1993a, Schlesinger 1988, Tomasello 1992). I argue that children start out with a particular form, where *form* is defined as a possible realization of a category, e.g., plural is a form, a possible realization of the category NUMBER. They later extend both the number of contexts for a particular form, and the inventory of forms for a given category. For example, children gradually extend the use of plural to many different verbs, and at the same time start using both singular and plural forms with the same verb. I argue that the initial generalization of input into structures is a process of approximation, or schema formation in the sense of Bybee and Slobin (1982).

Bybee and Slobin (1982) distinguished between **rules** and **schemas** to account for the acquisition of English past tense. To them, **rules** are generalizations that derive one form from another by changing features or strictly shared properties, while **schemas** are generalizations that derive one form from another by creating a product that resembles other words in the same morphological category. A *schema* may be of

the form "a past tense form may have the vowel [uw]". The application of this schema to different base-forms like *know, draw, fly* may yield the past forms *knew*, *drew* and *flew*. Since the base-form of these verbs does not share the same vowel, their past form cannot be formed by a rule that changes a single base vowel into past tense [uw]. Rather, Bybee and Slobin conclude that children account for such forms by formulating a schema.

Braine (1976) notes that the first syntactic structures that children acquire are "formulae of limited scope" for realizing specific kinds of meanings. In this sense, formulae are realization rules that map semantic elements into particular positions in the surface structure. Formulae are limited in scope since each concerns a specific and often rather narrow kind of semantic content. For Braine, the main part of early syntactic development consists in learning one formula after another. He notes that different children acquire formulae in a different order, and thus there are often individual differences between children early in development. Similar claims have been made by Tomasello (1992), Clark (1995), and recently by Ewa Dabrowska (1999) with respect to the acquisition of WH-questions.

Braine's notion of *formula* can be extended to morphology and semantics as well as syntax. In such a case, Hebrew *roce X* 'want-SG-MS-PR X', X-*ti* 'X-1SG-PT', and *la'asot* X 'to make/do X' represent different kinds of formulae. *roce* X is a syntactic formula, where instead of X the child may insert a variety of NP's, infinitival verbs or subordinate clauses, e.g., *roce balonim* 'want-SG-MS-PR balloons', *roce liftoax* 'want-SG-MS-PR to-open', *roce she aba yavo* 'want-SG-MS-PR that daddy come-3SG-MS-FUT' (see Berman's [1978] report of her daughter's early word combinations in Hebrew). Similarly, Tomasello (1992) reports that between the ages 1;4 – 1;5 his daughter used the syntactic formula 'Get it X' to demand objects which were perceptually present. In Hebrew, X-*ti* is a morphological formula in which X stands for any verb, and –*ti* is the 1st person singular past tense suffix. The child can replace the X with any verb to get the 1st singular past form, e.g., *axal-ti* 'eat-1SG-PT', *gamar-ti* 'finish-1SG-PT' (Similarly, English-speaking children use X-*ed* to mark past tense in their language). Finally, *la'asot X* is a semantic formula. The child can replace X with nominal complements to extend the meaning of the verb *isy1* 'make/do', e.g., *la'asot migdal* 'to-make = construct a tower', *la'asot pipi* 'to make = to produce wee wee', *la'asot ambatya* 'to-make = to engage in a bath', *la'asot igul* 'to-make = to draw a

circle'. Again, English-speaking children use 'make X' in a similar fashion (see Chapter 5, Section 3.1 for examples from Clark 1993).

In the proposed account, schemas are restricted generalizations. They yield formulae that children use with new verbs, or new forms of a particular inflectional category (e.g., PLURAL in the category NUMBER) that children use with both existing and new verbs. For example, Hebrew-speaking children may have a schema like "the feminine plural form has the suffix *–ot*". The corresponding formula is X+*ot*. Children, then, use this formula to form the feminine plural form for what they conceive of as feminine nouns, e.g., *buba – bub**ot*** 'doll-FM-SG – doll-FM-PL', *para – par**ot*** 'cow-FM-SG – cows-FM-PL', sometimes producing ungrammatical forms e.g., *kóva – *kova'**ot*** 'hat-MS-SG – hat-FM-PL' (cf. conventional *kova'**im*** 'hat-MS-PL').

3.1.3 From Generalizations to Rules

Acquisition research has paid relatively little attention to **transitions** between states of knowledge, particularly considering what triggers the transition from generalizations to rules, and how this process proceeds. The last period of phase I the transition *from generalizations to rules* in my model attempts to answer these questions, and so will be considered in some detail below.

Accounts that consider these questions all relate in one way or other to the amount of input or training children are exposed to across development. Maratsos and Chalkley (1981) propose a semantic-distributional account of the acquisition of lexical terms. They argue that if a term appears for the first time in a pattern, the representation of that term and the primitive category description become concrete. If a term is recognized as appearing in a given pattern, and if that term is identical to one that has previously appeared in the same semantic-distributional pattern, the bond between the pattern and the term is strengthened. Over time, an increasingly strongly represented pattern becomes linked with greater strength to a large number of specific lexical items. Also, pathways between category specifications in patterns become stronger and more numerous via intervening lexical connections. Along similar lines, Cartwright and Brent (1997) propose that children initially form syntactic templates on the basis of distributional analyses of linguistic input. These templates serve as the basis for the formation of syntactic categories and the resulting productivity that they license. In their model, children do not have any prior knowledge of syntactic categories until they acquire enough similar templates from which they can abstract a

general pattern. Relatedly, the "critical mass hypothesis" of Marchman and Bates (1994) states that children must acquire a sufficient number of exemplars (data) before abstracting general patterns that lead to productivity.

Schlesinger (1988) proposes a non-nativist account of the origin of syntactic categories, on the assumption that semantic categories expand into syntactic categories through a process of semantic assimilation. For example, at some early point children have an Agent-Action sentence schema, which they then use to analyze novel NP-VP strings, even though these may not be strictly Agent-Action sequences. As the Agent-Action schema is used to parse sentences with action verbs, the Agent and Action categories progressively expand beyond their original semantic nucleus. Schlesinger refers to the broadly extended agent category as a "generalized agent", in the sense that as it assimilates the subjects of intransitive verbs on the one hand, and of stative and experiential verbs on the other, it transmutes into **subject**.

A different type of account is based on prototype theory.[6] Anglin (1977), for example, argues that children form a perceptual schema or representation of an object, based on their first experience with it. At first, the prototype is limited to the perceptual characteristics of the first instance so named, but it will generalize as more instances are met. Children are at an intermediate level at the outset and then proceed to both more general and more specific meanings. Similarly, Bowerman (1978a) argues that initially children hear a word used frequently in a particular context, so that they first acquire and use the word in this context. They then impose a featural analysis upon the word's prototypical meaning, and some of these features can later be recognized in other contexts without the features with which they occurred in the previous stage.

Against this background, I argue that the transition from generalizations to rules in acquisition of verbs and VAS is triggered mainly by environmental factors like the amount of input that children are exposed to. After children have accumulated and processed a sufficient amount of data, they turn to a more abstract representation of

6 Prototype theory is an approach developed by Rosch and her colleagues to account for the representation of meaning by adults. In this theory, word meaning is conceived of as a set of features that capture family resemblances (Rosch 1973, Rosch & Mervis 1975). Certain features are more important than others in determining class membership, but none are required by all members of a class. Some objects are most typical of the word's meaning, since they share more of the word's features than others. In this sense, prototypes are like mental images, where the prototype is an abstract image that resembles all the members, yet is not necessarily any one in particular. Thus, certain features are more important than others in determining class membership, but none are required by all members.

the input. Once this process is completed, acquisition proceeds in a top-down manner. For example, probably only after children have acquired a variety of transitive verbs, and have heard others use word order contrastively with these verbs, will they be able to arrive at a truly general understanding of SVO order. Before this point, they tend to replicate the structures modeled with individual verbs they encounter. I argue that the transition from generalizations to rules forms a critical period in the acquisition of verbs and VAS, since it marks the shift from partial to full productivity of verb usage. In this sense, this is also the first point at which children's knowledge of verbs and VAS can be characterized as adultlike.

The next two phases (i.e., *top-down application of rules*, *the integrative phase*) lie beyond the scope of this work, since they relate to features of children's language after age three years. However, to present a complete model, I briefly describe them in the sections that follow.

3.2 Phase II

Phase II involves the *top-down application of rules*. In line with Karmiloff-Smith (1992), I assume that at this phase, children generate most of their behavioral output by an internal top-down control mechanism imposed on the environment to constrain the particular behavioral manifestations. That is, after children have accumulated sufficient data, and generalized it as described above (Sections 3.1.2 – 3.1.3), they start to formulate rules. From this point on, existing as well as new verbs that enter the lexicon are subject to the application of morphological, syntactic, and semantic rules of varying complexity. Two main properties characterize this phase. First, no verbs enter the child's lexicon as "unclear" or "stemlike", but rather resemble adult verb forms in pronunciation and inflection. Second, certain language specific derivational processes are acquired.

Berman (1993b, 1999) notes that Hebrew-speaking children start working seriously on derivational morphology from age 3 years, when they engage in analyzing word-forms into their component roots, stems, and affixes in terms of lexical form-meaning mappings, and in relation to categories such as causativity or inchoativity in the verb system. Hebrew-speaking children as young as 3 years old coin words both to fill genuine lexical gaps and to replace conventional terms in the adult lexicon. From a very young age, they are attuned to the language particular way of encoding form-meaning relationships in their language, so that unlike in English, in

which the most productive option for coining new verbs is zero-derivation (Clark 1993), Hebrew-speaking children avoid syntactic conversion. Instead, they coin all verbs by the typically Semitic device of combining a consonantal root with a given set of affixal patterns (*binyanim*), and in some cases CV(C) prefixes, or by verb-pattern alternation (see, too, Chapter 3, Section 1.4). For example, Hebrew-speaking children start to extract the consonantal root of familiar verbs and to alternate them in different *binyan* verb patterns, e.g., *y-r-d* 'go down' occurs in both P1 *yarad* 'go down' and P5 *horid* 'took off'. Similarly, *b-w-a* 'come' occurs in both *ba* 'come' (P1) and *hevi* 'bring' (P5), *r-a-y* occurs in both *ra'a* 'see' (P1) and *her'a* 'show (P5), *y-c-a* occurs in both *yaca* 'go out' (P1) and *hoci* 'take out' (P5), and *l-b-š* occurs in both *lavash* 'wear' (P1) and *hilbish* 'dress-TR' (P5).

Two additional strategies for coining new verbs, used mainly in experimental conditions, and usually at a later age (Berman 1993b), were attested in my data: (1) Children started to form denominal verbs, e.g., *ima tasmixi oti* 'Mommy blanket me = cover me with a blanket' [Hadar 2;4]. In this example, the child extracted the consonants of the word ***smixa*** 'blanket' (*s-m-x*), and used them to create a novel verb. In a similar way, she formed *ima tazligi oti* 'Mommy fork me = put something on my fork' [Hadar 2;4] from the noun *maz**l**eg* 'fork' (*z-l-g*). In innovating the verb *le-haglin* Hagar, aged 2;8, extracted a consonantal root from the onomatopoeic word for bell ring in Hebrew ***glin*** (*g-l-n*) to create a verb meaning 'to ring a bell'. (2) They started to make up novel verbs conjugating their own consonantal roots in particular verb patterns, e.g.,– *bodeshet* (*b-d-sh*), and *mangid (n-g-d)* [Smadar 2;1].

Since all of these processes are newly practiced at this phase, they occur alongside the use of overextension errors like *ani nofel otax* 'I fall-SG-MS-PR you-2SG-FM' [Leor 2;8] instead of *ani mapil otax* 'I make-fall = drop you' from the same root *n-p-l*. In this example, an intransitive verb is used to mark a transitive, causative action. Verbs now occur in a range of argument configurations, and missing arguments are mainly licensed by morpho-syntactic rules (null arguments). As a result, the amount of unlicensed null arguments during this period approximates zero, and so does the amount of null subjects in non-*pro-drop* contexts.

3.3 Phase III

The last phase in the acquisition of verbs and VAS involves the *integration* of extralinguistic, contextual factors with rule-bound behavior to promote children's

knowledge of verbs and VAS to a point of mastery. Use of *argument ellipsis* to meet appropriate discourse functions across extended texts, such as for purposes of thematic connectivity or to distinguish topic maintenance from topic shift in narrative (Berman 1990). This is illustrated by the following narrative segments in which a four year-old tells a story while looking at the frog story picture-book (adapted from Berman 1988b), and a five year-old tells a fight story (adapted from Berman 1995b).

(1) *"∅ ro'im po et ha-yeled, et ha-kelev - cfardea.*
see-PL-IPL-PR here ACC the-boy, ACC the-dog – frog =
'(one) can see the boy here, the dog – frog'

hu *yoshev, kelev leyado.*
he is sitting, dog beside-him

Hine ***hu*** *marim et ha - ze.*
here he picks-up ACC the – it

∅ ***maxzik*** *et ze. [ve az?] ∅ yoce haxuca.*
holds ACC it [and then?] goes out

Po ***hu*** *nafal...*
here he fell-down

hu *marim et ha-kelev [= ha-yeled].*
he picks-up the dog [the boy]

Ve po ∅ ***yoce****.*
and here goes-out

Po ***hu*** *gam roce la'alot,ve hu loh yaxol.*
here he also wants to go-up, and he can't

Yoshvim. [xxx yeled]".
sitting [xxx boy] = '(they are) sitting'

[Gali, girl 4;0]

In the first text, a girl is telling a frog story, a story based on the picture-book story about a little boy in search of his lost frog (Berman & Slobin 1994). She uses verbs in the 3rd person (masculine singular) to describe the adventures of the little boy in his search for the frog. This verb form is not a canonical *pro-drop* context, as will be discussed in Chapter 7 (Section 1.3.5). The child seems to know that, since she uses an overt subject pronoun with most of the verbs as in *hu yoshev* 'he sits = is sitting' (line 2), or *hu nafal* 'he fell (down)' (line 5), *hu merim* 'he picks up' (line 6), *hu roce* 'he wants' (line 8). The verbs *maxzik* 'holds' (line 4) and *yoce* 'goes out' (line 7) form an exception, since they occur with no overt subject in the *non-pro-drop* context of 3rd person present tense form. The subject of the previous utterance 'he = the child' (line 3, 6) is also the subject of the utterances starting with these two verbs. The speaker does not mention it, since it was already mentioned in the previous utterance, thus marking topic maintenance in these sequences.

(2) *"Yom exad ∅ sixakti xevel ba-xacer,*
one day play-1SG-PT rope in-the yard = 'One day (I) played jump-rope in the yard'

pitom yeled exad shovav kafac ve ∅ ***itxil*** *le'acik lanu ve ∅* ***ifria*** *lanu,*
suddenly one naughty boy jump-3SG-MS-PT and start-3SG-MS-PT to bother us and disturb-3SG-MS-PT us = 'suddenly, a naughty boy jumped and started to bother and to disturb us'

az kol a-xaverot sheli itacbenu, ve axarkax ∅ ***itxilu*** *lirdof axarav ve*
then all my girlfriends got-annoy-3PL-PT, and later start-3PL-PT to chase him and = 'then all my girlfriends got annoyed and later started to chase him'

∅ ***tafsu*** *oto, ve az* ***hu*** *yarak alay, ve* ***ani*** *daxafti oto ve ∅ amarti oto la-ganenet".*
catch-3PL-PT him, and then he spit on me, and I pushed him and told (about) him to the teacher = 'caught him, and then he spit on me, and I pushed him and told about him to the teacher'

[Galit, girl, 5;1]

In the second text, a girl is telling a personal experience about a quarrel she had. She, too, uses verbs in the third person (masculine singular) to describe the deeds of a boy who bothered her and her friends. The boy is mentioned as the subject of the first verb that introduces him into the story (i.e., *kafac* 'jumped'), and from then on there is no overt subject, to indicate topic maintenance. Similarly, the girl mentions her friends at the beginning of a sentence that describes their reaction to the boy (line 3), and then uses the verbs *itxilu* 'started' and *tafsu* 'caught' with no overt subject to mark topic maintenance. At the same time, the girl shows knowledge of canonical *pro-drop* in her use of missing subjects with first person verbs, i.e., when talking about herself, e.g. *sixakti* 'I played' (line 1).

Word order is another phenomenon that illustrates the integration between rule-bound behavior and discourse factors at Phase III. At Phase I word order is reversed, since children have not yet internalized what the canonical word order in their language is. At Phase III, however, the SV order is changed to VS order in a stylistically appropriate way to introduce a new referent (the moon) into the story with a presentative unaccusative type predicate (come-out) (Giora 1981). This is illustrated by comparing the examples of word order reversal in Lior's data (3) between ages 1;7 – 1;11 (Phase I) and in Maya's story (4) at age 3;0 (Phase III).

(3) *fal ze* [Lior 1;7]
fall-down-3SG-MS-PT it
'it fell down'
cf. normative *ze nafal*

naxash od asit [Lior 1;10]

snake more make-2SG-FM-PT
'(you) made another snake'
cf. *asit od naxash*

od meyxal lisgor [Lior 1;11]
another container to-close
'(I want you) to close another container'
cf. *lisgor od meyxal*

(4) *"pa'am axat haya yeled,*
one time was-MS a boy
'Once there was a boy'

ve betox ha-cincenet hayta cfardea,
and in the jar (there) was-FM a frog

ve kelev hicic
and (a) dog peeped (in)

ve ha-yeled yashan
and the boy sleep-3SG-MS-PT
'and the boy was sleeping'

ve ba yareax,
and come-3SG-MS-PT (the) moon
'(the) moon came-out = (there) emerged (a) moon'
cf. *yareax ba*

ve ha-kelev nixnas letox ha-cincenet"
and the dog go-3SG-MS-PT into the jar
'and the dog got in the jar'

[Maya, girl, 3;0]

These brief examples show how processes like argument ellipsis and word order alternations change with age from locally ungrammatical to globally discourse-motivated.

The proposed phase-based model has several advantages. It relates to the acquisition of verbs and VAS in a developmental perspective, describing this process from its start to a point of mastery. By examining various aspects of development for a particular linguistic feature or process, it integrates aspects of cognitive, linguistic and behavioral theories of development. Further, such an account is sufficiently flexible to accommodate differences in acquisition of particular verbs by a given learner and to account for individual differences between learners of a particular language and across languages.

3.4 Knowing a Verb

Verb acquisition is analyzed as a process beginning with no verb forms in production and proceeding to adultlike mastery of verb semantics, morphology and argument structure. Thus, whether a child "knows" a verb is not a one-time decision.

Rather, certain criteria may be basic or **necessary** to determine that the child has knowledge of a verb, but they may not be **sufficient** to specify that this knowledge is complete. Attainment of complete knowledge is a gradual process rather than an instantaneous event. Children can be said to "know" a verb when there are clear indications that they have reached a point of no return in terms of **using** the said verb. That is, when use of the verb is self-initiated, consistent, and persistent over time.

With respect to knowing a "verb", **necessary** conditions are mainly required to prevent communication breakdown, whereas **sufficient** conditions are mainly ones that prevent ungrammaticality. For example, when a Hebrew speaking child utters something like *aba nini* (i.e., '*Daddy gimme*-FM-SG-IMP') every time he points at something that he wants, we can say that certain **necessary** conditions are fulfilled to justify the claim that the child has knowledge of the verb *give* in Hebrew. In the example, there is no gender agreement between the subject and the verb, and the direct object is missing (cf. normative *aba ten li 'Daddy give*-MS-SG-IMP to-me'). Nonetheless, the child uses the verb consistently, with the appropriate illocutionary force, that is, in the imperative form to express a request for transferring something (from the interlocutor) to himself as speaker. To fulfill the **necessary** and **sufficient** conditions for mastering the argument structure of *give*, these conditions must be met together with the requirements that the verb has a direct object, and it agrees in gender with the subject. For example, in utterances like *ima ni i shokoat* '*mommy*-FM-SG *give*-FM-SG-IMP *to-me chocolate*', and compare the standard feminine form *ima tni li shokolad* with the standard masculine form *aba ten li shokolad*.

The development of verbs and VAS is thus described as a continuum from early/necessary knowledge to advanced/necessary and sufficient knowledge of verbs and VAS. This proposed subdivision is based on three main sources: Findings of previous studies (e.g., Bloom 1991, Brown 1973, Tomasello 1992), preliminary analyses of Hebrew data from the four children studied here, and an *a priori* set of hypotheses about the nature of early language knowledge.

To illustrate what is meant by necessary and sufficient conditions, consider an example from a different domain, walking. Can we claim that a child who is only a few days old knows how to walk when he demonstrates a walking reflex? The answer is no. Walking must be preceded by certain steps, and must comply with certain requirements to be mastered by the child. The ability to make a few steps when holding on to something is **necessary** to claim that the child is beginning to walk, but

it is not sufficient to argue that the child **has mastered** walking. Some additional conditions concerning the distance a child can walk without holding on to things and the number of steps s/he can make without falling down, will serve as criteria which are **sufficient** to determine whether a child has mastered this skill.

Just as there are individual differences between children in the age they begin to walk and the speed at which they advance from single steps to skilled walking, so there are individual differences between children in various aspects of language acquisition.

3.5 Individual Differences between Learners

All learners share certain aspects of acquisition but differ in others. For example, all Hebrew-speaking children show similar trends in the overall order of acquisition of inflectional morphemes, but differ in when they add particular verbs to their verb lexicon. Individual differences are important for several reasons. First, they can indicate whether a certain behavioral pattern is idiosyncratic or shared by all children. Second, they can indicate the MLU or age range for the acquisition of a certain phenomenon (this is more relevant as an analytical tool, or a developmental measure for language acquisition). Third, when found, they can support one acquisitional approach over another, e.g., nativist versus data-driven approaches. Finally, the nature of the differences can be suggestive as to the strategies children employ throughout the acquisition process. In the present study, individual differences are expected at the onset of verb usage, in the early make-up of children's verb lexicon, in the pace at which various aspects of verb and VAS are acquired, and in the acquisitional strategies that children employ. In the early phases of development, such individual differences will be attributed to pragmatic or extralinguistic factors like differences in individual experience and exposure to caregiver input, prior to grammaticalized and semantically motivated generalizations.

Chapter 2: Research Methodology

1. Database and Tools of Analysis

This chapter deals with the research methodology and the analytical tools utilized to analyze the data for this study. These tools are partly adapted from existing crosslinguistic materials, e.g. the CHILDES project, and partly devised specifically for purposes of my research. The general method I adopted aims to combine quantitative data with qualitative analyses. The quantitative patterns that emerged were not submitted to statistical tests mainly due to the small number of subjects in the sample, and the early stage of acquisition of the relevant features (verbs and arguments). The chapter has two parts. Part I describes the transcription and coding systems (Sections 1.1 - 1.4), and Part II discusses three measures of grammatical development, and proposes a computerized procedure for calculating one of these measures for Hebrew (2.1 - 2.5).

1.1 Database

The study is based on naturalistic longitudinal data collected on a weekly basis from four Hebrew-speaking children, three girls (Hagar, Smadar and Lior) and a boy (Leor). Each of the children was recorded for approximately one hour a week (usually in more than a single session) over a period of approximately 18 months (between ages 1;5 - 3). The corpus from which my data was extracted was recorded and transcribed as part of the Crosslinguistic Language Acquisition Project conducted by Berman and Weissenborn (1991).[7]

For each of the four children, I selected transcripts of sessions recorded twice a month, at intervals of 10 - 14 days, over a period of approximately 18 months. These intervals are sufficiently short not to miss significant developmental changes in the children's language, yet extended enough to allow such changes to take place. Information concerning the analyzed data is summarized in Table 2.1.

7 Three of the four children in the present study were studied by Armon-Lotem (1997). Any inconsistencies between the two studies may be due to a number of factors. (1) Differences in sampling (the two corpora are similar, not identical). (2) Differences in relating to methodological questions such as the definition and criteria for "productivity" and "acquisition" that constitute a central issue in the conception and data analysis of my study, and are not addressed by Armon-Lotem (in line with the generative conception). (3) The different conceptual frameworks within which the data are analyzed, also affect the way in which the data are interpreted, and which aspects of the data are focused on.

Table 2.1 Children's Longitudinal Data

Child's Name	Sex	Age Range	Number of Transcripts	Number of Child Utterances per Transcript	
				Range	Mean
Hagar	F	1;7-3;0	35	51 - 529	173
Leor	M	1;9-3;0	32	68 - 378	203
Lior	F	1;5-3;1	33	56 - 327	168
Smadar[8]	F	1;4-2;3	14	89 - 295	230

This database has several advantages. The interactions are natural since they were recorded in a setting familiar to the child (home), with his or her primary caregiver (usually the mother, and in Leor's case, his aunt) and at times with other members of the family. The data were collected over several sessions each week and so allowed a variety of contexts for the children to express themselves. Rich contextual information was provided by the caregivers who were available to the transcriber for clarifications. Finally, both the transcribers and the researchers know the children and their parents, and are familiar with their linguistic development beyond the data provided by the recorded sessions.

1.2 The CHILDES Transcription System

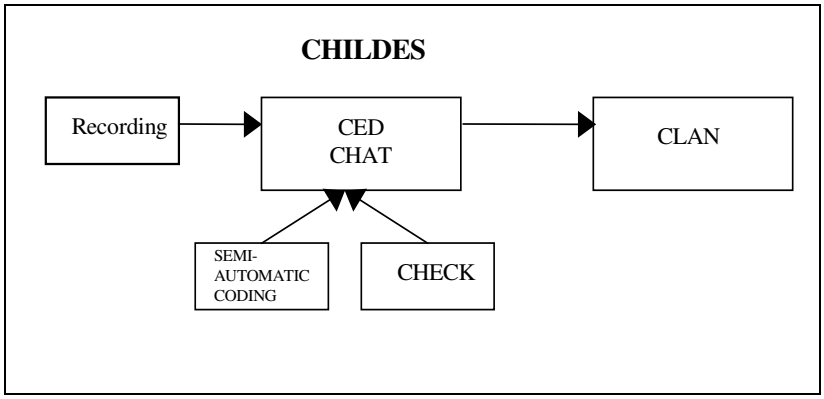
Naturalistic speech samples of this kind require careful transcription of the recorded data as a basis for subsequent coding and analysis. I decided to base these procedures on CHILDES (MacWhinney 1995), as a well-documented and carefully tested system.

CHILDES (Child Language Data Exchange System) is a computerized tool for storing and analyzing talk, established in the early 1980's at Carnegie Mellon University by a group of researchers headed by Brian MacWhinney and Catherine Snow as principal investigators in order to meet the need for providing raw data for further research and sharing data among researchers.[9] CHILDES consists of three components (see Figure 2.1): CHAT (Codes for the Human Analysis of Transcripts), CED (CHILDES Editor) and CLAN (Computerized Language Analysis).

8 For Smadar, the child with the most precocious language development of all the children in the sample, recordings were cut short for extrinsic reasons before age 3.

9 CHILDES has been revised on numerous occasions since it was first published. The most updated and comprehensive description of the project is provided in MacWhinney (1995). Recently, this information can also be accessed through the web (http://childes.psy.cmu.edu/childes).

Figure 2.1 Child Language Data Exchange System (CHILDES)



CHAT is the standard transcription system for the CHILDES project. It facilitates the transcription of linguistic data, and enables researchers to code data in a semi-automatic procedure, using predetermined code lists. CED is a plain-text oriented editor specifically designed to work with CHAT files in one of two modes: Editor mode [E] and Coder mode [C]. In Editor mode, it facilitates typing new CHAT files and editing existing files and allows for checking of the transcribed files for accuracy (by running the CHECK program inside the editor). In Coder mode, CED provides coders with a systematic way of inserting codes from a pre-defined coding menu. CLAN consists of a set of programs designed to allow researchers to perform automatic analyses on transcript data, such as frequency counts, word searches, etc.

Several reasons led me to choose the CHILDES system. (a) This tool was especially developed and designed to facilitate the analysis of audio- and video-recorded linguistic data in general, and children's speech output in particular. (b) CHILDES is language-neutral, it is adaptable to any natural language, and its reliability has been tested against crosslinguistic data. (c) Using CHILDES makes it easier to share the transcribed data with other scholars for evaluation and further research. (d) The database can be processed by a semi-automatic procedure. And (e) CHILDES makes it possible to analyze data using statistical and search programs, as especially developed within CHILDES for analyzing talk.

1.3 Transcript File Format

In order for the CLAN programs to be applied, transcripts are entered in the CHAT format.[10] Each transcribed file is divided into two main parts: headers and tiers (see Figure 2.2). The "headers" constitute the first part of each transcript, and contain information about the participants in the interaction and general comments on their linguistic behavior and extralinguistic situation.

Figure 2.2 CHAT File Format [Lior, girl, 1;5;19]

Headers

@Begin
@Filename: lio105a.cha[11]
@Coding: CHILDES 0.88, January 19, 1990
@Age of LIO: 1;5.19
@Sex of LIO: Female
@Date: 26-Jan-1990
@Situation: At home. Changing situation supplied during transcription.
@Participants: LIO Lior Child, MOT Rosa Mother, FAT Sahar Father,
TAL Tal Aunt, AVI Avital Family Friend, GRA Grandmother
@Utterances: LIO: 81
ADU: 200
@Cassette: 9a
@Comment: Transcriber hears first two-word combination *ze savta* 'this (is) granny', but participants do not seem to notice it. The two-word expression *od pa'am* 'another time, again' occurs as an unanalyzed formulaic routine; participants tend to pronounce *et ha* 'ACC the' as *ta*; *savta* 'granny' is always pronounced *safta*

Tiers

Main tiers (text lines)

*MOT: *Lior, boi kxi et ha-matate.*
*TAL: *ma ze, ma ze?*
*TAL: *matate.*
*MOT: *sapri lahem ma axalt, axalt avokado?*
*LIO: *kado [: avokado] [*].*[12]
*MOT: *ve axalt gam yogurt?*
*MOT: *ve ma od?*
*LIO: *eynanu [: gamarnu] [*].*

10 A sample recording of my transcripts was checked against the relevant transcript at intervals of once a month for each child in the corpus. An automatic check was performed on all of the written transcripts using the CHECK program in the CHILDES editor to detect formatting and syntax errors in the transcription.
11 Transcript filenames such as *lio105a.cha* have the following format: First, the child's name is listed in three lower case letters (e.g, *lio* = Lior); then the child's age is listed (e.g., *105* = one year and five months); finally, the number of the transcript is listed in one lower case letter (e.g., *a* = the first transcript of Lior at this age). The extension *.cha* indicates that the file was transcribed in the CHAT format (see Section 1.2).
12 Errors are represented on the main tier as follows: The relevant word or expression is transcribed in the textline as uttered by the child (e.g, *kado*). The standard adult form is then given in square brackets (e.g., [: *avokado*]), followed by an asterisk which marks it as deviant (e.g., [*]).

Dependent tiers (coding sequences)

%lex: $V:*gmr*1
%sem: $V:sch
%mor: $V:P:US:1:PAST

%src: $SF
%err: *eynanu* = *gamarnu* $PHO $SYL ;

%syf: $V:pd
%syn: $VP
%arg: $N:ELL:su:GR $N:ELL:do:PR

%spa: $FRZ
%thm: IRV

Coding Index	
$V	verb, *gmr* - consonantal root, 1 - *binyan qal*
$V	verb, sch - change of state
$V	verb, P - plural, US - unspecified gender, 1 - first person, PAST- past tense
$SF	a self-initiated utterance
$PHO	phonological error, SYL - involving a change in a syllable
$V	verb, pd- predicate
$VP	Verb Phrase
$N	noun, ELL - ellipsis, su- subject, GR - grammatical, do - direct object, PR - pragmatic
$FRZ	a frozen expression
IRV	irrelevant

The "tiers" part provides information on two different levels. The **main tiers** identify the speaker and give the content (i.e., textline) of his or her utterance, and the **dependent tiers** consist of specific comments (see Table 2.2) or coding sequences (see further Section 1.4).

Table 2.2 illustrates the types of dependent tiers incorporated in the transcripts for purposes of commenting rather than linguistic analysis. Each tier is given a specification of name, symbol, possible contents as defined in the CHILDES manual, and an example.

Table 2.2 Dependent Tiers used for Comments

Dependent tier	Symbol	Contents	Example
Action	%act	A description of the actions of the speaker or listener	%act: making a toy car
Comment	%com	The general purpose comment tier	%com: tape jumped
Explanation	%exp	An explanation tier useful for specifying the deictic identity of objects or individuals	*TAL: *bubale* %exp: a pet name often used to refer to the child (literaly 'dollie' from *buba* 'doll' with a Germanic diminutive suffix *–le*)
Paralinguistic behaviors	%par	Codes paralinguistic behaviors such as coughing, crying	%par: Child sighs in discontent
Situational information	%sit	Situational information relevant to this particular utterance	%sit: Investigator and grandmother are talking to child

Applying this system to Hebrew raised special problems. It was necessary to establish transcription conventions for representing Modern Hebrew pronunciation, to represent consonantal root+*binyan* verb-pattern, and to decide on conventions for representing morphemes such as conjunctions (e.g., *ve* 'and'), the article *ha* 'the', and prepositions (e.g., *be* 'in', *me* 'from', and *le* 'to') which are written as part of the

following word in conventional Hebrew orthography (for example, 'in the morning' or 'and the boy' are written as single words in Hebrew). These problems have been addressed in earlier studies of Hebrew child language (Berman & Armon-Lotem 1996), as well as in studies of adult Hebrew (Blum-Kulka & Snow 1992). Yet numerous other problems have been encountered, mostly concerning the standardization of the transcripts and the development and implementation of the coding system, that were addressed in detail for the first time in the present study.

Hebrew utterances are rendered in broad phonemic transcription representing the target forms, that is, the pronunciation of these children's caretakers (parents and grandparents). As such, the target forms are typical of "standard" Hebrew usage of well-educated Israelis for whom Hebrew is a first and major language (Berman 1987, Ravid 1995, Berman & Ravid 1999). In order to reflect the genuine usage of such speakers (and the primary input to the children in this research), the transcription deliberately departs from both the historical or underlying forms represented by the conventional Hebrew orthography and from the normative pronunciation stipulated by the Hebrew language establishment (Hebrew Language Academy, school grammars, official broadcasting, media).

I invested considerable effort in the standardization of all files according to the latest version of the CHILDES transcription system, since only standard files can serve as input for the statistical programs of CHILDES. This involved, for example, changing all existing transcripts to meet the CHILDES convention for representing child utterances versus target forms on the main tier, with various types of errors stemming from the gap between these two forms being marked as such on the main tier as well. This was necessary to facilitate analysis of data based on situational context or on caretaker reaction before coding started (for example, whether a form such as *pes* 'climb' should be taken to mean *letapes* 'to climb' or *metapes* 'climb-MS-SG-PR'). This saves the coder time, and makes the use of search programs or frequency counts more accurate. It is the only way for the error tier to identify the part of the utterance referred to on the main tier. For example, **Main Tier -** *LIO: *eynanu [: gamarnu] [*];* **Error Tier -** %err: *eynanu* = *gamarnu* $PHO $SYL. And it makes the contents of the transcripts more readable and so more accessible to investigators and students.

Implementation of the CHILDES system demands four different types of files. A **transcript** file contains a standard transcription of the recorded data. A **coding** file contains the code lists in a format that can be operated semi-automatically. A **check**

file which is used for checking the format of the transcription and the codes. And, a **documentation** file includes a description of the coded data and the coding categories. I endeavored to follow the CHILDES conventions closely in creating these various types of files. This was done to facilitate and make the coding process less error-prone, to monitor the format of the coded transcripts to fit them to the CLAN programs, and to describe the system for potential use by other researchers.

1.4 The Coding System

An original multi-tiered coding system was devised for this study, which was accessible to a semi-automatic coding procedure (see Appendix 2.I for details). This coding procedure was applied to all of the children's utterances in each of the analyzed files.[13] The coding system developed here consists of a large and varied array of coding categories, adapted in part from the standard CHILDES coding system, supplemented by categories from the coding manual of Berman and Weissenborn (1991), and by a large group of new categories necessary to meet the goals of my research. Table 2.3 gives a breakdown of these coding categories by source. All non-CHILDES categories were standardized to meet the current CHILDES format.

Table 2.3 Distribution of Coding Categories by Class and Source

Class of category	Source		
	CHILDES (1995)	Berman & Weissenborn (1991)	New (Uziel-Karl)
Lexical	√	√	√
Morphological	√	√	√
Syntactic form	√	√	√
Syntactic function	√	√	√
Error	√		√
Speech act	√		√
Semantic			√
Thematic			√
Argument			√
Source			√

This yielded an elaborate coding system at 10 distinct levels of analysis: lexical, morphological, syntactic form, syntactic function, thematic, semantic, source (= degree of repetition), speech act, error, and argument structure.[14] The variety of coding categories yielded two types of analyses: syntagmatic and paradigmatic.

13 A similar procedure could, of course, be applied to adult utterances, for example, for the study of input.

Table 2.4 outlines an example of a paradigmatic analysis for a Hebrew child utterance meaning *Donald Duck is eating a banana*.

Table 2.4 A Multi-tiered Analysis of an Utterance

Utterance	*Donat*	*oxeyet*	*banana*[15]
Syntactic structure	NP	VP	NP
Lexical structure	R	V	N
Syntactic function	subject	predicate	direct object
Them atic roles	A g e n t		T h e m e
Verb seman tics		a c t i v i t y v e r b	

A syntagmatic analysis of the utterance includes information on consonantal root and verb-pattern (*binyan)*, tense and mood, inflectional morphology, discourse function, and error types. This is illustrated in Table 2.5 for the verb *oxeyet* ('eats, is eating') in the utterance *Donat oxeyet banana*.

Table 2.5 Predicate Analysis

Utterance	**Gloss**	**Lexeme**	**Tns/Mood**	**Inflections**	**Discourse function**	**Error type**
oxeyet	is eating	*a-x-l1*	present	3SG-FM	answer to question	agreement

Table 2.6 below specifies for each coding category its dependent-tier, symbol, and contents. The choice of dependent tiers applied in this study is motivated first and foremost by the focus of the study, acquisition of VAS. In order to detect developmental trends, information on the presence or absence of arguments for all

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14 *Source* here refers to whether the utterance was child- or adult-initiated, repeated, or (partly) imitated (see Section 1.4.7 below).

15 This is a gloss of the sentence *Donat oxeyet banana* uttered by Raz [1;6;16]:

Child utterance:	*Donat*	*oxeyet*	*banana*
Target form:	*Donald*	*oxelet*	*banana*
	Donald Duck-SG-MS	eat-SG-FM-PR	banana-SG-FM

The sentence has an agreement error: the subject and the verb do not match in gender.

verbs in the database had to be coded, and argument structure errors were isolated from other errors in the data. And the data were coded for syntactic, semantic, lexical and morphological information, in order to estimate the relative weight and contribution of various linguistic modules to the acquisition of verb-argument structure. Such a procedure should, hopefully, provide a well-motivated basis for evaluating claims concerning what "triggers" the acquisition process, such as Pinker's (1984, 1989) "semantic bootstrapping" hypothesis, the arguments of Gleitman (1990) and her associates for "syntactic bootstrapping", and Shatz's (1987) idea of "multiple bootstrapping". Next, the data were coded for "source" (see footnote 14) and speech acts in order to evaluate the contribution of caretaker input (e.g., adult reinforcement, child imitation of adult speech) and type of interaction on VAS acquisition. Finally, a key goal of the study was to propose a multi-faceted diagnostic tool for determining level of linguistic development. In order to quantify the relative contribution of the various factors that interact in this measure, the data needed to be coded for all the different kinds of information reported in the literature as relevant to the acquisition of verb-argument structure. These three major considerations yielded the following sets of codes.

Table 2.6 Dependent Tiers used for Coding

Dependent Tier	Symbol	Contents
Lexical	%lex	lexical category; and (for all verbs and some adjectives): consonantal root, *binyan* verb-pattern, type (e.g., modal, aspectual, infinitival complement, auxiliary, aspectual, existential)
Morphological	%mor	agreement (number, person, gender), tense
Syntactic form	%syn	phrasal categories and constituent structure, sentence type (simple, coordinate, complex)
Syntactic function	%syf	the function of each lexical element in the sentence (subject, predicate, direct object, complement, etc.)
Thematic	%thm	thematic roles of the different arguments of the verb (agent, patient, goal, instrument, source, benefective, etc.)
Semantic	%sem	semantic class to which the verb belongs (activity, state, motion, transfer of location, change of state, etc.)
Source	%src	the child initiates the utterance, it is a direct or partial imitation of a caretaker's utterance, or a variation of the caretaker's utterance
Speech act	%spa	type of interchange and illocutionary force of child utterance: question, answer, request, repetition, etc.
Error	%err	various types of errors, other than errors of argument ellipsis
Verb argument structure	%vas	meta-argument structure and realized argument structures of a particular verb

1.4.1 Lexical Coding

All the utterances containing a predicate in the data of the four children were coded for their lexical composition. Table 2.7 lists the major lexical categories used for the coding procedure.

Table 2.7 Coding of Major Lexical Categories

Code	Category	Example
A	Adjective	*tov* 'good'
ADV	Adverb	*le'at* 'slowly'
AR	Article	*ha* 'the'
CONJ	Conjunction	*ve* 'and'
FO	Functor	*od* 'more'
N	Noun	*buba* 'doll'
NG	Negation	*loh* 'no'
P	Preposition	*im* 'with'
P &AR	Preposition + article	*la* 'to the'
PN	Pronoun	*ani* 'I'
PN&P	Pronoun + preposition	*iti* 'with me'
QUANT	Quantifier	*kcat* 'a little'
QW	WH-question	*ma* 'what'
UC	Unclear	***pes*** = *lexa**pes*** 'search', or *leta**pes*** 'climb'
V	Verb	*oxel* 'eats/is eating'
V:inf	Infinitival	*le'exol* 'to eat'
X	Existential	*yeš*'(there) is/are'

Certain lexical elements were coded for additional information as follows. Nouns were coded for whether or not they were proper names. Various forms of *be* were coded for whether they functioned as copula, existential, or possessive morphemes. Pronouns were coded for case (all pronouns other than nominative pronouns which occur as free elements are suffixed to prepositions, e.g., *ani* 'I' (nominative), *oti* 'me' (accusative), *sheli* 'of-me = my, mine', *li* 'to-me', *iti* 'with-me' *bishvili* 'to-me'). Prepositions were coded for whether they are fused with an article, e.g., *le* + *ha* = *la* 'to + the = to-the', *be* + *ha* = *ba* 'in + the = in-the'. Verbs were coded for whether they were infinitival or participle, and whether they were modal or aspectual. Each verb was also coded for its unique combination of consonantal root + verb-pattern, i.e., *verb lexeme*. For example, *akl1* 'eat' is a lexeme made up of the root *a-k-l* conjugated in P1, *akl5* 'make eat = feed' is a lexeme made up of the same root conjugated in P5, *yrd5* 'get down' is made up of the root *y-r-d* conjugated in P5, and *spr3* 'tell' is made up of the root *s-p-r* conjugated in P3 (see Chapter 4, Section 1 for a description of the Hebrew verbal system).

1.4.2 Semantic Coding

All verbs and other predicates in Lior's data were coded for their semantic categories using the semi-automatic coding procedure of CHILDES. Examples of nonverbal predicates include modal expressions like *efshar* 'possible', *mutar* 'allowed', *carix* 'should, have to', xayav 'must', predicative adjectives like *male* 'full', *ratuv* 'wet', *asuk* 'busy', *meluxlax* 'dirty', and the existential deictic *hine* 'here's something', like French *voici*. I used the following five broad categories, based to a large extent on Levin (1993), Bowerman (1996c), Clark (1993), and Lederer, Gleitman and Gleitman (1995): Activity, Change-of-State, Cause-Change-of-State, State, and Other (Aspect and Mood). These categories were further refined, and divided into subclasses (see Appendix 2.II). The coded inventory elicited from Lior's data was augmented by verbs and predicates not found in her sample, extracted from the corpora of the three other children (Leor, Hagar and Smadar), to create a shared semantically-coded database, totaling 526 verb types. This shared database was then used to automatically code the entire verb and predicate inventory in the corpora of the three other children – Leor, Hagar, and Smadar.

Verbs and other predicates were listed in the database or "semantic dictionary" in a format that included: (1) **Verb form** (where verb form refers to an inflected occurrence of a verb as uttered by the child and entered on the main tier, e.g., *boi* 'come-2SG-FM-IMP, *bo*-2SG-MS-IMP, *lavo*-INF, *ba*-3SG-MS-PT). (2) **Verb lexeme** (i.e., the consonantal root + verb pattern or *binyan*, e.g., *bwa1* 'come') as entered on the lexical tier, and (3) **Verb Semantics** as entered on the semantic tier. In addition, the child's name and age were listed next to each entry, to allow the researcher to detect developmental trends within the same subject, and to enable comparison across subjects for specific semantic classes.

Figure 2.3 The Semantic Dictionary

Age	Child's Name	Child's Verb Form	Target Verb Form	Verb Lexeme	Gloss	Semantic class
1;5	Lior	*xol [: le'exol] [*]*	*le'exol*	$V:*akl1*	'eat'	$V:act:ing
1;5	Lior	*bo [: boi] [*]*	*boi*	$V:*bwa1*	'come'	$V:mdc
1;5	Lior	*eynanu [: gamarnu] [*]*	*gamarnu*	$V:*gmr1*	'finish'	$V:asp:cmp
1;5	Lior	*tni eze [: et ze] [*]*	*tni*	$V:*ntn1*	'give'	$V:trp

Each occurrence of a single lexeme was listed in the "semantic dictionary" as a separate entry, on condition that it exemplified a different meaning e.g., the lexeme *bwa1* 'come' was listed four separate times to indicate: deictic motion, hortative

aspect, telic motion, and affective state (see Appendix 2.II for examples). This made it possible to show both how a variety of meanings are related to a single lexeme, and how the same lexeme may denote a variety of meanings. For frequency counts, repeated contiguous occurrences of a single verb or predicate on the same textline were counted as a single occurrence (e.g., 1a). In contrast, two occurrences of a single verb or predicate in consecutive textlines of the same speaker were counted as two occurrences (e.g., 1a + 1b).

(1) a. Lior: *bo bo bo bo* = 1
come-2SG-MS-IMP come-2SG-MS-IMP come-2SG-MS-IMP = 'come! come! come!'

b. Lior: *bo* =1

1.4.3 Morphological coding

All verbs, nouns, pronouns, oblique pronouns and adjectives of the four children were morphologically coded. Nouns and adjectives were coded for number and gender; pronouns and oblique pronouns were coded for number, gender, and person, and verbs were coded for tense in addition to number, gender, and person (see Table 2.8). For each lexical element, the coded string was headed by the category name, followed by a number marker, a gender marker, and if relevant, by a person marker, and finally by a tense marker. For example, the verb *axal* eat-3SG-MS-PT was coded as $V:S:MASC:3:PAST, where $V= verb, S= singular, MASC= masculine, 3= third person, and PAST= past tense, the separating ':' meaning 'morphologically fused'.

Table 2.8 Distribution of Inflectional Categories across Lexical Categories

Category	Number	Gender	Person	Tense	Coded Example
N	✓	✓	—	—	*yeled* 'boy' **$N**:S:MASC
A	✓	✓	—	—	*yafe 'nice'* **$A**:S:MASC
PN	✓	✓	✓	—	*hu 'he'* **$PN**:S:MASC:3
V	✓	✓	✓	✓	*axal* eat-3SG-MS-PT **$V**:S:MASC:3:PAST

Verbs with a stemlike form were marked as unclear (UC), as illustrated in Table 2.9 with examples from Hagar.

Table 2.9 Examples of Stemlike Verb Forms Marked as Unclear (UC)

Age	Verb Form	Gloss	Possible Readings
1;7	*per*	'tell'	*lesa**per*** 'to tell', *mesa**per*** 'tell-1SG-PR', *asa**per*** 'tell-1SG-FUT', *nesa**per*** 'tell-1PL-FUT', *sa**per*** 'tell-2SG-IMP', *tesa**per*** 'tell-2SG-MS-FI', *tesa**per*** 'tell-3SG-FM-FUT', *si**per*** 'tell-3SG-MS-PT',

1;7	*sim*	'put'	*la**sim*** 'to put', ***sim*** 'put-2SG-IMP'
1;8	*kaxat*	'take'	*la**kaxat*** 'to take', *lo**kaxat***-'take-SG-FM-PR'
1;11	*migal*	'shave'	**mi(t)gal**eax 'shave-SG-MS-PR', **mi(t)gal**axat 'shave-SG-FM-PR', **mi(t)gal**xim 'shave-PL-MS-PR', **mi(t)gal**xot 'shave-PL-FM-PR'

Categories where gender is not overtly marked as in 1st person singular and plural, or 3rd person plural in the past or future tense, were marked as unspecified (US). US was also used to mark instances where there were no person distinctions, as in present tense.[16] Table 2.10 gives examples of verb forms that are unspecified for gender, and Table 2.11 examples of verb forms unspecified for person from Hagar's data.

Table 2.10 Examples of Verb Forms Unspecified for Gender (US)

Age	Verb Form	Gloss
1;7	*igati*	'arrived-1SG-PT'
1;8	*ishev*	'sit-1SG-FUT'
1;8	*gamarnu*	'finish-1PL-PT'
1;10	*nase*	'do-1PL-FUT'

Table 2.11 Examples of Verb Forms Unspecified for Person (US)

Age	Verb Form	Gloss
1;7	*roca*	'want-SG-FM-PR'
1;7	*holxim*	'go-PL-MS-PR'
1;7	*mekapec*	'jump-SG-MS-PR'
1;9	*yahsen*	'sleep-SG-MS-PR'

In addition, impersonal forms were marked as IPL. Table 2.12 displays examples of such forms from Hagar's data (ages 1;7 - 3;3).[17]

Table 2.12 Examples of Impersonal Verb Forms (IPL)

Age	Utterance	Gloss
1;9	*kaxa loh **mecayrim** ricpa*	this way not draw-PL floor = 'that's not the way (you) draw/ (one) draws floor'
1;11	*ma **osim**?*	what do-PL = 'what does one do?'
	*loh **ro'im***	not see-PL = '(one) can't see'
2;3	*eyx **kor'im** la-shokolad?*	how call-PL to-the-chocolate = 'what's the chocolate called?'
	*aval loh **marbicim** le-shauli*	but not hit-PL to-Shauli = '(you/one) shouldn't hit Shauli'
2;8	*lean **holxim** ha-yom ?*	where go-PL the-day = 'where are (we) going today?'

16 Present tense forms were historically participles, and like nouns and adjectives, they are inflected for number and gender but not for person (see Berman 1978, 1990).
17 Hebrew has several strictly subjectless impersonal constructions, most typically with verbs in 3rd person masculine plural as shown by the –*im* plural suffix (Berman 1980).

3;3	*eyfo* ***samim*** *et ze, kan ?*	where put-PL ACC-this, here = 'where do (you)/ does (one) put it? here?'

1.4.4 Coding of Verb Argument Structure

Two major questions facing the study were to decide whether a given element is an argument of a particular verb and what is *the meta argument structure* of a given verb. Here, *meta argument structure* refers to an idealized, fully spelled-out set of argument structures that includes all the obligatory arguments required by a particular verb. For example, the *meta argument structures* of a bitransitive verb like *give*, a transitive verb like *wash,* and an intransitive verb like *arrive* are SVOI, SVO and SV, respectively. This section discusses these questions from a methodological perspective. The conceptual issues they arise and their possible theoretical implications are considered in detail in Chapter 6, Section 2.1.

Verbs may occur in actual discourse with only some (or even none) of their arguments realized. Also, there is a danger of circularity in determining the argument structure(s) of a verb by the data, and then reanalyzing the same data for argument structure. To overcome these problems, I used predetermined *meta argument structures*, as defined above. These were determined on the basis of previous linguistic analyses of VAS in Hebrew (Berman 1982, Armon-Lotem 1997, Stern 1979, 1981), as well as on my intuitions as a native speaker of the language.

Along these lines, a single verb can have a set of argument structure patterns. For example, *rcy1* will have the following three argument structure patterns: SVO as in *ani roca tapuax* 'I want-SG-FM apple = I want an apple', SVV(X) as in *ani roca le'exol (tapuax)* 'I want-SG-FM to eat (apple) = I want to eat (an apple)', and SVC as in *ani roca she telxi habayta* 'I want-SG-FM that go-2SG-FM-FUT home = I want you to go home'. Contextual information determines which of the possible argument structure patterns is relevant for a given utterance. For example, *loh roca* 'not want-SG-FM-PR = (I) don't want' uttered by a child is analyzed as having two missing arguments, a subject and either a direct object, an infinitival complement, or a sentential complement. Given a conversational context in which the child's utterance is an answer to the question *at roca le'exol banana?* 'you-SG-FM roca-SG-FM-PR to eat banana= (do) you want to eat (a) banana', the missing argument in post-verbal position is analyzed as an infinitival complement (cf. *ani loh roca le'exol banana* 'I not want-SG-FM-PR to eat banana = I don't want to eat (a) banana'). This is consistent with Lyons' (1977) idea that part of the speakers' language-competence is that they be

able to produce grammatically incomplete, but contextually appropriate and interpretable sentence-fragments.

1.4.4.1 Coding of Meta Argument Structure

All utterances containing a lexical verb, a copular construction, a positive or a negative existential particle, a passive participle, and an adjectival or adverbial modal were coded for argument structure. Argument structure was coded on the %vas tier using a two-part sequence. The first part specified the meta argument structure of each predicate, while the second part specified the argument structure that was actually realized in the utterance. That is, the first part encoded information about the number and types of arguments taken by a verb, while the second part encodes information about argument realization in a particular occurrence of the verb. For example, a verb such as *lavo* 'to come' requires only one external argument as in *aba ba* 'Dad come-3SG-MS-PT = Daddy came/has come'. Thus, on the %vas tier, the first part of the argument structure sequence for *lavo* is $SV, where S stands for *Subject* and V stands for *Verb*. If the child utters only *ba* 'come-3SG-MS-PT', the second part of the sequence would be EV where E stands for ellipted or empty, but if the child utters a sentence like *Dani ba* 'Danny come-3SG-MS-PT', the second part of the sequence will be SV. Thus, the complete sequence for *ba* would be $SVEV, and for *Dani ba* would be $SVSV.

Table 2.13 specifies the possible argument structure combinations for intransitive, transitive, optional transitive, and bitransitive verbs in which the second internal argument is an indirect, dative object.

Table 2.13 Examples of Possible Argument Structure Configurations

Argument Structure	Possible Realizations of VAS	Example
SV	EV	*ba* 'come-3SG-MS-PT'
	SV	*aba ba* 'Daddy came'
SVO	EVE	*roca* 'want-SG-FM-PR'
	SVO	*ani roca balon* 'I want (a) balloon'
	EVO	*roca balon* 'want (a) balloon'
SV(O)	EV, EVE	*axal* 'eat-3SG-MS-PT'
	SV	*aba axal* 'Daddy ate'
	SVO	*aba axal banana* 'Daddy ate (a) banana'
	EVO	*axal banana* 'ate (a) banana'
SVOI	EVEE	*hevi* 'bring-3SG-MS-PT'
	SVEE	*aba hevi* 'Daddy brought'
	SVOE	*aba hevi sefer* 'Daddy brought (a) book'
	SVEI	*aba hevi le-Lior* 'Daddy brought to Lior'
	EVOE	*hevi sefer* 'brought a book'
	EVOI	*hevi sefer le-Lior* 'brought (a) book to Lior'
	EVEI	*hevi le-Lior* 'brought to Lior'
	SVOI	*aba hevi sefer le-Lior* 'Daddy brought a book to Lior'

1.4.4.2 Coding of Argument Ellipsis

To analyze the development of null and overt arguments, I extended Brown's (1973) notion of *obligatory contexts*[18] to include *potential contexts*. These form a subset-superset relation, since all obligatory contexts are also potential contexts, but not vice versa. For example, morpho-syntactic licensing constitutes both an obligatory and a potential context for subject omission. In contrast, semantic licensing constitutes only a potential and in no way an obligatory context for direct object omission. Consequently, the amount of ellipsis is calculated out of the total number of potential or obligatory contexts, rather than out of the total number of verbs in the output. The following examples demonstrate this method.

Consider examples (2) and (3), each containing three utterances.

(2) a. *aba ba* 'Daddy came'
b. *aba halax* 'Daddy went away'
c. **aba raxac* 'Daddy washed'

(3) a. *aba ba* 'Daddy came'
b. **aba raxac* 'Daddy washed'
c. *aba raxac yadayim* 'Daddy washed (his) hands'

Example (2) contains only one case of ellipsis. The direct object of *raxac* 'washed' is missing. If the percentage of ellipsis in this sample is calculated out of the total number of verbs, it amounts to 33%; if it is calculated out of the number of potential cases of object ellipsis (sentence (c)), it amounts to 100%. Similarly, if we calculate the percentage of ellipsis in (3) out of the total number of verbs, it amounts to 33%, but if we calculate it out of the number of potential cases of object ellipsis (sentences (b) and (c)), it amounts to 50%.

Example (4) relates to the **licensing conditions** of null arguments. In this example, all three sentences are potential contexts for direct object ellipsis, of which two are realized as such (sentences (a) and (c)). The missing direct objects could be licensed either pragmatically (PR) in all three sentences (a, b, c), semantically (SM) in two sentences (a and b), or be unlicensed (ILL).

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18 Brown (1973) proposes to consider the notion of *obligatory contexts* as a measure of acquisition of grammatical morphemes as follows: "… the grammatical morphemes are obligatory in certain contexts, and so one can set an acquisition criterion not simply in terms of output but in terms of output-where-required. Each obligatory context can be regarded as a kind of test item which the child passes by supplying the required morpheme or fails by supplying none or one that is not correct. This performance measure, the percentage of morphemes supplied in obligatory contexts, should not be dependent on the topic of conversation or the character of the interaction." (p. 255).

(4) a. *aba axal* 'Daddy ate' (PR:SM)

b. *aba axal tapuax* 'Daddy ate (an) apple' (PR:SM)

c. **aba raxac* 'Daddy washed' (PR:ILL)

If we calculate the amount of semantically licensed null direct object out of the total contexts for ellipsis in the sample, it would amount to 33%, since only one direct object is semantically licensed – (a). But this calculation is misleading, since one of the three contexts is irrelevant – in sentence (c) the missing direct object cannot be accounted for semantically. However, if we calculate the amount of semantically licensed null direct-objects out of their potential contexts (a and b) only, we arrive at 50% missing arguments, since only one of the two contexts, (a), is actually realized as ellipsis.

Data analysis relative to a potential or an obligatory context has a number of advantages. First, it eliminates irrelevant cases from calculation. So, for example, a large number of intransitive verbs in the data will not affect calculations concerning direct object ellipsis if calculation is performed in relation to obligatory contexts for direct object ellipsis rather than to the total amount of argument ellipsis in the sample. Second, the notion of potential or obligatory context for licensing of null arguments distinguishes between subject ellipsis in the case of syncretic verb forms. For example, in future tense 2nd person masculine singular is the same as 3rd person feminine singular, e.g., *toxal* means both 'eat-2SG-MS-FI = you will eat' and 'eat-3SG-FM-FI = she will eat'. However, they differ in the licensing of their null subjects. The missing subject of the former is grammatically licensed, and so constitutes both a potential and an obligatory context for subject ellipsis while the latter is either pragmatically licensed or unlicensed, and thus constitutes only a potential context for ellipsis (in the case of pragmatic licensing).

Finally, as suggested in Brown (1973), the ratio between the number of potential and correctly realized cases of ellipsis can serve as an acquisition measure. For example, the more cases of ellipsis correctly realized in obligatory contexts (e.g., canonical *pro-drop* in Hebrew), the greater the certainty that this licensing condition has been acquired, and the more advanced the learner is in the acquisition process.

Actual and potential contexts for argument ellipsis were coded using two distinct dependent tiers that are adaptations of CHILDES (MacWhinney 1995). *%ept* (ellipsis potential) was used to code all arguments (both missing and overt) for their potential licensing condition(s), while *%elp* (ellipsis) was used to code each

occurrence of ellipsis for its actual licensing condition. Take, for example, the verb *axalti* 'eat-1SG-MS-PT = I ate'. This verb was coded on the *%ept* tier for two arguments, subject and direct object. Here, subject omission is potentially licensed pragmatically (by context or previous discourse) and morpho-syntactically (a canonical *pro-drop* context), and object omission is potentially licensed either pragmatically or semantically, since 'eat' is an optional transitive verb. On the *%elp* tier, subject and object omissions are each coded for only one of the potential licensing modules to indicate the actual cause of omission. For example, if *axalti* is a self-initiated utterance in which the child tells the caregiver about the activity of eating (e.g., *ima, etmol axalti ba-gan* 'Mommy, yesterday I eat-1SG-PT in kindergarten = Mommy, yesterday I ate at (nursery) school'), the potential licensing condition for subject omission is realized as morpho-syntactic, and for object omission as semantic. In contrast, if the child says *axalti* in reply to a question like *Smadari, axalt et ha-tapuax?* 'Smadar eat-3SG-FM-PT ACC the apple = Smadari, did you eat the apple?' then subject omission is still morpho-syntactically licensed, but direct object omission will be pragmatically licensed (by discourse context). Note that unlicensed and null arguments as well as overt arguments were coded as such.

1.4.4.3 Coding Argument Structure on Other Tiers

Errors that are relevant to the acquisition of VAS but do not involve ellipsis were coded on the %err tier. These include word-order substitutions, overextensions, and subject-verb agreement errors. Word order substitutions refer to deviations from canonical word order as illustrated in examples (5) – (6). In example (5) the direct object *Coke* precedes the verb instead of following it.

(5) *kola liftoax* [Hagar 1;9]
Coke to-open
'open (the) Coke'

cf. *liftoax kola*

In example (6) the verb *went away* precedes the subject rather than follows it.

(6) *halxa ha-cipor* [Hagar 2;2]
go-3SG-FM-PT the bird-SG-FM
'the bird went (away)'

cf. *ha-cipor halxa*

Overextension errors refer to using an intransitive verb to denote a transitive action (Bowerman 1982, 1988, 1996, Pinker 1989). In Hebrew, this involves using a verb in an intransitive verb-pattern as if it were transitive (Berman 1980,1985, 1993), as illustrated in examples (7) – (9). In example (7), Hagar uses the root *š-p-k* 'spill' in

the intransitive (passive) P2 pattern to denote the causative action 'spill' instead of using the same root in the P1 pattern.

(7) **nishpaxim et ha-te shelaxem* [Hagar 2;3]
spill-PL-MS-PR-INTR ACC the tea yours
'spilling your tea'

cf. *shofxim* (P1) *et ha-te shelaxem*

In example (8) Leor uses the root *s-r-k* in the intransitive (reflexive) P4 pattern to denote the combing of the woman's hair instead of using the same root in the transitive P3 pattern.

(8) *isha *mistarek searot ba-rosh* [Leor 2;0]
woman comb-SG-FM-PR-INTR hair on head
'(a) woman is-combing herself (the) hair on (her) head'

cf. *isha mesareket* (P5) *searot ba-rosh*

In example (9) Leor overextends the use of n-p-l in the P1 pattern to denote the causative action 'make fall = drop' instead of using the same root with the P5 pattern which denotes causativity in Hebrew.

(9) *ani epol otax* [Leor 2;8]
I fall-1SG-FUT-INTR you
I'll drop you/ I'll make you fall down'

cf. *ani apil* (P5) *otax*

Finally, errors in subject-verb agreement refer to cases of mismatch in number, gender, and/or person between the subject and the verb, as illustrated in examples (10) – (12). In example (10) there is a mismatch in person between the subject of the sentence, Lior, who should refer to herself in the 1st person, and the person of the pronoun that she uses – the 2nd person.

(10) *la'azor lax* [Lior 1;7]
to-help to-you-2SG-FM
'to help you'

cf. *la'azor li* (= me)

In example (11) the subject and verb do not match for gender. Lior tells her mother that she is angry, but she uses a verb in the masculine form to refer to herself. She keeps using this form despite her mother's correction.

(11) Lior: *koés*. [Lior 1;8]
angry-SG-MS-PR
Mother: *koéset*.
angry-SG-FM-PR
Lior: *Koés*.
angry-SG-MS-PR

In example (12) the subject and verb do not match for number. While the verb is in the singular form, the subject is in the plural.

(12) *ma *ose xamorim?* [Hagar 1;9]
what do-SG-MS-PR donkies
'what does donkies (do)?'

cf. *ma osim xamorim?*

Coding of VAS as described in section 1.4.4.1 makes it possible to use a CLAN command to list all argument structure configurations for any particular verb in the sample. For example, the verb *roce* 'want' can take a direct object, an infinitival, or a sentence as its complements, as illustrated in (13) – (15) below.

(13) a. *roce sefer*
'want-SG-MS-PR book'

b. *roce balonim*
'want-SG-MS-PR balloons'

(14) a. *roce lakum*
'want-SG-MS-PR to get up'

b. *roce lashevet*
'want-SG-MS-PR to sit down'

(15) *roce she yihye menora ba-xeder ha-ze*
want-SG-MS-PR that be-3SG-MS-FUT lamp in the room this
'(I) want there to be a lamp in this room'

The same coding system allows for cross-referencing of a particular argument structure across all verbs in the sample, e.g., all verbs that allow verb+direct-object, or subject+verb sequences. These lists can be obtained by cross-referencing information on the %lex and %vas tiers using the MODREP command in CLAN. This information is particularly relevant for detecting patterns of VAS acquisition, and relating to claims such as Du Bois's (1985, 1987) notion of Preferred Argument Structure, or Braine's (1976) claim that children start out by learning a small number of positional formulae.

1.4.5 Coding of Thematic Relations

Several accounts relate to the function that thematic roles do or do not play in acquisition of VAS (Bowerman 1990, Chomsky 1981, Grimshaw 1990, Pinker 1984, Tomasello 1992, Van Valin 1990). To evaluate these accounts and compare the Hebrew data with their findings, I coded all overt arguments in utterances that contained a lexical verb for their thematic roles. The thematic categories used for this purpose were adapted from several sources (Bowerman 1996c, Cowper 1992, Dowty 1991, Jackendoff 1972, Radford 1997, Van Valin 1990).[19] Table 2.14 lists the categories used in the present study, and illustrates them with examples from Smadar.

19 I used two additional sources located on the web at www.jtauber.com and ceditor@tnos.ilc.pi.cnr.it.

Table 2.14 Thematic Roles

Thematic Role	Explanation	Example
Agent/causer	Initiator, doer of action	*ma **Benc** ose?* 'what is **Benc** doing?'
Patient	Entity which undergoes an action	***Pigi** nafla* '**Pigi** fell down'
Experiencer	The individual who feels or perceives a situation	***ani** loh yoda'at* '**I** don't know'
Goal	Entity towards which motion takes place	*aba halax **la-avoda*** 'Daddy went **to work**'
Source	Entity from which motion takes place	*natxil **me-po*** '(let's) start from **here**'
Location	Place where something is	*shama at hishart **ba-agala*** 'there you left (it) **in the stroller**'
Possessor/ recipient	Subtype of goal which occurs with verbs denoting change of possession	*Savta Xana natna **lanu** et ha-smalot ha-ele* 'Grandma Hanna gave **us** these dresses'
Benefective	The one for whose benefit the event took place	*ima asta **li** et ha-harkava ha-zoti* 'Mommy made this puzzle **for me**'
Theme	Entity that is moved or located somewhere	*kax **teyp*** 'take **a tape-recorder**'
Comitative	Entity that accompanies	*tishni **iti*** 'sleep **with me**'
Product	Entity produced as a result of an activity	*axshav gamarti livnot **ec** gavoha* 'I just finished building a tall **tree**'
Instrument	Object with which an action is performed	*ma Dekel asa **im lego*** 'what's Dekel doing **with Lego**?'
Identity	Entity which is the same as another entity	*ha-bardas ha-meofef **hu** xalam xalom nora* 'the flying hood **he** dreamt a terrible dream'
Stimulus	Entity which draws an emotional response	*axshav **al Benc** Arik nora koes* 'now Arik is very angry **at Benc**'
Percept	Entity which is experienced or perceived	*ani roa **et ha-dubi*** 'I see **the teddy bear**'

1.4.6 Coding of Pragmatic Information

To evaluate the contribution of pragmatic factors to the acquisition of verbs and VAS, taking into account claims for the importance of this element (e.g., Bruner 1983, Ninio & Snow 1988), all utterances in the data were coded for pragmatic information. The categories employed were adapted from the CHILDES speech-act codes list, and included: Question, Answer to question, Request, Statement, Negation, and Marking (the occurrence of an event, e.g., thanking, greeting, apologizing, congratulating). These broad categories were also coded for whether they were Repetitions, or Frozen Expressions. Another category – Unanalyzed – was used to code uninterpretable utterances, which had an unclear pragmatic function. Table 2.15 lists examples of the major coding categories.

Table 2.15 Pragmatic Coding Categories

Coding Category	Example
Question	*ma kara?; ma ze?* 'what happened?'; 'what's this?'
Answer	Grandma: *eyx kor'im li? mi ani?* 'what am I called? who am I?' Lior: *ze savta* 'it's grandma'
Request	*tni et ze* 'give-IMP ACC this'
Statement	*hine, hu ole* 'here he goes-up'
Negation	*loh roca!* 'don't want'
Marking	*maspik; ima, lila tov!* 'enough'; 'Mommy, good night!'
Repetition	*lizrok la-pax, lizrok la-pax* 'to throw to (the) the garbage can'
Frozen Expression	*gamarnu* 'alldone, allgone'
Unanalyzed	*xol*

1.4.7 Coding of Source = Degree of Repetition

Several methodological and theoretical reasons motivated the classification of utterances by what I called "degree of repetition". First, a three-partite distinction was used to separate out utterances that were exact imitations of previous utterances. The first degree of repetition was exact imitation, the second – imitation or repetition with some variation, and the third – no repetition, that is, children's self initiated utterances. In some cases exact imitations were excluded in order to permit a more accurate description of children's development. Besides, an examination of children's errors in self-initiated utterances and in variations on caregiver utterances served as an additional measure of productivity in acquisition. That is, the fewer errors children make, the more productive a certain structure or inflection is, and the closer it is to being acquired. This type of coding was necessary to examine the influence of parental input on the acquisition of verbs and verb argument structure, and to evaluate claims for the effects of such input. Such a three-way distinction is also helpful for detecting individual differences between learners.

All utterances that contained a predicate were coded for degree of repetition – the extent to which a child repeated an adult utterance. As noted, three categories were distinguished: [-Repetition] = SF was used for utterances which were self-initiated by the child, [+ Repetition] = MO was used for exact imitation of adult

utterances, and [±Repetition] = MC was used for alterations of adult utterances.[20] Examples of each category from Lior's data are shown in Table 2.16.

Table 2.16 Lior's Utterances by Degree of Repetition [1;5;19 - 2]

Degree of Repetition	Example
[-Repetition] Self-initiated utterance (SF)	*boi* (calling her mother) come-2SG-FM-IMP = 'come here' *Lior roca lashevet* Lior want-3SG-FM-PR to sit down 'Lior wants to sit down'
[±Repetition] Mother + change (MC)	M: *lexi tizreki et halixlux la-pax* go-2SG-FM-IMP throw-2SG-FM-FI ACC the litter to the garbage can 'go throw the litter in the garbage can' L: *lizrok la-pax* 'to throw to (the) garbage can' M: *azarti lax* helped-1SG-PT to you-2SG-FM = '(I) helped you' L: *laazor lax* to help to you-2SG-FM = 'to help you'
[+Repetition] Exact imitation of mother's utterance (MO)	M: *shvi* sit down-2SG-FM-IMP = 'sit down' L: *shvi* sit down-2SG-FM-IMP = 'sit down' M: *Ma kara?* what happen-3SG-MS-PT = 'what happened?' L: *Ma kara?* what happen-3SG-MS-PT = 'what happened?'

Following Ochs Keenan (1977), imitation, or [+Repetition], is defined here as an accurate copy of a previous utterance. To determine whether a child imitated a caregiver's utterance, I examined five of the child's utterances that immediately followed a caregiver's utterance. This criterion follows a similar proposal made by Bloom, Hood and Lightbown (1974).

I marked as MC or [±Repetition], all utterances that differed from the original in showing omission, addition, or substitution, or differences in verb inflections (number, gender, person, tense). Tables 2.17a and 2.17b list examples from Leor for each type of variation. Table 2.17a lists changes that relate to the utterance as a whole. This part includes deviations from adult speech mainly in pronunciation and syntax.

20 *Mother* is used here generically to refer to an adult caregiver, be it the child's mother, father, grandparent or a family friend.

Table 2.17a Types of Changes at the Utterance Level [Leor 1;9 - 2;3]

Module	Type of Change	Example
Pronunciation		I: *tagid 'ani roce lasim disk'* 'say "I want to put (a) disk' L: *lasim pe dik* 'to put he(re) di(s)k'
Syntax	substitution	I: *psanter ata roce?* '(the) piano you want?' L: *roce psanter.* 'want (the) piano'
		I: *ata loh roce yoter?* 'you don't want (any)more?' L: *yoter loh roce.* 'more don't want'
	omission	I: *crixim lehaziz et ze, carix lehaziz et ha-meavrer.* 'need to move ACC it, should move ACC the fan' L: *laziz ta-mavrer.* 'move ACC the fan'
	addition	I: *et ze? Ma ze?* 'this? what's this? L: *roce et ze, roce axer* 'want this, want another'
		L: *bayit.* 'house' I: *eyze bayit?* 'which house?' L: *lir'ot ba-xalon yeš bayit* 'to see through the window (there) is (a) house'

Table 2.17b lists changes that relate only to the predicate, and includes deviations from the caregiver's input mainly in morphology and semantics.

Table 2.17b Types of Changes at the Predicate Level [Leor 1;9 - 2;3]

Module	Type of Change	Example
Morphology	number	I: *ata **soger** et ha-trisim ve omer layla tov?* 'you close-SG-MS-PR ACC the shades and say good night?' L: ***sogrim*** 'close-PL-MS-PR'
	gender	I: *naxon, af exad loh **yoshev** al hasapa.* right, no one doesn't sit-SG-MS-PR on the sofa = 'right, no one is sitting on the sofa' L: *saba **yoshevet** sham al ha-kise.* 'grandpa is sitting there on the chair'
	person	I: *ma ata roce she aba **yoxal**?* 'what (do) you want that daddy eat-3SG-MS-FUT' L: *aba **toxal** ugiya* 'Daddy eat-2SG-MS-FI (a) cookie'
	tense	I: *et ma **lakaxat**?* 'ACC what to-take' L: ***kax***. 'take-2SG-MS-IMP'

Module	Type of Change	Example
Semantics		I: ***eyn*** *po tinok.* '(there) is not here (a) baby' L: ***nigmar*** *tinok, nigmar tinok.* 'finished baby, alldone baby'

As noted, the main function of separating self-initiated utterances from partial or complete imitation is to distinguish rote learning from productive use.

2. Developmental Measures

This section defines the notions "productivity", "acquisition" and "amount of knowledge" as used in this study (Section 2.1), and reviews three commonly used measures of linguistic development (Section 2.2).

2.1 Productivity and Acquisition

The purpose of this section is to define the terms "productivity", "acquisition", and "amount of knowledge" (e.g., Brown 1973) as used in this study. To determine when a particular inflectional category is "**acquired"**, I define *acquisition* as follows: Children are said to have acquired a given inflectional category if and only if they demonstrate productive, self-initiated use of this inflection. Use is defined as "productive" in either of the following cases: (1) The child produces more than one inflectional form of a given category (e.g., singular **and** plural number, masculine **and** feminine gender, past **and** present tense) with three different lexemes. Or (2) the child produces a given inflectional form (e.g., singular **or** plural number, feminine **or** masculine gender, past **or** present tense) with five different verb lexemes. The figures *three* and *five* are based on Bloom's (1991) definition of "productivity", one of the most careful and detailed considerations of this complex issue known to me. However, my use of these figures departs from Bloom in certain respects. For her, the distinction between three or five occurrences of a given target form depends on the aspect of the language being studied, and on the researcher's intuition regarding the expected frequency of that form in the adult language. For me, this distinction depends on the nature of the data and on the frequency of a given form in the child's output. That is, given the type of data used here, a single inflectional form of a given category is more likely to be produced with different lexemes than multiple forms of that category. For example, singular is more likely to be produced with different verb lexemes than both singular and plural forms with a single lexeme. Thus, a larger

number of occurrences is required to determine productive use of a single form (hence 5 occurrences) than to determine productive use of multiple forms within a given inflectional category (hence 3 occurrences).

Productivity and acquisition are thus determined quantitatively, by the number of occurrences of a given inflectional form with a variety of lexemes. However, any form can be productive only in relation to another form, a **basic** form of the same category. For example, it might appear, given the multiple occurrences of nouns like *yeladim* 'children-MS', *kubiyot* 'blocks' that a child uses the plural in Hebrew productively. But, children initially use these words in the plural, and learn their singular form only later on, so that these forms are "basic" for children. Similarly, nouns like *para* 'cow-FM', *ganenet* 'preschool teacher-FM', and *tarnegolet* 'hen', are first used in the feminine, which is thus the "basic" form for them, instead of the unmarked masculine (Dromi & Berman 1982). That is, in analyzing initial stages of morphological acquisition, it is important to decide which forms are morphologically basic, not only for each category, but also for particular lexical items. It turns out that in early acquisition, a *basic* form is not always the morphologically unmarked one. The unmarked masculine singular form of nouns is not the basic form in cases like dual *yadayim* 'hands', feminine plural *kubiyot* 'blocks' (cf. *yad* 'hand', *kubiya* 'block'), feminine singular *para* 'cow', *tarnegolet* 'hen' (cf. *par* 'bull', *tarnegol* 'cock'). Here, the notion "basic" is defined developmentally, as *the form initially used by the child*, so that it is a relative rather than an absolute notion, determined initially by pragmatic and communicative pervasiveness, and by relative **use** in the child input and output (see also Berman 1981, 1988a). Later, with the onset of grammar acquisition, the notion *basic* becomes less usage-based and more structure-dependent and grammatically based, so that it corresponds largely to morphologically unmarked forms.

The question of representativeness is also relevant. It refers to the fact that a child may have knowledge that is not reflected in the available data. I therefore defined "productive knowledge", and so the notion "acquired" as anchored in speech production as the only type of data available in naturalistic samples like mine. This problem could be partially resolved by experimental methods such as structured elicitations that allow for comparison of comprehension and production.

2.2 Measures of Linguistic Development

The performance and linguistic abilities of the four children in my sample were compared to establish developmental trends of verb argument structure. One option was to compare their development by examining the transcripts of each of the four at set chronological ages. However, previous research has shown that chronological age is not a satisfactory indicator of children's linguistic abilities, particularly at the critical age of 2-3 years under study here, since children vary greatly in their individual rate and style of acquiring language (Brown 1973).

I examined three linguistically based measures for assessing children's language development. The Communicative Development Inventories (CDI) devised by Fenson, Dale, Reznick, Thal, Bates, Hartung, Pethick and Reilly (1993), Brown's (1973) Mean Length of Utterance (MLU), and Dromi and Berman's (1982) Morpheme Per Utterance (MPU), which was devised specifically for Hebrew morphology. I then propose my own multi-tiered profile of verb and VAS use as a means for measuring linguistic development (see Chapter 8, Section 2.2).

2.2.1 Communicative Development Inventories (CDI)

The MacArthur Communicative Development Inventories (CDI; Fenson *et al.* 1993) are tools for assessing the early language skills of children through parental report. The CDI was adapted into a large number of languages among which are Italian (Camaioni, Caselli, Longobardi & Volterra 1991), Spanish (Jackson-Maldonado, Thal, Marchman, Bates, Gutierrez-Clellen 1993), Icelandic (Thordardottir & Ellis Weismer 1996), Japanese (Ogura 1991), American Sign Language (Reilly 1992), and Hebrew (Maital, Dromi, Sagi & Bornstein 2000). Two forms of the CDI are available: The CDI/Words and Gestures and the CDI/Words and Sentences. The former measures comprehension and production vocabulary, and the use of gestures between ages 0;8 – 1;4, and the latter, measures vocabulary production as well as some aspects of grammar and syntax between ages 1;4 – 2;6. The CDI measures productive vocabulary through an extensive checklist of words commonly used by young children. Parents are required to mark on the list each of the words that their children say.

The CDI is simple and requires few resources compared with the efforts involved in other methods for measuring language development such as language sampling, or experimental procedures. Yet, it has several drawbacks. First, it cannot include all the words which children produce, so that if a particular child produces more words of a

given lexical category, it might not be expressed in his overall CDI score (see discussion in Robinson & Mervis 1999, Pine, Lieven & Rowland 1996). Second, certain words on the list might not constitute part of children's early vocabulary across languages so that speakers of one language might consistently rate higher than speakers of another. Third, the CDI is usually administered cross-sectionally. An administration of this test longitudinally to an individual child might reveal that it is not sufficiently reliable. Robinson and Mervis (1999) tested this question by comparing diary data and CDI scores for one English-speaking child between the ages 0;10 – 2;0. They found that the CDI underestimates the number of words in the diary study, with the underestimation increasing as vocabulary size increases. Specifically, the proportion of diary study words that appeared on the CDI differed as a function of the words' lexical class. The CDI was found to perform best for a large number of closed class words, which represent a small proportion of the English lexicon. Robinson and Mervis note that the lack of uniformity in the proportion of words captured by the CDI across lexical classes may lead to the underestimation of some children's vocabulary knowledge.

2.2.2 Mean Length of Utterance (MLU) Counts

Mean Length of Utterance (MLU) in morphemes was first proposed by Brown (1973) as a straightforward mechanism for selecting, from different children, language samples that represent comparable developmental levels and thus may display similar linguistic properties. Brown's testing of the MLU measure longitudinally against three English-speaking children (Adam, Eve and Sarah) showed their samples, selected at particular MLU points, to be similar in other respects as well as length: the types of semantic relations expressed in their speech, and the types of morphological markers they used. The MLU measure was subsequently tested cross-sectionally by de Villiers and de Villiers (1973) and found to be highly consistent with the results of Brown's longitudinal study. Brown suggested MLU as a simple index of grammatical growth based on the assumption that each new morphological or syntactic structure used by the child (at least in the early stages of development) will increase utterance length. That is, as children begin to acquire grammar, they not only produce utterances made up of one or two words, but also of grammatical morphemes such as plural markers or articles. In the early stages, grammatically more complex

utterances also tend to be longer in size, particularly in a relatively analytical language like English.

Despite its advantages over chronological age, certain problems have arisen concerning the MLU measure, as noted in Dromi and Berman (1982) for Hebrew, by Pan (1994), Rollins, Snow and Willett (1996) for English and by Hickey (1991) for Irish. Some of these drawbacks are as follows.

First, in methodological terms, there is some question as to which utterances to include in the MLU calculations and what should be the basic counting unit to ensure representativeness. *Ad hoc* attempts to answer this question have led researchers to make arbitrary decisions concerning these units, thus rendering the MLU calculation unreliable. In effect, MLU computed in words and/or morphemes has been found to be sensitive to such factors as transcript length, and interactional situation. Moreover, even if the basic counting unit is taken to be the morpheme rather than the word, the variable criteria used in counting morphemes may influence the outcome. For example, there is a requirement that only morphemes the child uses productively be included in the MLU counts, but it is not always easy to determine which morphemes are used productively by the child, particularly but not only in cross-sectional studies.

The MLU measure also raises problems of principle. Being a composite measure, the MLU calculation cannot in itself provide information about either the emergence or the mastery of particular grammatical structures. That is, MLU reflects changes in a variety of language systems, including morphology, syntax, semantics and conversational skills. As such, it is a useful indicator of a child's global language level. However, the relative contribution of each of these skills may differ across children with similar MLUs, yet the MLU measure does not provide the means for tracing changes in component systems. Rather, it obscures individual differences among children in the extent to which they attend to semantic compared with morphological or syntactic learning, for example. In addition, the ability of MLU to predict linguistic development and to reflect structural characteristics of the child's language decreases above MLU 4.00 (around age 3;6), when acquisition of new grammatical knowledge is no longer reflected in utterance length. For example, the use of sophisticated syntactic or discourse-motivated devices such as ellipsis results in shorter rather than longer utterances.

It is also difficult to apply the MLU measure to languages with a more synthetic morphology than English, like Hebrew and Italian. In Hebrew, length of utterance *per*

se cannot be taken as the criterion for linguistic sophistication, since increased complexity does not necessarily mean increased length (see Section 2.2.3 below). In this sense, the MLU measure produces results that are not comparable across different languages. Finally, MLU may reflect knowledge of language differently for different populations of children acquiring a given target language.

2.2.3 Morpheme Per Utterance (MPU) counts

Dromi and Berman (1982) propose a measure of early language development for Hebrew, which handles the fact that increased complexity in a highly synthetic language with a complex system of bound morphology, is not necessarily determined by the linear sequencing of elements manifested by increased length. In Hebrew, a sentence such as *Dan katav* 'Dan write-3SG-MS-PT' cannot be assumed to indicate greater complexity than a verb such as *yixtevu* 'write-3PL-FUT', although a computerized MLU count based on Brown's measure would predict exactly that. It will assign the former the value 2, and the latter – the value 1.

Dromi and Berman (1982) base their measure on counting morphemes, rather than length, as a criterion for characterizing linguistic maturity. They propose a set of detailed rules for calculating MPU in Hebrew, motivated by developmental considerations in the analysis of Hebrew morphology and not only by purely formal or structural criteria (See Appendix 2.III for their list of rules).

The MPU measure thus appears to have certain advantages over MLU. Yet it, too, leaves unsolved some of the problems noted for MLU. First, it still remains unclear which utterances should be included in the MPU calculation to ensure representantiveness. Second, there are no explicit criteria for determining that certain morphemes are used productively by the child. Third, the MPU value reflects changes in morphology, but requires additional measures to measure syntactic and semantic development. Nonetheless, I believe that in linguistic analysis, and hence too, in language acquisition, morphology is the single domain where languages differ most markedly from one another, and in fact, traditional typological classifications relied exclusively on morphological criteria. For this reason, it seems clear to me that a single type of MLU or MPU analysis cannot be applied crosslinguistically, in contrast, for example to categorization in the lexical, semantic and syntactic domains and hence in these tiers in computerized coding analyses. From this point of view, Dromi and Berman are right to point out that these measures (MLU, MPU) are most effectively

applied within rather than across populations, and indeed, their rules are language-specific and so relevant only for calculating MPU values for Hebrew. However, for any such measure to be effectively applied within a system such as the one I am using, which aims at maximum comparability across researchers, languages, and populations, it needs to be applied effectively in other populations and to other languages.[21]

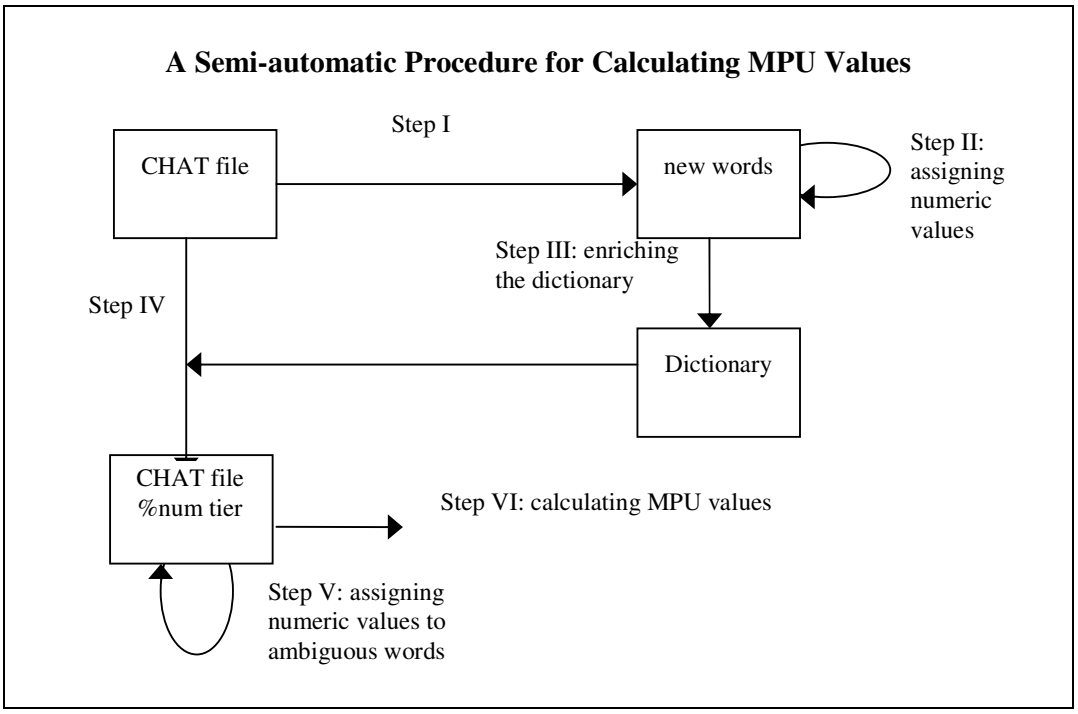
Despite these arguments against MPU as a developmental measure, I decided to use it as a simple approximate indicator of linguistic age, to provide some preliminary evaluation of the children's linguistic development as the basis for further investigation, rather than as a principled means of evaluation. I devised a special computer program to perform MPU counts in a semi-automatic fashion for each of the transcribed files, based in part on the rules in Dromi and Berman (1982), as further elaborated by the Tel Aviv University Child Language Research Project (Berman 1990).

Several reasons motivated the need to develop a new computerized program for these counts instead of the standard CHILDES MLU program. First, initially, morpheme boundaries were not marked word-internally in my transcribed files, so that a word such as *axbar-a* 'mouse-FM-SG' would not have counted as two morphemes by the CHILDES MLU program, thus resulting in inaccurate MLU values. Second, certain morphemes are not isolated but rather fused with other morphemes into a single affix. For example, the Hebrew suffix *-ot* 'FM-PL' in a form like *par-ot* 'cows', stands for both feminine gender and plural number, while the prefix *ni-* 'PL-FUT' in a form like *ni-kanes* 'we'll enter' stands for first person, plural number, and future tense. A simple computerized MLU count, however, would assign each affix the value 1 rather than 2 or 3, thus underestimating its MLU value. Third, certain words and word combinations are formulaic unanalyzed amalgams even in adult usage, but the CHILDES MLU program would assign them values of more than 1 if they are transcribed as two words. For example, a preposition such as *al yad* 'near, next to' and a time expression such as *axar kax* 'afterwards' would each be assigned the value 2 by the CHILDES morpheme count, although there is no syntactic or lexical justification for this.

21 Note, however, that calculating the average number of morphemes per utterance rather than average length of utterance can be successfully adapted to other synthetic languages as well.

To avoid such problems, I designed a special semi-automatic procedure for calculating MPU values for Hebrew, as shown in Figure 2.4.

Figure 2.4 A Semi-Automatic Procedure for Calculating MPU Values



Following is a step-by-step description of the MPU calculation procedure as illustrated in Figure 2.4:

1. [Step I] Exhaustive lists of words and morphemes uttered only by a given child are extracted from the transcripts of child # 1, and stored in a special **dictionary** file, so that each item occurs in the dictionary only once.
2. [Step II] Each of the extracted words is manually assigned a numerical value according to the number of morphemes it contains (see Appendix 2.IV for a sample file). Values range from 0 (unintelligible strings) to 5 (the largest number of morphemes found in a single word in the database)
3. [Step VI] A **"mapping"** command automatically maps the numerical values onto the relevant words and morphemes in each of the files from which these items were formerly extracted by adding a new dependent tier %num which contains the strings of numbers (see Appendix 2.IV for a sample file).
4. [Step IV] Another **"calculating"** command now calculates the sum of numbers within every single %num tier in every file into a subtotal. A "summing" command then calculates the overall total of all subtotals for every file, and divides it by the number of child utterances in that file. This yields the MPU value for each child in each of the files examined (see Appendix 2.IV for a sample calculation).
5. This value is then **checked** against the CHILDES MLU value to verify the accuracy of the utterance count, and to examine the correspondence between the MLU-MPU values for purposes of reliability.
6. Words and morphemes of the three other children (child # 2, 3 and 4) are incorporated into the database cumulatively, so that only new words and

morphemes beyond those entered for child # 1 are added into the dictionary. This requires two manual editing operations:

a. [Step III] After the program automatically compares the list of words and morphemes in the dictionary against those extracted from a new file, an editing option allows the researcher to manually **assign numerical values only to the newly added items** and to store them as such in the dictionary. Items that occur in both the new file and the dictionary are not listed twice, nor are they assigned a new numeric value with every new occurrence.

b. [Step V] Certain ambiguous items are left without a numeric value assignment in the dictionary. These are ambiguous items that could have been assigned more than one value depending on their function in the utterance (e.g., the word *oto* is ambiguous between 'auto = car' for which the numeric value would be 1, and 'him' for which the numeric value would be 2). A second editing option allows the researcher to **fill in the missing values** in such cases, and to store them in the specific file for which the MPU value is calculated. This is done right after the automatic mapping of values to all other words and morphemes in that file (stage 3 above) is completed, and just before the actual MPU calculation takes place (stage 4 above).

Using this procedure, I calculated the MPU values for each of the four children in the sample at intervals of once a month, from age 1;9 - 2;9 (except for Smadar, for whom MPU was calculated only until age 2;3). Table 2.18 specifies for each child and age the MPU value calculated for that age (a graphic representation of this information is given in Figure 2.5 below).

Table 2.18 MPU values for Hagar, Lior, Leor and Smadar

Age	Hagar	Leor	Lior	Smadar
1;8	–	–	–	1.65
1;9	2.72	2.11	1.54	–
1;10	2.31	2.18	1.76	3.46
1;11	2.06	3.02	1.95	4.19
2;0	2.36	2.99	2.55	3.76
2;1	2.41	2.38	2.14	4.47
2;2	3.36	3.01	2.72	5.04
2;3	4.24	3.14	3.27	5.17
2;4	2.25	2.56	2.84	–
2;5	2.17	2.96	3.73	–
2;6	2.93	2.86	2.65	–
2;7	2.67	3.46	4.42	–
2;8	3.28	3.12	4.11	–
2;9	2.48	3.51	1.72	–

Figure 2.5 MPU Values for Hagar, Lior, Leor and Smadar

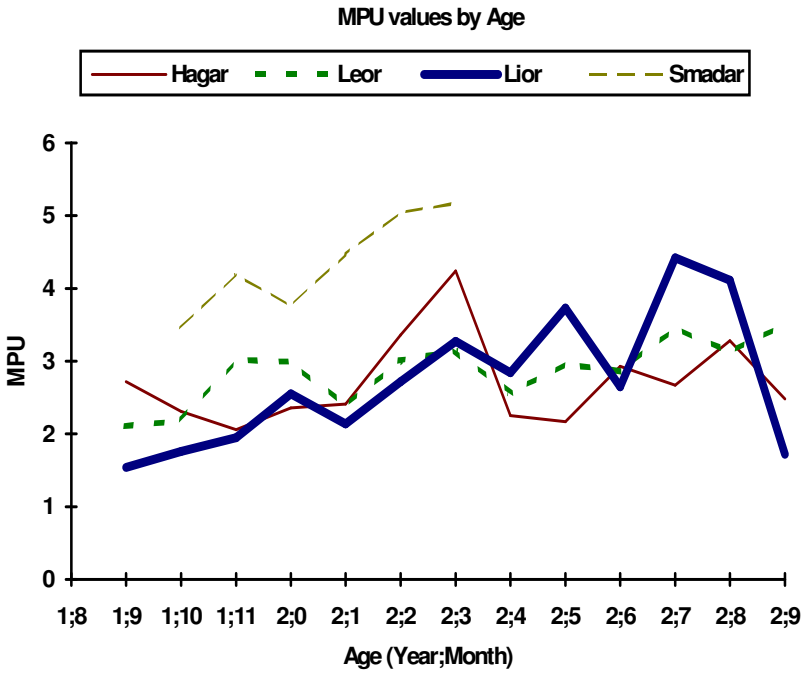


Table 2.18 indicates that the MPU counts of Lior and Smadar show a gradual increase whereas the MPU counts of Hagar and Leor do not. Despite these rather unsatisfying results, it should be re-emphasized that two of the four children did exemplify the expected increase in MPU values. Besides, MPU counts are used here only as a preliminary tool for comparing the children's linguistic abilities and are not a result of the analysis proposed in this study. There was also quite a good correlation between the MPU counts for all four children and their respective MLU counts as calculated by the standard CHILDES MLU program.

These findings may be accounted for in several ways: either the sampling (the entire database) is inadequate, or the MPU measure is deficient. A third possibility is that the two combined are at fault. The second possibility seems implausible since very similar results were obtained in a corresponding MLU calculation. It is hard to assume that two different measures would result in a similar pattern of inadequate results, given the principled differences between these two measures discussed above. The first possibility is also unlikely, since transcripts were examined at similar intervals for all four children in the sample, and the results for two of them did come out well. This rules out the third possibility as well.

A closer examination of Leor and Hagar's transcripts, the two "problematic" cases, suggests that other quite different, independent factors may have affected these children's MPU results. First, the linguistic abilities of the two children develop at a different rate than the two other children in the sample. They appear to take longer to pass from one developmental stage to another than Lior and Smadar. This is reflected in their MPU counts in the form of a relatively steady value of around MPU 3 during the entire period sampled here. Second, certain interactional or developmental factors that are not taken into account in the MPU count interfere. In fact, previous analyses of Leor's transcripts (Berman 1993a, Armon-Lotem 1997) as compared with the other children in the database point to the fact that he is relatively the slowest to show syntactic development in such domains as grammatical relations and case-marking. With respect to Hagar, the nature of the interaction is heavily caretaker-biased, since her mother, in particular, talked far more than any other caretaker in my sample so that there was a much higher ratio of parent input to child output for Hagar than for the other three children (this assumption will be tested by a calculation of Mean Length of Turn (MLT) for both Hagar and her mother).

This combination of findings leads to the conclusion that any single measure or analysis along any single tier will necessarily misrepresent critical aspects of a child's linguistic development. The intrasubject variability revealed by my MPU calculation suggests that my *a priori* assumption of a multi-tiered analysis for studying verb-argument structure is in fact justified.

Part II: Analyses

This section deals with word-level and sentence-level analyses. Word-level analyses include the early verb lexicon (Chapter 3), verb morphology (Chapter 4), and verb semantics (Chapter 5). Sentence-level analyses consider verb argument structure (Chapter 6), and interactions between factors affecting the acquisition of verbs and VAS (Chapter 7). Each chapter starts with a review of relevant literature, outlines main predictions, describes distributional and developmental findings, and discusses the findings in relation to hypotheses.

Word-Level Analyses
Chapter 3: The Verb Lexicon

1. Introduction

The development of the lexicon is one of the most remarkable tasks children face in the early phases of acquisition. For example, Clark (1993) notes that English-speaking children from age 2 on master an average of some 10 new words per day. The acquisition of verbs and other predicates contributes significantly to this lexical expansion, although these lexical elements are not always the first to emerge (see Gentner 1982, Goldfield 1998 as against P. Brown 1998, Gopnik & Choi 1990, Choi & Gopnik 1995, Gelman & Tardif 1998). This chapter presents evidence for the early composition and development of Hebrew-speaking children's verb lexicon and proposes measures of early lexical development based on Hebrew verb acquisition. These measures include the increase in size of verb vocabulary (1.1), distribution of verb-containing utterances (1.2), development of early verb forms (1.3), and the distribution of verb-pattern alternations (1.4).

As background, I first determined the "linguistic age" of each of the four children, using two general developmental measures: Mean Length of Turn (MLT), and Mean Length of Utterance in words (MLU-W), as discussed and motivated, for example, in Pan (1994), MacWhinney (1995). Children's scores on these measures indicate that only Lior and Smadar's data qualify for what I termed the initial phase of acquisition – MLU ≤ 2 (Chapter 1, Section 3.1). Leor and Hagar were initially sampled at the stage of early word combinations (see Appendix 3.I).

1.1 Verb Vocabulary Size

Below, I distinguish between *verb lexeme, verb type,* and *verb token. Verb lexeme* refers to a combination of consonantal root + verb-pattern, e.g. *bwa1* 'come'.[22] *Verb type* refers to a verb's particular inflectional configuration (number, gender, person, and tense), and *verb token* refers to the actual occurrence of a particular verb type. Thus, an utterance like *bo, bo, boi* 'come-2SG-**MS**-IMP come-2SG-**MS**-IMP come-2SG-**FM**-IMP = come, come, come!' has a single lexeme *bwa1*, shared by both *bo* and *boi*, two verb types (*bo*-**MS**, *boi*-**FM**), and three tokens – 2 of *bo* and 1 of *boi*. Tables 3.1a and 3.1b show the distribution in percentages of verb-like items (types) out of the total number of lexical items (types) in the lexicons of Lior and Smadar.

Table 3.1 Distribution (in percentages) of Verb-like Items (Types) in the Early Lexicons of Lior and Smadar by Age

a. Lior

Age	MLU	Verb-like Items	Other Lexical Elements	No. of Lexical Elements (Types)
1;4	—	—	—	—
1;5	1.15	8%	92%	59
1;6	1.14	8%	92%	205
1;7	1.38	8%	92%	161
1;8	1.56	12%	88%	126
1;9	1.48	12%	88%	247
1;10	1.6	12%	88%	161
1;11	2.08	14%	86%	226

b. Smadar

Age	MLU	Verb-like Items	Other Lexical Elements	No. of Lexical Elements (Types)
1;4	1.56	0%	100%	38
1;5	1.37	2%	98%	39
1;6	1.93	10%	90%	198
1;7	2.06	15%	85%	153

These figures show, that at the onset of the one-word stage (up to MLU 2, age range 1;5 - 1;11 for Lior and 1;4 - 1;7 for Smadar), verb-like items constitute only a

22 This decision is based, inter alia, on Berman's extensive research on the structure and function of the system of *binyan* verb-pattern conjugations in Modern Hebrew (Berman 1978, in press) and in acquisition (Berman 1980, 1982, 1993a,b, 1999). She shows that the *binyan* system reveals only partial productivity and so belongs to the domain of derivational morphology (word formation, hence the lexicon and lexical knowledge) rather than inflectional morphology (marking form-function relations of grammatical categories such as tense, number, and gender). Thus, for example, for the root *k-t-b* 'write' in P1, as many as 24 inflected forms can be identified, e.g., present tense *kotev* 'writes-MS', *kotevet* 'writes-FM', *kotvim* 'write-MS', *kotvot* 'write-FM', infinitive *lixtov*, imperative *ktov* 'write-MS', *kitvi* 'write-FM', etc. These are all treated together as a single lexeme. In contrast, *ktb1* 'write' is a separate lexeme from *ktb6* katuv 'written', or *ktb5 hixtiv* 'cause-to-write'.

small percentage of the girls' early lexicons. This is in line with findings reported in Berman (1978) for her daughter Shelli, who at the one-word stage had 75% nouns and names, 15% functors, and only 10% verbs, and by Dromi (1986, 1987) who reports that her daughter, Keren, did not produce words for actions until the fourth month of her one-word stage, at age 1;2. This suggests that Hebrew child language is initially noun, rather than verb-biased.

Also, the percentage of verb-like items (types) in the girls' lexicon increases gradually across development. This increase correlates with the gradual increase in MLU scores: So, the higher the girls' MLU the higher the proportion of verbs in their lexicons. Along similar lines, Maital, Dromi, Sagi and Bornstein's (2000) cross-sectional study of seven age groups between 1;6 - 2;0 using a Hebrew adaptation of the MacArthur Communicative Development Inventory (HCDI) revealed a large increase in proportion of predicates with growth in overall lexicon size. A vocabulary of less than 50 words included few lexical verbs and adjectives. At the 50-word level predicate terms constituted 4%, and at the 400-word level – 25%. Similar results are reported for English (Bates, Marchman, Thal, Fenson, Dale, Resnick, Reilly & Hartung 1994) and Italian (Caselli, Bates, Casadio, Fenson, Fenson, Sanderl & Weir 1995, Caselli, Casadio & Bates 1997). These findings suggest that the amount of verb types in children's lexicons over time may be a reliable measure of linguistic development.

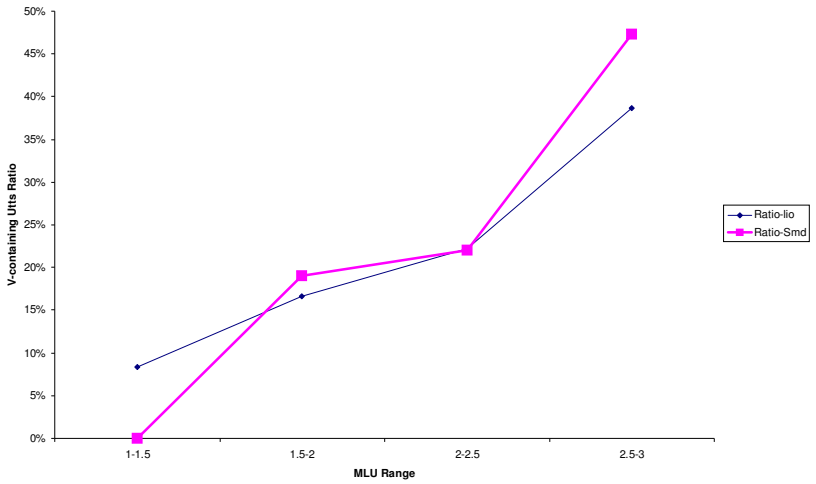
Relatedly, Plunkett and Marchman (1993) found that increase in the size of the lexicon beyond a particular level triggered a shift from rote learning of [stem → past tense mapping] to general patterns of lexical acquisition. Marchman and Bates' (1994) analysis shows that age and especially number of verb types are predictors of the frequency of correct and overgeneralized verb forms.

1.2 Verb-Containing Utterances

This means that as acquisition proceeds, the proportion of verb-containing utterances in children's speech can be expected to increase. To test this claim, I examined the proportion of verb-containing utterances in Lior and Smadar's data out of their total utterances across development. Figure 3.1 displays the average ratio of verb-containing utterances over the total number of utterances for each girl by MLU (for a detailed listing of the data see Appendix 3.I, Tables 4a and 4b). The MLU range

was extended beyond the single-word period to allow a clear presentation of the expected developmental trend.

Figure 3.1 Average Ratio of Verb-Containing Utterances Over all Utterances by MLU



The Figure shows a correlation between the proportion of verb-containing utterances and MLU score: the higher the MLU, the higher the number of verb-containing utterances. Similarly, taking the clause rather than the utterance as the basic unit of analysis, Berman and Dromi (1984) and Dromi and Berman (1986) found, for their cross-sectional Hebrew-speaking sample of 1 to 5 year-old Hebrew-speaking children, that at each age level, children produce consistently fewer verbless clauses. Between 1;6 - 2 children had almost no lexical verbs, since only 20% of their clauses contained a lexical verb, the rest were verbless present tense copular sentences or existentials and possessives. The number of clauses containing a lexical verb rose between ages 2 - 3 to 40 - 50% of all clauses, and to 60% by ages 4 – 5. Similarly, in the English sample of picturebook based narratives, lexical verbs occurred in less than 60% of the clauses produced by 3-year-olds as compared with 80% among children aged 4 years and up (Berman & Slobin 1994, p. 137). These findings suggest that the ratio of verb-containing utterances or clauses (a more restrictive measure) in children's speech over time can serve as a reliable measure of linguistic development.

In sum, convergent findings from different databases (longitudinal and cross-sectional, from typologically different languages (Hebrew, English, and Italian), and from different communicative settings (parental reports, interactive conversations and monologic stories) suggest that an increase in children's verb lexicon and the proportion of their verb-containing utterances are good predictors of language development. The more verbs children produce, the more developed their language.

This measure holds across languages and different types of sampling, although it may not necessarily apply to ages beyond these covered by the present study. The following sections (1.3 – 1.4) discuss two developmental trends that are more specific to Hebrew – the distribution of verb forms and verb-pattern alternations across development.

1.3 Verb Form Alternations

Two types of evidence relate to changes in the morpho-phonological form of verbs across development: the use of unclear versus tensed verb forms, and the acquisition of verbs as individual lexical items.

1.3.1 Distribution of Unclear versus Tensed Verb Forms

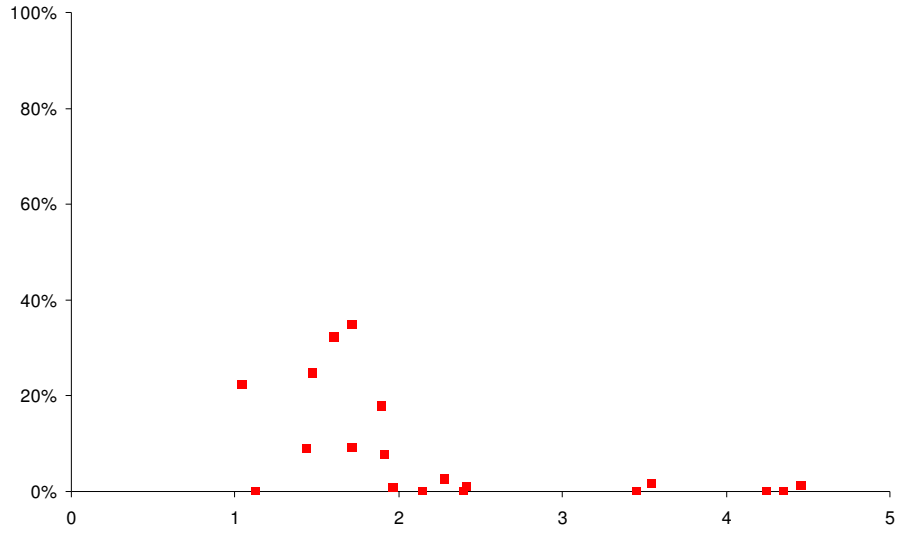
Hebrew verbs have no clear morphologically unmarked "basic form" which can be characterized as neutral in terms of both form and content, analogous to English *play*, *think*, *arrive* (Berman 1978). Also, because of the synthetic nature of Hebrew morphology, every verb must be an integrated construct of a *consonantal root* and an *affixal pattern* (Berman 1999, in press). Initially, this construct can be predicted to be a stemlike, unanalyzed base (MacWhinney 1978, 1982; Bowerman 1974, 1982) in the sense that children do not yet identify the morphological elements that constitute the forms they produce as independent entities (inflection markers, consonantal root + pattern).[23]

Initially, this unanalyzed verb form is most often realized as an *unclear* form. *Unclear* refers here to verb forms that have ambiguous inflectional or lexical forms. For example, *pes* can be interpreted either as an instantiation of several forms of the lexeme *xps3* 'search, look for', as in *mexa**pes*** 'search-SG-MS-PR', *xi**pes*** 'search-*3*SG-MS-PT', *texa**pes*** 'search-3SG-FM-FUT' or 'search-2SG-MS-FI', *nexa**pes*** 'search-1PL-FUT', or of the lexeme *tps3* 'climb', as in *meta**pes*** 'climb-SG-PR', *leta**pes*** 'climb-INF', *yeta**pes*** 'climb-3SG-MS-FUT, etc. Figure 3.2 shows the distribution (in percentages) of unclear forms by MLU for each of the four children.

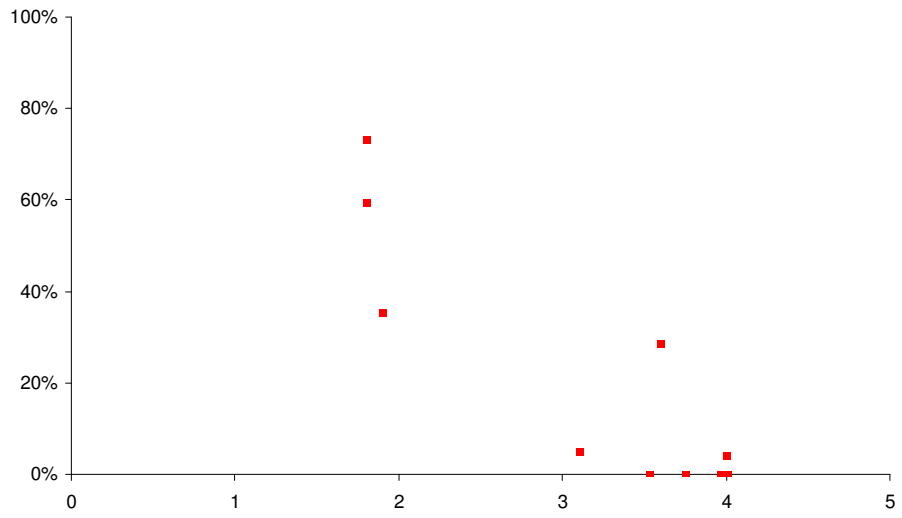
23 Hebrew-speaking children will obviously not rely on root consonants alone since they are unpronounceable in isolation without syllabic nucleus.

Figure 3.2 Distribution of Unclear Verb Forms by MLU

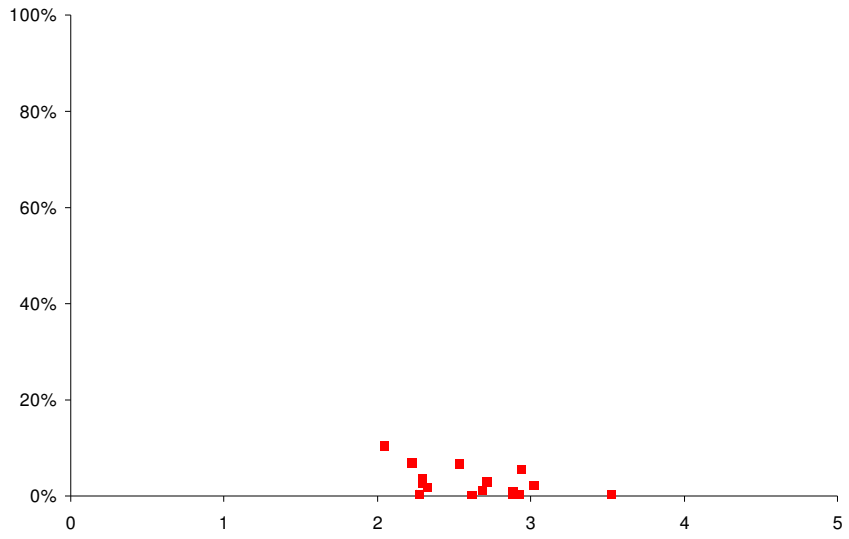
3.2a Lior



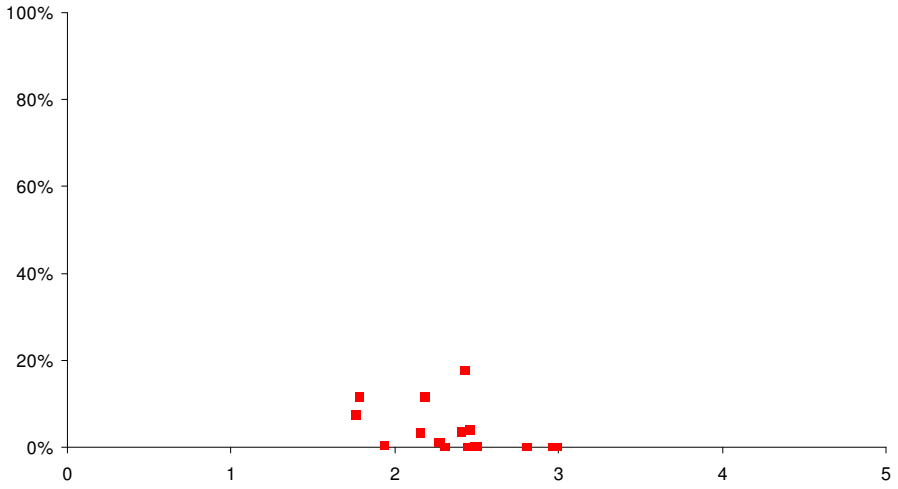
3.2b Smadar



3.2c Leor



3.2d Hagar



The amount of unclear forms decreases with age, until they disappear to be replaced by tensed forms, correlating with the gradual increase in MLU. In the sample, Smadar has the highest percentage of unclear forms, evidently because her recordings started when she was younger than the other children in the sample (see Appendix 3.III for examples of unclear verb forms in her data between the ages 1;6 – 1;8). Most of her early verbs are one syllable long – a stressed syllable (marked in bold in the Table), and are morphologically unanalyzed, as discussed by Berman and Armon-Lotem (1996), and with Armon-Lotem (1997). This suggests that the distribution of unclear forms in children's verb lexicon over time (at least in a highly inflected

language like Hebrew) is a good measure of linguistic development: the fewer unclear forms, the more advanced the acquisition process.

The diagrams in Figure 3.2 also indicate that despite individual variations in overall number of unclear forms, they decrease for all children after MLU 2. This is most evident from Lior and Smadar's data before and after MLU 2, and from comparison of their data with Leor and Hagar, who were recorded mainly from MLU 2 on. This finding supports the claim concerning the "boundedness" of the training level discussed in Chapter 1 (see Section 3.1.1).

1.3.2 Use of Specific Verb Forms

An important view of early acquisition is that young children's grammatical knowledge is initially organized around specific lexical items (Akhtar 1999, Akhtar & Tomasello 1998, Clark 1995, Lieven, Pine & Baldwin 1997, Pine & Martindale 1996, Tomasello & Brooks 1999). As they learn more lexical items, children become more likely to act consistently in the syntactic patterns they produce. I also argue that along with a wide use of unclear forms, or soon afterwards, children start using verbs in a particular morphological form, in a unique tense, gender, number, and person configuration. These verbs are still unanalyzed in the sense that children are not aware of their compositional make up in the language (for Hebrew, consonantal root + verb-pattern and stem + inflectional affixes). Rather, each one is learned as an unanalyzed form or amalgam (MacWhinney 1978).

For example, Lior initially uses the verb *bwa1* 'come' as *bo* in the imperative masculine form even when referring to her mother, and does not alternate the gender of the verb by the context of use. She uses the verb *npl1* 'fall' as *nafal* in the 3rd person masculine singular past tense to refer to everything that falls down, whether feminine, masculine, plural or singular. She uses the verb *ntn1* as *tni li* 'gimme' in the feminine singular imperative with a dative marked pronoun, and the verb *rcy1* 'want' as *roca* in the feminine singular, present tense. She uses the verb *gmr1* 'finish, end' as *gamarnu*, in the 1st person plural past tense, and the verb *ily1* 'go up' as *la'a lot* in the infinitive in all contexts. Smadar uses the forms *shev* 'sit down' and *sim* 'put' repeatedly to refer to her mother (e.g., *shev ima* 'sit down mommy', *ima sim (mi)ta sus* 'mommy put bed horse = mommy put the horse on the bed') although these forms, if analyzable at all, are closest to the **masculine** singular imperative form (cf. *sim* 'put-2SG-MS-IMP', *shev* 'sit-2SG-MS-IMP'). That is, each verb appears to be used in

a single morphological form with no alternations or governing rules, and regardless of the agreement and tense marking required by the context (see, too, Berman & Armon-Lotem 1996, Uziel-Karl 1997).

Additional evidence comes from analyzing the distribution of the first eight verbs documented in the early vocabulary of Hebrew-speaking children (Berman & Armon-Lotem 1996).[24] Table 3.2 lists for each verb, the total number of tokens in the data, and the morphological form in which it was most frequently used by the four children (combined) between ages 1;5 – 1;11.

Table 3.2 Morphological Form of 8 Early Verbs across Four Children

Verb	Gloss	No. of Tokens	Target Morphological Form	Phonetic Form	Verb Morphology	Other Forms Produced by the Children
npl1	'fall down'	43	*nafal* (40)	***fal***	3rd-SG-MS-PT	*(yi)pol*-3SG-MS-FUT (1) *nipal*-UC (1) *(na)falt*-2SG-FM-PT (1)
yrd1	'go/get down'	8	*laredet* (7)	***ede*** ***dedet***	INF	*red*-2SG-MS-IMP (1)
akl1	'eat'	17	*le'exol* (7) *oxelet* (7)	***lexol, xol***	INF SG-FM-PR	*oxel*-SG-MS-PR(1) *axalti*-1SG-PT (1) *axal*-3SG-MS-PT(1)
šyr1	'sing'	14	*lashir* (12)	***shir***	INF	*shara*-SG-FM-PR (1) *shar*-SG-MS-PR (1)
rcy1	'want'	209	*roce* (163) *roca* (45)	***se, ce*** ***ca***	SG-MS/FM-PR	*rocim*-PL-MS-PR (1)
gmr1	'finish'	35	*gamarnu* (27)	***nanu*** ***gamanu***	1st-PL-PT	*gamarta*-2SG-MS-PT (2) *gamarti*-1SG-PT (5) *gamart*-2SG-FM-PT(1)
ntn1	'give'	20	*tni* (14)	***ni li***	2nd-SG-FM-IMP	*ten*-2SG-MS-IMP (2) *eten*-1SG-FUT (1) *titni*-2SG-FM-FUT(1) *titen*-2SG-MS-FUT (2)
sym1	'put'	64	*sim* (37) *lasim* (20)	***sim***	2nd-SG-MS-IMP INF	*simi*-2SG-FM-IMP (5) *simu*-2PL-IMP (1) *sama*-SG-FM-PR(1)

Table 3.2 shows that until around age 1;11, when there is evidence that grammatical subjects and morphological inflections are becoming productive, each of these eight verbs was used in a single morphological form. Three of the eight verbs (*akl1* 'eat', *rcy1* 'want', and *sym1* 'put') occur concurrently in two different forms, each of which can be accounted for differently. With *le'exol/oxelet*, the form *oxelet* '*eat*-SG-FM-PR' was used by Hagar several times, in a single session, whereas *le'exol* 'to-eat-INF' was used by all four children. The fact that both masculine (*roce)* and

feminine (*roca)* were used has to do with the speaker's sex. Leor, the boy, used only the masculine a large number of times, while the girls Hagar, Smadar and Lior used only the feminine. Besides, both verb forms occurred in the present tense, so the one-verb/one-form prediction is still borne out. In the case of *sim/lasim* 'put' these two forms can be attributed to a certain degree of ambiguity since *sim* could be either a bare infinitive, without the infinitival prefix *le-* 'to' or the masculine singular imperative. Since the period of early verbs is transitory with respect to the use of unclear forms, some occurrences of *sim* could be truncated versions of *lasim* 'to put'.

The data also suggest that there is no correlation between a verb's initial morphological form and its transitivity value or semantic class. Thus, it is not the case that all transitive or all intransitive verbs are necessarily used with the same morphological form. For example, the verbs *rcy1* 'want' and *gmr1* 'finish' which are both transitive, are used in different tenses (present and past, respectively). Similarly, verbs which share a semantic class are not necessarily acquired with the same morphological form, for example, the verbs *ntn1* 'give' and *sym1* 'put', both verbs of transfer, are used in the imperative and infinitive, respectively. These findings suggest that Hebrew-speaking children do not use verb morphology as a cue to verb argument structure or verb semantics. Initially, each of these features (inflectional and derivational morphology, syntactic transitivity, and semantic class) has to be learned individually for any particular verb.

How can the choice of particular morphological forms be accounted for? One explanation involves the frequency of particular verb forms in input to the child. On this account, children will prefer a particular verb form if it is the one most often heard in the input. To test this hypothesis, I examined the distribution of the verb *gmr1* in input to Lior and in her production data prior to MLU 2, as shown in Table 3.3. The verb *gmr1* was chosen, since it occurred in Lior's data a large number of times.

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24 These eight verbs, as noted, occurred in the initial verb lexicon of all six children in the first conjugation (the *qal* pattern) which has by far the highest frequency (type and token) in Hebrew usage and in Hebrew child language in particular (Berman 1993a).

Table 3.3 Morphological Distribution of *gmr1* in Lior's Data at MLU < 2 and in Input to Lior

Verb Form	Gloss	Input (Caretaker)	Production (Lior)
gamarnu	'alldone'	67% (26)	65% (13)
gamart	'done-2SG-FM-PT	13% (5)	5% (1)
gamarti	'I'm done'	13% (5)	20% (4)
gamarta	'done-2SG-MS-PT'	3% (1)	10% (2)
nigmeret	'is-finishing-SG-FM-PR	3% (1)	0% (0)
nigmor	'we'll finish'	3% (1)	0% (0)
Total tokens		39	20

Note with respect to these figures that *input* here is limited to caretaker data recorded in the transcripts, on the assumption that it represents the overall input to the child during the early phases of acquisition; also, the number of occurrences of any particular verb at these early phases is quite small. Yet, the data still indicates a correlation between the distribution of particular morphological forms in the input, and the extent to which Lior used these forms in production. The highest correlation is between caretaker use of *gamarnu* 'alldone' and Lior's use of this verb form (shaded in gray), and in use of *gamarti* 'I'm done'. Normally, we would expect a correlation between caregiver 2nd person verbs in addressing the child, and child 1st person forms in response to the caregiver's queries. A correlation in use of 1st person forms thus suggests that the child does not engage in adultlike question-answer interactions, but rather is imitating the use of a particular verb form in the input.

As acquisition proceeds, different morphological forms are acquired, and verbs occur in different tenses and with different inflectional markers of agreement. Tables 3.4a and 3.4b display the distribution of verb forms per lexeme for each of the eight verbs by child. In this analysis, for any given verb, 2SG-**MS**-IMP and 2SG-**FM**-IMP and 1SG-US-**PT** and 1SG-US-**FUT** constitute distinct verb forms, while, MS-SG-PR and MS-SG-PR are taken as two occurrences of the same form, since they share the same agreement and tense specifications.

Table 3.4a Distribution of Verb Forms per Lexeme by Child between Ages 1;5 – 1;11

		Number of Verb Forms			
Lexeme	**Gloss**	**Smadar**	**Lior**	**Leor**	**Hagar**
npl1	'fall'	3	3	—	2
yrd1	'get down'	—	—	—	2
akl1	'eat'	1	2	—	2
šyr1	'sing'	—	1	—	2
rcy1	'want'	2	1	4	1
gmr1	'finish'	—	1	—	2
sym1	'put'	2	—	3	2
ntn1	'give'	1	2	—	1

Table 3.4b Distribution of Verb Forms per Lexeme by Child between Ages 2 – 3;3

		Number of Verb Forms			
Lexeme	**Gloss**	**Smadar**	**Lior**	**Leor**	**Hagar**
npl1	'fall'	4	5	11	8
yrd1	'get down'	1	5	11	5
akl1	'eat'	12	14	12	7
šyr1	'sing'	3	12	8	3
rcy1	'want'	4	6	4	7
gmr1	'finish'	4	4	8	6
sym1	'put'	10	7	22	11
ntn1	'give'	10	6	6	10

Comparison of Tables 3.4a and 3.4b shows that the number of different forms for each verb increases sharply with age. This characterizes all four children In spite of individual differences in total use of each verb, and suggests that increase in number of distinct verb forms by age is a reliable developmental measure.

1.4 Distribution of Hebrew Verb Patterns

Two main reasons motivate the discussion of Hebrew verb patterns in this context. First, it involves derivational rather than inflectional morphology (which is discussed in chapter 4). Second, distribution of verb patterns over time can serve as a measure of lexical development as do increase in size of verb vocabulary, distribution of verb-containing utterances and development of early verb forms discussed above.

In Hebrew, verbs are based on the integrated constructs of consonantal root and affixal pattern called *binyan* conjugations. The five major morphological patterns are shown in Table 3.5 for the root *k-t-b* 'write'.[25] The capital C's mark the positions of the root consonants in each pattern.

25 I do not deal here with the two strictly passive verb patterns *pu'al*, which corresponds to the active P3 pattern *pi'el* and *hof'al*, which corresponds to the P5 pattern *hif'il*, because they are largely absent from and/or irrelevant to early child language (Berman 1993b).

Table 3.5 Conjugation of the Root *k-t-b* in Five Different Verb Patterns[26]

Pattern	***k-t-v***[27]	**Gloss**
P1 *CaCaC*	*katav*	'write'
P2 *niCCaC*	*nixtav*	'be/get written'
P3 *CiCeC*	*kitev*	'captionize'
P4 *hitCaCeC*	*hitkatev*	'correspond'
P5 *hiCCiC*	*hixtiv*	'dictate'

Unlike inflectional morphology, which is associated with the grammar, *binyan* patterns are associated with the lexicon, since they manifest the irregularities and accidental gaps typical of derivational morphology. Nontheless, *binyan* patterns interact markedly with syntax – they form the basis for morphological marking of predicate-argument relations like transitivity, causativity, passive vs. middle vs. active voice, reflexivity, reciprocality, and inchoativity, so that acquisition of verb syntax and semantics involves command of a fixed set of morphological patterns (Berman 1985, 1993). True, each verb-pattern has a basic transitivity value and often a major semantic function. For example, P3 and P5 are typically transitive while P2 and P4 are intransitive. P2 is the basic change-of-state verb, while P5 is the basic causative verb. Thus, VAS alternations at the level of the sentence almost always entail morphological alternation at the level of the verb, marked by a shift in *binyan* assignment. But there are many exceptions. Most markedly, P1 which is highest in frequency (both type and token) in child and adult Hebrew is neutral with respect to transitivity (it has both transitive and intransitive verbs, e.g., *ba* 'come', *raxac* 'wash-TR'). And it lacks semantic bias (it has activity, state, and change-of-state verbs, e.g., *rac* 'run', *axal* 'eat', *xashav* 'think', *yada* 'know', *nafal* 'fall', *ratax* 'boil').

Berman (1980, 1982, 1986a, 1993a,b) describes the acquisition of Hebrew verb patterns as outlined in Table 3.6. Children use verbs formed in all five major patterns as early as the one- or two-word stage, but only around age 3 - 4 years that they start showing command of verb-pattern alternations.

26 Verbs are presented in the morphologically unmarked form of past tense, 3rd person, masculine, singular.
27 The stops /k/and /b/ alternate with the spirants /x/ and /v/ in different morphological contexts, irrelevant for present purposes.

Table 3.6 Development of Verb-Pattern Alternations [Berman 1985]

Age	Developmental pattern
2-3	A given verb-root is used in only one pattern as an unanalyzed, rote-learned form.
3-4	Initial variation of verb patterns occurs with certain verbs. These alternations show that the child can use the appropriate lexical form in different contexts.
4-5	Patterns are varied for numerous roots and in many different contexts.
By age 6	Children manifest command of the system through appropriate verb-pattern assignment to most verbs in the lexicon.

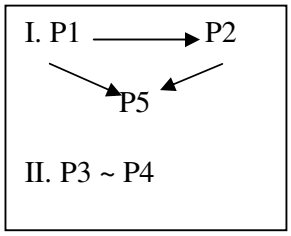
To test these claims, I examined the distribution of verb-roots across the five major verb patterns (P1 *qal*, P2 *nif'al*, P3 *pi'el*, P4 *hitpa'el*, P5 *hif'il*) in the speech of the four children between the ages 1;5 - 3;1, an age range which covers only the 1st and 2nd phases of Berman's model. Findings can be summed up as follows (detailed in Appendix 3.IV, Tables a–d): First, all children make extensive use of the P1 pattern throughout (50%-70%); P3 and P5 account for 10%-20% of the lexemes used; and the intransitive P2 and P4 account for remaining 5%-10%. These findings corroborate Berman's (1993) findings, that P1 accounts for over half the verbs (types and tokens) used by children in a variety of cross-sectional studies of pre-school and early school-age usage (e.g., Berman & Dromi 1984, Kaplan 1983), and for 50%-60% of the early verbs of children studied longitudinally. Berman and Armon-Lotem (1996) note, too, that about 55% of the verbs were in the basic P1 pattern, another 30% were in the two typically transitive patterns P3 and P5, and the remaining 15% were in P4 and P2. Second, the distribution of various verb patterns (types) changes over time as follows: The use of P1 decreases slightly and of P2 and P4 increases slightly, appearing to partially replace P1. Use of the transitive patterns P3 and P5 remains more or less stable, suggesting that increase in use of verb types in the intransitive P2 and P4 patterns over time can serve as a measure of linguistic development.

These distributions derive from the properties of the verb patterns. Thus, P1 has a privileged status semantically, syntactically and in frequency of use: Semantically, it lacks specific semantic or functional bias, including both active and stative verbs. Syntactically, it is neutral with respect to transitivity, including both canonically transitive and intransitive verbs. In frequency of use, P1 is most salient in child language input and output, and includes most of the generic level, least specific verbs typical of young children's early lexical usage (see Chapter 5, Section 2). The other four major verb patterns are all more restricted. For example, P3 and P5 are both typically transitive and either activity-based or durative (P3), or causative (P5), while

P2 and P4 are both typically intransitive, and they never take a direct object marked by the accusative *et*, and so lack passive counterparts.

Productive command of verb-pattern alternations is mastered along with other aspects of Hebrew derivational morphology between ages 3-5. Nonetheless, certain alternations are already evident in the third year. Berman (1993a) discusses two typical systems of interpattern alternations, outlined in Figure 3.3.

Figure 3.3 Typical Interpattern Alternations



In Figure 3.3, P1 alternates with P5, as in *rakad* 'danced' vs. *hirkid* 'made dance' (*r-k-d*), P1 alternates with P2 as in *zarak* 'threw' vs. *nizrak* 'was/got-thrown' (*z-r-k*), and P2 alternates with P5 as in *nirtav* 'got wet' vs. *hirtiv* 'make-wet' (*r-t-v*). The relation between P1 [+trans] and P2 [+intr], and P1 [+intr] and P5 [+trans]-causative are highly productive alternations but not fully grammaticized in current Hebrew. The second type of alternation is between P3 ~ P4, as in *bishel* 'cooked' vs. *hitbashel* 'got cooked' (*b-š-l*). Berman (1993a) reports that structural elicitation of verb-pattern alternations from 2- and 3-year-olds revealed that children use alternations between P1 ~ P5, and P1 ~ P2 the most, between P4 ~ P3 next, and between P2 ~ P5 the least.

Table 3.7 shows the occurrence of a particular root in different patterns for Leor (the oldest child in the sample). The figure in each cell indicates the number of occurrences of a given alternation at a given age. The *Total* column sums the occurrences of the various alternations by age, while the *Total* line sums the occurrences of alternations by verb patterns. Table 3.7 shows a steady, gradual increase in number of roots used with more than one verb-pattern by age (compare one alternation at age 1;11 with four alternations at age 2;10, shaded in gray in Table 3.7). This suggests that verb-root/verb-pattern ratio over time can serve as a reliable measure of linguistic development: the closer the ratio to 1, the more linguistically advanced the child.

Table 3.7 Verb-Pattern Alternations in Leor's Data [1;9 - 3]

Age	P1~P5	P1~P2	P3~P4	Other	Total
1;9	1		1		2
1;10					
1;11	2				2
2;0	2	1			3
2;1	2	3		1	6
2;2	1				1
2;3	3	1			4
2;4	4	3		1	8
2;5	2	1	1		4
2;6	2			1	3
2;7	2	1	1		4
2;8	5	2	1		8
2;9	3	1	1	1	6
2;10	4	3	2	1	10
2;11	5	3		1	9
3;0	1	1		1	3
Total	39	20	7	7	73

Leor's most productive alternation was between P1 ~ P5 (from basic intransitive to causative), with less productive alternations between P1 ~ P2 and P3 ~ P4, and the least between P2 ~ P5 (see also Berman 1993a). Distribution of verb-pattern alternation can also serve as a developmental measure: the larger the number of least productive alternations at a given age, the more advanced the child.

Berman (1982, 1993a,b) proposes a number of factors for the attested distribution of verb-pattern alternations. These include lexical productivity (the extent to which a given alternation is favored in contemporary usage), and familiarity and frequency of use of a given form (young children rely on the more productive options in producing verb-pattern alternations). These are later augmented by syntactic and semantic considerations, together with cognitive considerations of simplicity and transparency (Clark 1993). Other lexical factors such as accidental gaps, frozen forms, and semi-productive alternations also affect the preference of a particular alternation.

2. Conclusion

The findings outlined above suggest that the percentage of verb-like items in the early lexicon of Hebrew-speaking children is initially quite small. With development, and with increase in vocabulary, the proportion of verb-like items increases, as does the proportion of verb-containing utterances in children's speech. Children also show a transition from unclear, 'stemlike' forms to tensed verb forms, and an increase in verb-pattern alternations. These trends correlate with the gradual increase in

children's MLU scores, less so with age, suggesting that they are measures of linguistic development.

These findings yield the following characterization of a "basic" verb in Hebrew child language. Syntactically, it has no overt arguments; morphologically, it is frozen, since it is most often used in a particular configuration of inflections (number, gender, person, tense). A "basic" verb is most often in *binyan qal* (P1), or "stripped" in terms of its verb-pattern, with almost no alternation of more than one verb pattern across the same verb-root.

Chapter 1 (Section 3) presented a three-phase developmental model of verb and VAS acquisition, where the initial period of Phase I was described as a period of no productivity; that is, children rote-learn their first verbs, and do not attempt to analyze their composition. This period was characterized as a 'level' in the sense of Karmiloff-Smith (1986, 1992, 1994), since it is non-recurrent and bound by MLU. This gains strong support from data reviewed in this chapter for the transition from unclear to tensed forms and the low amount of verb-pattern alternations in the early phases of acquisition.

My claim for the early role of pragmatics in verb and VAS acquisition (Chapter 1, Section 3.4) seems to contradict the initial "verb-by-verb" approach supported by the data presented here (Section 1.3.2), since pragmatic constraints are assumed to apply across the board, whereas a verb-by-verb approach emphasizes the acquisition of individual lexical items. I would say that these two approaches do not contradict but rather complement one another, since the period when verbs are acquired as individual lexical items **precedes** the period when pragmatic principles are applied. In the initial period of acquisition, children meet their need to communicate by using verbs in particular morpho-phonological forms. Only once they get beyond the single-word stage, with the early acquisition of arguments, will pragmatic principles like Du Bois's (1985, 1987) Preferred Argument Structure apply and guide the acquisition process.

Chapter 4: Inflectional Verb Morphology

Morphology is the linguistic module in which languages differ most (Anderson 1985, Aronoff 1976, Berman 1993b). In many languages, including Hebrew, verbs tend to be the lexical elements that show the greatest morphological variation. Development of verb morphology in languages with different morphological systems can thus shed light on language acquisition in general and refine the distinctions between language particular and universal factors in the process. Hebrew is worth studying in this respect since, as noted, a great deal of information is morphologically encoded inside the verb: tense-mood, agreement (person, number and gender), and valence (causativity, transitivity, voice, etc.).

Verb morphology plays an important role in addressing the central goal of this study: to propose an integrative developmental model of verb and VAS acquisition. First, if verb morphology, verb semantics, and pragmatic factors can be shown to interact in acquisition, this can lend support to the proposed model as **integrative**. For example, a given inflection may be initially realized only with verbs of a particular semantic class, or only with verbs that exhibit particular valence relations or occur extensively in input to the child. Second, acquisition of inflection has an effect on the realization of arguments, as in the case of null subjects or the gradual increase in use of infinitivals as complements of inflected verbs.[28]

This chapter discusses the development of inflectional morphology in the Hebrew verb system, and addresses the following. (a) The order of emergence of inflectional morphemes for agreement (gender, number, person) and tense/mood; (b) the interaction between other linguistic modules and the acquisition of morphology; (c) the move from emergence to mastery; and (d) the question of when a morphological system has been acquired. The interaction between morphology and other modules (semantics, syntax, pragmatics) and its effects on the acquisition of VAS are discussed in a later chapter.

28 I use the neutral term *null-subject* rather than *pro-drop* or *ellipsis* to refer to cases in which an overt subject is missing, e.g., *raxacti yadayim* washed-1SG-PT hands 'I washed (my) hands', in order to refrain from theory-specific claims at this point in the analysis. The term *null-subject* also includes subjectless impersonal constructions, where no ellipsis can be assumed (Berman 1981).

1. Hebrew Verb Morphology

Across languages, acquisition of inflectional morphology tends to precede derivational morphology (Berman 1995, Clark & Berman 1995). Inflectional morphology typically marks obligatory, across-the-board grammatical categories like tense/aspect or agreement, whereas derivational morphology provides optional alternatives for lexical expression.

Hebrew is a Semitic language with a characteristically synthetic morphology. All verbs and most nouns and adjectives are based on the integrated constructs of *consonantal root* and *affixal pattern*. As noted earlier, Hebrew verbs are constructed in one of five morphological patterns called *binyan* conjugations, each of which is marked for the same rich system of inflections (Chapter 3, Section 1.4). This system is illustrated in Tables 4.1 – 4.2.

Table 4.1 displays T/M categories in three verb patterns *pa'al* (P1), *pi'el* (P3) and *hif'il* (P5) in the unmarked singular masculine form. The major inflectional paradigms in the Hebrew verb system are of Tense/Mood and agreement. T/M is expressed in a five-way distinction between nonfinite (Infinitives and Imperatives) and finite forms (Past, Present and Future). There is no grammatical marking of aspect or modality.[29]

Table 4.1 Tense/Mood Categories in 3 Verb Patterns [Unmarked - Masculine Singular]

		–Tense		∅ Tense	+Tense	
Verb-pattern	**Lexeme**[30]	**INF**	**IMP**	**PR= Participle**	**PAST**	**FUT**
pa'al, qal	*gmr1* 'finish'	*ligmor*	*gmor!*	*gomer*	*gamar*	*yigmor*
	sty1 'drink'	*lishtot*	*shte!*	*shote*	*shata*	*yishte*
pi'el	*dbr3* 'talk'	*ledaber*	*daber!*	*medaber*	*diber*	*yedaber*
	nky3 'clean'	*lenakot*	*nake!*	*menake*	*nika*	*yenake*
hif'il	*txl5* 'begin'	*lehatxil*	*hatxel!*	*matxil*	*hitxil*	*yatxil*
	npl5 'drop'	*lehapil*	*hapel!*	*mapil*	*hipil*	*yapil*

Table 4.2 displays a complete inflectional paradigm (including number, gender, person and tense) of the verb *gmr1* 'finish, end' in *binyan* P1 *pa'al*.

29 The only exception is the verb *haya* 'be' used with the participial *benoni* forms to mark past habitual aspect or irrealis conditionals as in *haya holex* be-3SG-MS-PT go(ing) = 'used to go', and in *hayiti roca* be-1SG-PT want-1SG-FM-PR = 'would want'.
30 For a definition of the term *verb lexeme* see Chapter 3, Section 1.1.

Table 4.2 A Full Inflectional Paradigm for the Root *g-m-r* 'finish' in the *Pa'al* Conjugation

		Past		Present[31]		Future	
No.	**Person**	MS	FM	MS	FM	MS	FM
SG	1	*gamárti*	*gamarti*	*gomer*	*gomeret*	*egmor*	*egmor*
	2	*gamárta*	*gamart*	*gomer*	*gomeret*	*tigmor*	*tigmeri*
	3	*gamar*	*gamra*	*gomer*	*gomeret*	*yigmor*	*tigmor*

		Past		Present		Future	
No.	**Person**	MS	FM	MS	FM	MS	FM
PL	1	*gamárnu*	*gamarnu*	*gomrim*	*gomrot*	*nigmor*	*nigmor*
	2	*gamártem*[32]	*gamarten*	*gomrim*	*gomrot*	*tigmeru*	*tigmorna*
	3	*gamru*	*gamru*	*gomrim*	*gomrot*	*yigmeru*	*tigmorna*

		Imperative		Infinitive
No.	**Person**	MS	FM	*ligmor*
SG	1			
	2	*gmor*	*gimri*	
	3			
PL	1			
	2	*gimru*	*gmorna*	
	3			

Verbs take agreement markers governed by the subject NP for the categories of number, gender (in imperative, present, past, future) and person (past and future). **Number** consists of singular and plural.[33] Number distinctions are largely semantically motivated, distinguishing one from many except for some frozen forms, e.g., *shamayim* 'sky', *mayim* 'water', *xayim* 'life', which have no singular forms. In the number category, plural is derived from the unmarked singular form by affixation of masculine *–im* or feminine *–ot* (e.g., *kadur/kadurim* 'ball-SG-MS/balls-PL-MS', *buba/bubot* 'doll-SG-FM/dolls-PL-FM).

Gender – All nouns are obligatorily masculine or feminine, with a semantically motivated contrast in animate nouns, e.g., *more/mora* 'teacher-MS/teacher-FM', *xayal/xayelet* 'soldier-MS/soldier-FM', *tabax/tabaxit* 'cook-MS/cook-FM', *par/para*

31 Person is not marked on present tense verbs.
32 Nonnominative, regularized.
33 Apart from singular and plural, the number category in Hebrew has a nonproductive dual form -*ayim* used mainly for parts of the body, clothing, and calendar terms (e.g., *yadayim* 'hands', mixnasayim 'pants', shvuayim 'two weeks'). Nouns in the dual take ordinary plural agreement.

'bull/cow', *tarnegol/tarnegolet* 'rooster/hen'. Inanimate nouns are inherently masculine or feminine, e.g., *shulxan* 'table-MS', *kadur* 'ball-MS', *mita* 'bed-FM', *buba* 'doll-FM'. Morphologically, feminine is derived from masculine singular form by affixation of stressed *-a(t), -it,* or unstressed *-et,* (e.g., *sapar/sapar-it* 'barber-MS/hairdresser-FM' *tinok/tinok-et* 'baby-MS/baby-FM'). Neutralization is always to the masculine form, so that in a sentence like *Dan ve Rina mesaxak-im* 'Dan-MS-SG and Rina-FM-SG play-MS-PL' the verb is in the masculine plural although there is a feminine noun as subject (compare masculine = neuter *mesaxakim* vs. feminine *mesaxakot*). Also, there is no gender distinction in 3rd person plural in past tense, e.g., *hayeladim sixaku* 'the children-MS-PL (+FM-PL) played-PL' versus *hayeladot sixaku* 'the children-FM-PL played-MS-PL'.

Person – Hebrew distinguishes between 1st, 2nd and 3rd person, although the paradigm is defective since there are no person distinctions in present tense, and 3rd person singular is a default form (see Table 4.2). Inflectional categories are marked by suffixes, by prefixes in future form, or by vowels interdigited with root consonants both with and without additional affixes, e.g., *gamar-ti* 'finish-1SG-PT = finished', *yigmor* 'finish-3SG-MS-FUT = will finish', *gamar* 'finish-3SG-MS-PT = finished', *gomer* 'finish-SG-MS-PR = finishes'. Hebrew-speaking children thus face a complex task in acquiring the rich system of verb inflections in their language.

2. Previous Studies

This section reviews model-based approaches to the acquisition of inflection (2.1), and previous studies on the acquisition of Hebrew verb morphology (2.2).

2.1 Model-Based Approaches to the Acquisition of Inflection

I review the acquisition of inflection in generative (2.1.1), rule-based (2.1.2), and connectionist (2.1.3) models as representing distinct approaches to acquisition, all of which differ from the developmental approach adopted in this work. All of these frameworks attempt to account for acquisition of inflection within a broad, theoretically-anchored model of acquisition, and all have been the basis for quite extensive research on the acquisition of inflection.

2.1.1 Generative Analyses

INFL(ection) is considered a functional category constructed hierarchically according to the X-bar schemata.[34] Pollock's (1989) analysis splits INFL into three distinct functional categories where each functional head heads its own maximal projection: T(ense) heads TP (Tense Phrase) and consists of the features [±tense], and presumably [±past] when tense is [+finite], Neg heads NegP (Negative Phrase), and Agr heads AgrP (Agreement Phrase) and consists of the ϕ-features [person] (i.e., 1st, 2nd, 3rd), [number] (i.e., ±singular) and [gender] (i.e., ±masculine). A major question arising from the dissociation of functional properties is whether Agr dominates Tense or Tense dominates Agr. Since there is crosslinguistic evidence for both cases, Chomsky (1989) proposes to split Agr into AGRs (Agreement of Subject Phrase) and AGRo (Agreement of Object Phrase) as illustrated in Figure 4.1. This way, Agr can both dominate Tense and be dominated by it. Based on data from modern Hebrew, Shlonsky (1989) proposes to break down the AgrP node further into its components (as illustrated in Figure 4.2).

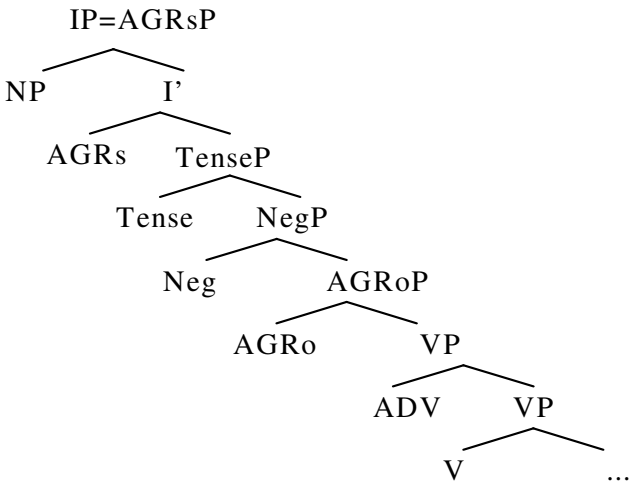


Figure 4.1 The Expansion of INFL [Chomsky 1989]

34 A *functional category* is a category like INFL, COMP, D, T, AGR, etc. whose members are *functors* – a closed class of elements, which serve an essentially grammatical function and have no descriptive content. Unlike lexical categories (e.g., N, V, A, P), functional categories do not assign theta-roles and do not permit recursion on X-bar.

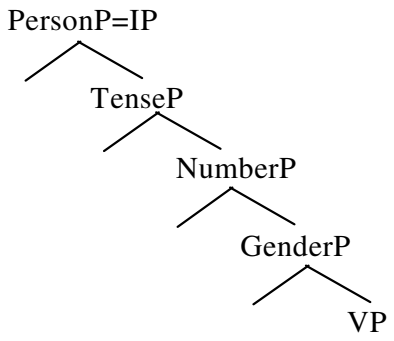


Figure 4.2 The Expansion of INFL [Shlonsky 1989]

Since generative grammar treats inflection as a "functional category" (e.g., Fukui & Speas 1986), the acquisition of inflection has concerned generative linguists primarily as a means to determine whether children have functional categories in the initial stages of language acquisition. Radford (1990), for example, argues that children up to age 24 months lack functional categories so that early child grammars of English are lexical systems in which thematic argument structures are directly mapped into lexical syntactic structures. At the other end of the scale, Meisel and Muller (1992) find early examples of Verb-second in children learning German, and so conclude that they have both AgrP and TP and that they use TP as a place into which to move the finite verb. Wexler (1994) argues against the missing functional categories analysis, based on what he considers evidence from early child language that implies verb movement of different kinds. For example, Verb movement for negation and for Verb-second when the verb is finite, but not when it is nonfinite, which suggests that children do have functional categories, since otherwise the verb could not move to get inflection. Similarly, Poeppel and Wexler (1993) propose the Full Competence Hypothesis (FCH) by which German children acquire finiteness, verb agreement and verb movement very early in syntactic development. A third alternative is that functional categories are present but not fully visible in the child's speech. Deprez and Pierce (1993), for example, claim that children's grammars differ from adults' not because they lack functional categories or movement, but because they allow the subject NP to remain inside the VP. Children at the earliest stages of syntax know that English differs from French in Verb movement, and since parameters are always associated with functional heads, children must thus know functional categories.

Ingram and Thompson (1996) argue against the FCH of Poeppel and Wexler (1993). Their analysis of four German children yields the Lexical/Semantic Hypothesis (LSH) which assumes that children have only partial knowledge of syntactic structures and X-bar schemata, with much of their early syntactic acquisition being lexically and semantically determined. Thus, German-learning children first acquire verbs from the input as separate lexical entries each with its own properties (e.g., person, aspect, subcategorization), and only later show evidence for a rule-based behavior.

Armon-Lotem's (1997) study of the early acquisition functional categories in a minimalist framework (Chomsky 1993) used longitudinal data for three of the Hebrew-speaking children in the present study, at ages 1;6 to 3 years, supplemented by diary data on the early verbs of three other children at the one-word stage (Berman & Armon-Lotem 1996). The minimalist hypothesis is that UG provides children with full knowledge of phrase structure right from the start, but at each point in the process of acquisition, they construct the smallest convergent trees that their grammar requires, based on the evidence at their disposal. For Armon-Lotem, "the minimalist child" builds trees in a bottom-up fashion, the only way to build well-formed trees with limited evidence. She views bottom-up acquisition as accounting for a range of phenomena like null subjects, and root infinitives. Such an acquisitional pattern is also necessary to explain the order in which verbal morphology is acquired: Children first distinguish aspectually durative from perfective actions, then proceed to acquire gender and number, followed by tense and, finally, person morphology.

Generative accounts dealing with children acquiring a range of languages including Hebrew thus all share the attempt to relate acquisition (in the case in point, of verb inflection) to a formal model of linguistic (syntactic) structure. But they differ in the way they interpret the facts, often in the facts themselves.

2.1.2 Rule-Based Analyses

A different point of departure is adopted by researchers who propose *a dual route model* in the development of inflectional morphology (e.g., Berko 1958, Brown 1973, Pinker & Prince 1988, Pinker 1991). Much of their work is based on Bybee and Slobin's (1982) study of the acquisition of irregular past tense in English, as noted earlier (see Chapter 1, Section 3.1.2). They argue that two separate and dissociable mechanisms are needed to handle regular compared with irregular inflectional forms.

One is a memory storage device that contains, for example, the past tense of highly frequent and irregular forms in the language. The other is a rule-based system, which attaches the appropriate allomorph of /-ed/ to the verb stem to form the past tense. In this view, early correct usage of past tense forms is explained by the operation of the memory storage device. The onset of overgeneralization errors is explained by the interference of the two mechanisms such that the memory storage device fails to block the application of the regular rule to an irregular stem. Finally, adult competence is explained by the two mechanisms discovering the correct division of verbs into regulars and irregulars. This division is achieved by strengthening the representations of irregular verbs in the memory storage device so that blocking the application of the regular rule to irregular forms becomes more effective.

2.1.3 Connectionist Analyses

This developmental process was supposedly re-analyzed in a *single-route (connectionist) model* that accounts for acquisition by associative memory. Studies of morphology in this framework have focused on the acquisition of English past tense (e.g., Kuczaj 1977, Plunkett & Marchman 1993, Marchman & Bates 1994, Rumelhart & McClelland 1994), and of noun plurals in German (e.g., Clahsen, Rothweiler, Woest & Marcus 1992) and Arabic (e.g., Plunkett & Nakisa 1997; Ravid & Farah 1999). This is done by constructing learning models for simulating these processes, or by testing the results of these simulations in naturalistic studies.

Plunkett and Marchman (1993) simulated the acquisition of English past tense forms of regular and irregular verbs using a connectionist network. The performance of the network reflected a shift from the rote learning of [stem → past tense mapping] to the organization of the lexicon in terms of general patterns. This shift was triggered by the increase in the size of the lexicon beyond a particular level ("the critical mass effect") rather than by amount of training, which also means that overregularizations will only emerge once the data set is large enough for extraction of general patterns.

Marchman and Bates (1994) investigated the connection between vocabulary growth and the onset of overregularization errors by analyzing parental report data from English-speaking children aged 1;4 - 2;6. Age and especially size of verb vocabulary were found to be reliable predictors of the frequency of correct versus overgeneralized forms. They view this as evidence for the notion of a "critical mass",

as consistent with a connectionist, single-mechanism model of morphological learning.

Rumelhart and McClelland (1994) simulated a three-stage acquisition process of past tense in English (see, too, Brown 1973, Kuczaj 1977) by constructing a connectionist network, and training it to learn regular and irregular past tense verbs. They claim that in order to acquire English past tense forms, the child does not have to figure out what the rules are, or to decide whether a verb is regular or irregular, familiar or novel. The statistical relationships among the base forms themselves determine the patterns of past-tense forms.

There are no connectionist studies on acquisition of Hebrew morphology, but there are some on noun plurals in Arabic, a language where regular forms are initially highly productive despite their relatively low frequency in the language. This could challenge single-route connectionist models, where learning is based on the frequency of a given form rather than on its regularity. Plunkett and Nakisa (1997) examined the capacity of a simple feedforward network to learn noun plurals in Modern Standard Arabic, using a database of 859 nouns. Their simulation yielded three predictions. (1) Children will start out by overregularizing the sound plurals (the less frequent but more regular class of nouns). (2) At a later stage of learning, children's errors will consist mostly of broken plural forms (the more frequent but less regular class of nouns). And (3) masculine sound plurals will be the slowest to be learned. Their results suggest that three different types of single-route models make better generalizations for Arabic plural acquisition than a dual-route model.

Ravid and Farah (1999) examined the acquisition of noun plurals in (spoken) Palestinian Arabic to test the predictions of Plunkett and Nakisa, using a structured elicitation task with children aged 2;3 - 6;2. They also found that children start by overregularizing the sound plurals (less frequent, more regular), and only later supplement these by erroneous responses in the form of broken plurals (more frequent, less regular). In addition, feminine sound plurals were preferred over masculine, leading Ravid and Farah to conclude that in forming noun plurals in their language, Arabic speakers may be sensitive not only to phonological structure, but also to considerations of morphological class.

In sum, these various orientations are based on different linguistic analyses (e.g., formal principles of current models of UG and parameter setting, the notion of functional categories), and on different theorizing on the nature of learning – top-

down or bottom-up acquisition of inflectional categories, early rule-based accounts, or a single-route mechanism. The major drawbacks of these accounts relate to the nature and scope of the evidence used to support them. That is, generative accounts often bring conflicting evidence to bear on a particular phenomenon like the early occurrence of functional categories, while rule-based and connectionist accounts base their assumptions on narrow-scope phenomena like the acquisition of past tense in English.

2.2 Studies of Hebrew Verb Morphology

Although there are universal trends, inflectional morphology typically involves highly language particular knowledge. This means that, for example, acquisition of the first 14 morphemes in English (Brown 1973) or of the case system in Russian (Slobin 1981) are of little relevance for studying the acquisition of Hebrew morphology. The rich body of research on the acquisition of inflection in other languages will thus not be reviewed here.[35]

Research on acquisition of Hebrew verb morphology includes cross-sectional sampling (Berman & Dromi 1984, Dromi & Berman 1986, Kaplan 1983, Ravid 1995), longitudinal studies (Berman & Armon-Lotem 1996, Levy 1983a, 1983b, Ravid 1997), and a few structured elicitations (Berman 1981, Levy 1980, Ravid 1995).

This review focuses on longitudinal data, since the relevant corpora cover the period critical for acquisition of inflectional morphology (around age two). A longitudinal database alone reveals developmental processes within and across children, a central goal of my study. And methodologically, since my own database is longitudinal, and in part overlaps with that of other researchers, these studies are more clearly comparable with my analyses.

Berman and Armon-Lotem (1996) studied the first twenty verb forms recorded in the longitudinal corpora of six children aged 14 - 25 months.[36] Around half turned out to be unclear or "stripped" stemlike forms, which typically take the shape of the second, stem-final syllable, and stand for a variety of grammatical mood/tense categories. Next in frequency were imperatives. Less than 30% of early verb forms were marked for finiteness, i.e., present, past, or future. In gender, feminine marking

35 For example, Brown (1973) on English, Karmiloff-Smith (1979) on French, Pizzuto & Caselli (1994) on Italian, Pye (1992) on K'iche' Maya, Allen (1996) on Inuktitut.

was most salient in the singular. There were no markers of person. In distribution of verb patterns, 55% of these early verbs were in the P1 pattern, 30% in P3 and P5, and only 15% in the two typically intransitive P4 and P2 patterns. There were almost no alternations of more than one verb-pattern across the same verb root. Transitive and intransitive verbs were used to an equal extent. These early verbs revealed minimal alternations across inflectional forms within and across children, and overall, the verbs used by the different children were similar in both form and content. Some individual differences emerged with respect to the extent of reliance on "stripped" forms, and use of stem-like imperative forms with the feminine suffix *-i*.

The findings of Berman and Armon-Lotem (1996) are strongly confirmed by analysis of diary data for my son Raz, over a period of several days at age 18 months. The 43 verb types and 66 tokens recorded were distributed as follows: First, 35% were unclear or "stemlike", ambiguous forms, 23% were infinitives, 15% imperatives, and the remaining 27% were clearly marked for present or past tense, with no verbs in future tense. Second, masculine was more salient than feminine (33% vs. 11% feminine and 56% no marking), there were few plurals (2% only of all verbs), and (d) person was also only sparsely marked (only 6%). In *binyan* (verb-pattern) distribution, 77% of the verbs were in the basic P1 (*qal*) conjugation, 17% in P3 (*pi'el*) and P5 (*hif'il*), 6% in P4 (*hitpa'el*) and P2 (*nif'al*). Raz showed almost no alternations of more than one verb-pattern across the same verb-root, except for one case of using both P1 and P5 with the lexeme *yrd1* 'go down, take off'. Transitive and intransitive verbs occurred almost equally (47% intransitive, 53% transitive verbs).

Ravid's (1997) study of a pair of Hebrew-speaking twins (a boy and a girl) between the ages 1;11 - 2;5 distinguishes two stages of morphological development: **pre-morphology** or "emergence" and **proto-morphology** or "mastery" (see, Dressler & Karpf 1995). At the pre-morphological stage, when the morphological module is not yet formed, children rely on general cognitive rather than grammatically specific knowledge. Most of the verbs used by the twins at this stage were in the imperative/infinitive, both inflectionally impoverished categories (infinitives have no grammatical alternations, and imperatives have only three forms). Ravid notes that this enables children to acquire the basic verbal meanings without having to fully acquire the relevant grammatical knowledge, and each verb can be treated as a

36 Three of these children are included in the present study.

separate entity with no alternations. These pre-verbs were typically embedded in rote-learned chunks or pragmatically-oriented word order, none were marked for plural, and very few for person. Next, at the proto-morphological stage, Ravid reports a decline in infinitives and other inflectionally impoverished verb forms, accompanied by the emergence of "grammatical-word" clusters, where a single lexical verb stem is used in diverse inflected forms, different tenses, and with markings for person, number and gender. Alternations of the same verb root in different verb patterns occur together with errors in transitivity marking.

In Levy's (1983) study of inflected verb forms, her son Arnon aged 1;10 - 2;10, used masculine verb forms to address both males and females until age 2;2, when feminine singular verb forms became frequent, with plural forms mainly in the masculine. Arnon showed no confusion in number and person, only in gender distinctions with the same person.

These studies reveal many common trends. All find that children begin the process of verb acquisition using mainly stemlike, unanalyzed forms along with some inflected forms. Initially, they report almost no alternations of a single root in more than one inflectional category or in more than one verb-pattern. Nonstemlike forms occur mostly in the P1 *qal* pattern, and are inflected for tense, number and gender, but not for person. Singular is earlier and far more pervasive than plural. Past and present tense are earlier and more pervasive than future, while use of these three tenses increases with age as reliance on nonfinite infinitives and imperatives decreases. As for gender, Armon-Lotem reports that feminine is most widely used (she had 4 girl-subjects), whereas diary data for my son Raz and for Levy's son Arnon reveal the opposite trend, with masculine most common.

3. Predictions

These studies deal with one or several aspects of morphological development, either the initial stage or some intermediate stages, but none presents a complete account of what is meant by "mastery" of verb morphology. Yet it is only with respect to the final state of the process that development in the intermediate phases can be adequately assessed. To this end, and in line with my general definition of "productive knowledge" (Chapter 2, Section 2.1), I propose the following criteria for

mastery of verb morphology in general, and by Hebrew-speaking children in particular.[37]

For a child to have mastered verb morphology, each verb in his or her repertoire must be used in the correct morphological form. This means that it must (a) show correct marking for **grammatical tense or mood**; (b) meet agreement requirements in **gender, number and person,** and (c) be constructed in verb-pattern that matches its **argument structure** requirements in transitivity and voice. Usage must be self-initiated and not the result of a repetition, imitation, recitation of a nursery rhyme, or use of a frozen or formulaic expression. The use of a particular morphological form should also be **consistent** and not sporadic. It should occur in *repeated similar contexts* so that it is clearly comprehensible to an adult listener/interactor other than the primary caretaker, and it should persist over time, in the present case, over a period of one year.

Prior research, yields the following predictions for development of verb morphology by Hebrew-speaking children.

3.1 Inflection

The acquisition of inflection will follow a three-step path from zero-inflection through partial to complete marking. Initially children will show no productive knowledge of inflectional morphemes; they will, then, acquire a partial inventory of inflectional morphemes for gender, number, tense and person (e.g., only singular form for number); and finally, this will be followed by a complete set of inflectional morphemes.

Gender – Initially, boys will produce more masculine forms, while girls will produce more feminine forms (e.g., with the suffixes *-a* or *-et* in present tense and *-i*, in imperative). This is because acquisition here is primarily pragmatically motivated and depends to a large extent on parental input. In Hebrew this input differs by the sex of the addressee (e.g., *bo* 'come-2SG-MS-IMP' versus *boi* 'come-2SG-FM-IMP' [come!], *lex* 'go-2SG-MS-IMP' versus *lexi* 'go-2SG-FM-IMP' [go!], and *ten* 'give-2SG-MS-IMP' versus *tni* 'come-2SG-MS-IMP' [give!]).

37 I distinguish between acquisition and mastery, on the one hand, and occurrence or usage, on the other. Certain patterns of usage may serve as indication of mastery, but a child may also use a form without it being acquired; that is, a form may be rote-learned rather than rule-governed. A particular form will be **acquired** only when there is evidence that a productive rule-system has been internalized.

Number – Singular, representing the morphologically unmarked and semantically basic form will be acquired before plural.[38]

Person – Person applies only in past and future tense in Hebrew. After the no-inflection phase, 1st person will be acquired, followed by 2nd and 3rd person, later supplemented by impersonal forms, which are verb-initial constructions with no surface subject. Paradigmatically, impersonal constructions usually have a 3rd person masculine plural predicate as in *loh ovdim be-Shabat be-Israel* 'not work-3PL-MS-IPL-PR on Saturday in Israel' (adapted from Berman 1990, p. 1139). They are common at all levels of usage, and occur in adult input to children.

Tense/Mood – Infinitives, imperatives and present tense will be acquired first, followed by past and then future tense. Children may use some past and future tense verbs in the early phases of acquisition, but these will be used sporadically and nonproductively until later in acquisition.

Also, initially, acquisition of each tense will be restricted to a few verb lexemes, and in this sense, tense will be verb-specific. For example, change-of-state verbs like *npl1* 'fall down' or *gmr1* 'all done, finish' will initially be acquired in the past tense (which in Hebrew also represents perfective or completive aspect), whereas a motion verb like *bwa1* 'come' will be acquired in the imperative. Only later will verb lexemes be varied across tenses, and a single tense, say past, used with an increasing variety of verb lexemes.

4. Findings

This section presents findings on acquisition of inflection: Gender (4.1), number (4.2), person (4.3), and tense (4.4). Data are based on quantitative analyses performed on the data using two statistical programs in CLAN. (a) The FREQ program for frequency counts, and (b) the program for frequencies of word matches across tiers, e.g., the frequency of the lexeme *akl1* 'eat' in the present tense involves matching the lexical and morphological tiers for the category *Verb* (see, too, Chapter 2, Section 1.4.4.3).

38 This does not apply to formulaic, frozen forms such as *gamarnu* 'finished-1st-PL-PT = all done, it's over' and to nouns such as *eynayim* 'eyes', *yadayim* 'hands', *zeytim* 'olives' which are initially acquired in the plural for pragmatic reasons of lexical usage and reference.

4.1 Gender

The acquisition of gender by Hebrew-speaking children was predicted not to be uniform, but boys would acquire masculine and girls feminine form first, due to parental input. Figure 4.3 contrasts the distribution of masculine forms for the three girls (GMS) and the boy (MS), based on figures detailed in Appendix 4.I.

Figure 4.3 Distribution of Masculine Forms by Age

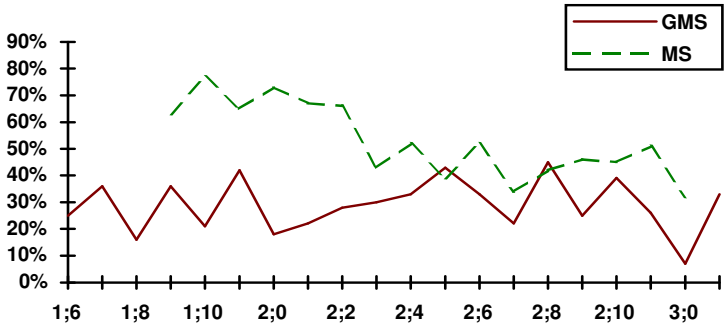


Figure 4.4 contrasts the distribution of feminine forms produced by the girls (GFM) compared with these of the boy (FM).

Figure 4.4 Distribution of Feminine Forms by Age

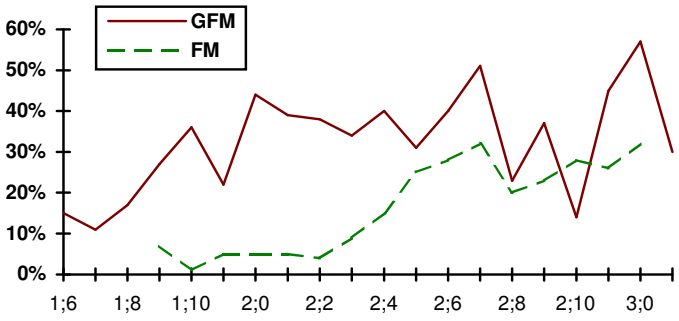
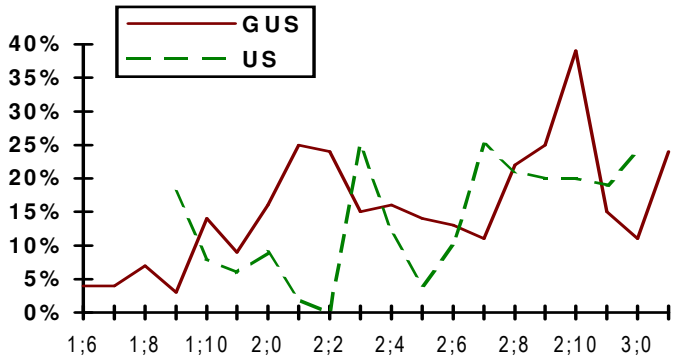


Figure 4.5 contrasts the distribution of unspecified forms used by both sexes (girls - GUS, and boy - US).

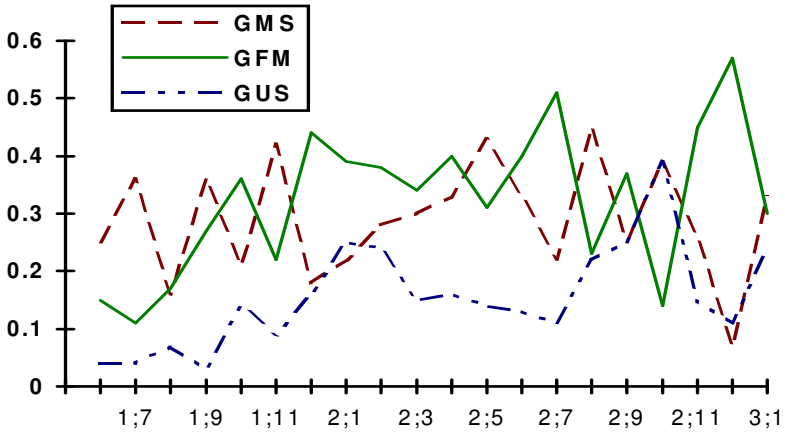
Figure 4.5 Distribution of Unspecified Forms by Age



These figures show the following. First, **masculine** is more salient for the boy, Leor, than for the girls, corroborating findings from diary data for my son Raz and for Levy's (1980) son Arnon. Second, **feminine** is more salient for the girls than for the boy, in line with Berman and Armon-Lotem (1996) who report that in their data (four of their six subjects were girls) feminine was more salient than masculine, and see also Berman (1978). Third, **unspecified** forms show a similar tendency in both girls and boy – they are used the least, and show a gradual increase. Finally, masculine and feminine forms become more evenly distributed for all subjects at around age 2;5.

Figures 4.6 and 4.7 compare the distribution of masculine, feminine and unspecified verb forms for the girls and the boy.[39]

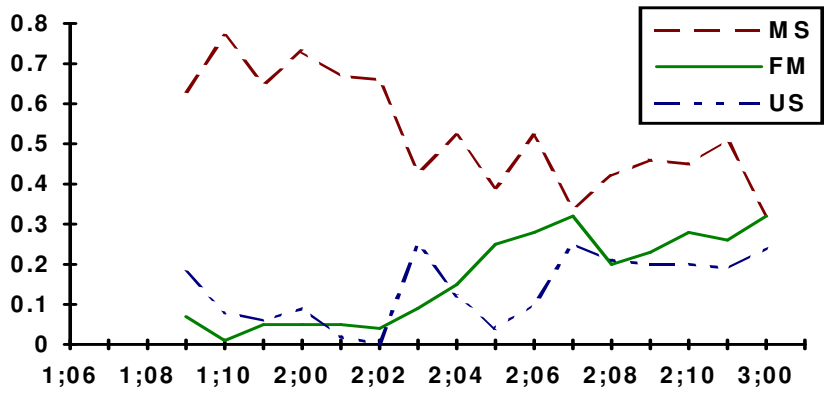
Figure 4.6 Distribution of Masculine, Feminine and Unspecified Verb Forms in Data from Hagar, Smadar and Lior Combined



39 The occasional peaks in the graph lines are due to contextual bias; that is, the number of masculine, feminine or unspecified forms in a given transcript varies according to the gender of the speakers and the topics of conversation. Nevertheless, overall distributional trends remain pretty clear.

Until age 1;7, the girls seem to use masculine more than feminine. This may be due to a methodological flaw, such as contextual bias, but may also imply that in the pregrammatical phase, when gender is not productive, more masculine forms are rote-learned than feminine forms. This changes once the use of gender becomes productive. From around age 1;7, feminine and masculine forms are distributed more evenly for the girls than for the boy, Leor, who seemed to use masculine forms far more than feminine until as late as around age 2;5. In contrast, the three girls use both masculine and feminine forms throughout, with a mild preference for feminine. This is in line with Ravid's (1997) twin study, where in her "premorphological" stage, the girl but not the boy used both masculine and feminine forms with imperative verbs.

Figure 4.7 Distribution of Masculine, Feminine and Unspecified Verb Forms in Leor's Data



Although there is some evidence that initially, the three girls use masculine more than feminine forms in line with Kaplan's (1983) cross-sectional study of children aged 1;9 - 3;6, this changes as early as the pregrammatical phase. From around age 1;7, the girls prefer feminine while the boy clearly prefers masculine throughout. This bears out the prediction that acquisition of gender will be affected by parental input as guided by the child's biological sex, since girls are addressed in the feminine, and boys in the masculine.

Gender acquisition can be summarized as follows. Initially, most verbs are acquired with no gender marking, as either unclear or infinitival. Next, each verb is used with a unique marking for gender, e.g., *gmr1* 'finish' is unspecified, *npl1* 'fall down' is marked as masculine, and *ntn1* 'give' as feminine. Then, a single gender marking, say, masculine, is extended to different verb forms within a single lexeme (e.g. *izr1* 'help' is extended to both 2nd person **masculine** imperative and 2nd person

masculine future-imperative. Different gender markings are also extended to verb forms that are mutually exclusive within a particular lexeme (e.g., *npl1* 'fall down' occurs as both 3rd person **masculine** past and 2nd person **feminine** past, and *isy1* 'do' is extended to 1st person **unspecified** past, 3rd person **feminine** future, and singular **masculine** present forms). Finally, masculine, feminine, and unspecified forms occur in similar contexts with all verb lexemes (e.g., *bwa1* 'come' occurs in both 2nd person **masculine** imperative and in 2nd person **feminine** imperative, and *yšn1* 'sleep' occurs in both singular **masculine** present and singular **feminine** present).

4.2 Number

Table 4.3 displays the percentage of plural versus singular verb forms for the four children. For each child, the leftmost column shows the total number of verb tokens for a given age, the middle – percentage of singular forms, and the rightmost – percentage of plural forms. Data for unclear and infinitival forms are excluded, since number distinctions are irrelevant for them.

Table 4.3 Distribution of Singular and Plural Verb Forms by Child and Age

Age	Hagar			Lior			Smadar			Leor		
	Total No.	SG %	PL %	Total No.	SG %	PL %	Total No.	SG %	PL %	Total No.	SG %	PL %
1;5				6	50	33						
1;6				40	63	13	97	31	0			
1;7	27	30	7	10	60	0	67	54	0			
1;8	34	38	6	39	41	0	32	31	3			
1;9	79	68	11	67	46	1				136	68	20
1;10	59	69	8	33	64	9	117	62	5	132	77	9
1;11	237	66	7	53	51	8	118	73	14	154	70	5
2;0	148	59	11	58	67	5	325	75	6	343	78	9
2;1	106	75	1	138	72	6	301	73	20	242	71	4
2;2	120	83	6	106	81	5	387	76	15	71	69	1
2;3	121	70	9	235	72	4	213	73	10	300	54	22
2;4	82	79	11	111	71	17	50	70	20	461	69	10
2;5	80	83	8	162	72	15				173	66	2
2;6	119	76	12	173	82	3				193	80	10
2;7	77	78	10	239	77	5				354	72	18
2;8	417	77	14	190	68	21				389	66	17
2;9	272	76	10	8	63	38				175	73	15
2;10	28	64	29							214	83	9
2;11	93	82	5							294	79	16
3;0				28	71	4				114	81	7
3;1				221	70	22						

Table 4.3 shows that singular forms are more frequent than plural forms throughout, ranging from 30% to 83% for Hagar, 50% to 82% for Lior, 31% to 76% for Smadar, and 68% to 83% for Leor compared with only 1% -29% plural forms for

Hagar, 0% to 38% for Lior, 0% to 20% for Smadar, and 1% to 22% for Leor. This is in line with Berman and Armon-Lotem (1996), Ravid (1997), and findings for my son Raz. But both singular and plural forms gradually increase as unclear and infinitival forms are replaced by inflected forms. A somewhat surprising finding emerges from the early data of Lior and Leor. At 1;5 and 1;6, the percentage of plural forms in Lior's data is relatively high (33% and 13%, respectively), then it decreases so that plural forms seem not to be used at all until Lior is 1;9; and a similar trend is evident for Leor at ages 1;9 - 1;10. I assume, following Berman (1981, 1986a, 1993) and MacWhinney (1975, 1978) that the extensive use of plurals in the early phases of acquisition is the result of rote learning. Initially, children learn plural verb forms such as *gamarnu* 'all done, finished-1st-PL-PT' as formulaic, isolated lexical items, without realizing that these forms have an internal structure, and without understanding what this structure is. This is supported by the fact that initially, singular and plural forms are mutually exclusive, i.e., certain verbs are used only in the plural and others only in the singular.

Acquisition of NUMBER proceeds as follows. Initially, both singular and plural forms are widely used (with more singular than plural), but with different verbs. In the following phase, singular – the unmarked form for Hebrew, takes over. Next, plural forms are used again, but now with more verb types, and in complementary distribution with the singular form of the same verb. Only at the final phase are plural and singular forms used with a wide variety of verbs and in similar contexts. Figure 4.8 illustrates this process for the verb *gmr1* 'finish' for all four children.

Figure 4.8 Development of Number Inflection for a Single Verb

Singular and plural forms in complementary distribution		**Singular forms take over**		**Singular and plural inflections with mutually exclusive forms of the same lexeme**		**Singular and plural forms as minimal pairs**
gmr1-1**PL**-US-PT	→	*gmr1*-1**SG**-US-PT	→	*gmr1*-1**SG**-US-PT *gmr1*-2**SG**-FM-PT *gmr1*-1**PL**-US-PT	→	*gmr1*-1**PL**-US-PT *gmr1*-1**SG**-US-PT
lqx1-2**SG**-FM-IMP						
npl1-3**SG**-MS-PT						
bwa1-2**SG**-MS/FM-IMP						

When singular and plural forms are used in complementary distribution (i.e., with different verb lexemes), or when only one form is used throughout (e.g., singular), it cannot be said that the number category had been acquired. It can only be

said to have been acquired when both singular and plural forms alternate in self-initiated utterances across at least three different verb lexemes (see definitions of "productivity" and "acquisition" in Chapter 2, Section 2.1).

4.3 Person

Hebrew-speaking children receive confusing input about person distinctions in their language from two sources. The first involves homophonous verb forms including 2nd person masculine and 3rd person feminine singular in future tense (e.g., *tavo* 'come-2SG-MS-FUT = you-will-come' versus *tavo* 'come-3SG-FM-FUT = she-will-come'); past and present tenses 3rd person masculine (and feminine) singular of certain verbs in the P1 pattern (e.g., *ba* 'come-SG-MS-PR = coming' versus *ba* 'come-3SG-MS-PT = he-came', *sama* 'put-SG-FM-PR = she-is-putting' versus *sama* 'put-3SG-FM-PT = she-put'); and past and present 3rd person masculine singular of some verbs in the P2 pattern (e.g., *niftax* 'open-3SG-MS-PT/PR = is-opened/ was-opened'). The second involves neutralization of the 1st person future prefix (ʔV-/) to 3rd person masculine singular prefix (/yV-/) in the future tense, e.g., *ani yi-gmor* 'I finish-3SG-MS-FUT' – versus nominative standard 1st person prefix *e-gmor* Berman (1990), Ravid (1995). Moreover, Hebrew does not show person distinctions in present tense, and imperatives are only inflected for 2nd person. means that, in fact, acquisition of person distinctions can be established mainly for data from the past and future tenses.

It is difficult to determine the exact initial order of acquisition of person inflections due to the very close association between particular verbs, a particular tense/mood inflection, and a preferred person marking. As noted repeatedly so far, in the pregrammatical phase, Hebrew-speaking children tend to use particular verbs with a unique configuration of tense/mood **and** person inflections as indicated by the examples in Table 4.4. Schieffelin (1985) reports a similar pattern for Kaluli-speaking children.

Table 4.4 Examples of Early Verbs in Unique Tense/Mood and Person Configurations[40]

Verb Form	Gloss	T/M	Person
oxel	'eat-SG-MS-PR'	present	—
boxe	'cry-SG-MS-PR'	present	—
ose	'make/do-SG-MS-PR'	present	—
gamarnu	'finish-1PL-PT'	past	1st
nafal	'fall down-SG-MS-PR'	past	3rd
roce	'want-SG-MS-PR'	present	—
bo	'come-2SG-MS-IMP'	imperative	2nd
halax	'go-3SG-MS-PT'	past	3rd
tavi (li)	'bring-2SG-MS-IMP (to-me)'	imperative	2nd
ten (li)	'give-2SG-MS-IMP (to-me)'	imperative	2nd
kax	'take-2SG-MS-IMP'	imperative	2nd

Table 4.4 shows that certain verbs are initially used in the present tense, and as such are not specified for person. Others are initially used in the imperative, and as such are inflected for 2nd person. Still others are initially used in the past tense and inflected for 1st or 3rd person. This trend is reinforced by data from the acquisition of four frequently used early verbs (*bwa1* 'come', *hlk1* 'go', *isy1* 'make/do', and *sym1* 'put'), that I examined for person alternations for a period of around 18 months (ages 1;6 - 3). As a result, in determining the productivity of a particular person inflection, I consider these particular T/M-person configurations to be basic, unanalyzed forms, which do not reflect productive use of their specific person inflections.

Acquisition of person inflections was established on the basis of past and future verbs. However, since past and future are not the earliest verb forms to be acquired (Berman 1985, Berman & Armon-Lotem 1996), using them to determine when person inflections have been acquired might inflate age of acquisition. To balance this, order of acquisition of the different person inflections was determined by the "age of first use", i.e., the age at which the child first used a clear, novel example of a construction (Stromswold 1996). In the case in point, "age of first use" refers to the age at which a verb was first used with a particular person inflection in a self-initiated utterance. Another measure of acquisition is "age of productive use", which was established using the criteria for "productivity" and "acquisition" outlined in Chapter 2, Section 2.1. This measure relates here to the age at which initial self-initiated alternations of person were evident in the data. Finally, these two age-dependent measures were compared with a linguistic measure, the mean MLU-W score between these two age-points. The timings of acquisition of person inflection by the three measures are shown in Table 4.5. Note, however, that as in the case of number

40 All verbs in the Table are presented in the masculine form for purposes of simplification.

inflection, the category **person** is mastered only once **all** person inflections have been acquired.

Table 4.5 Measures of Acquisition of Person Inflection

Child	Age of 1st use	Age of productive use	Mean MLU-W
Lior	1;7	2;1	1.7
Hagar	1;7	1;9	2.2
Smadar	1;6	1;10	2.0
Leor	1;9	2;0	2.5

The Table shows that all children seem to start using person inflection at around the same age (there is no data available for Leor before age 1;9). Second, all children show a gap between age of first use and age of productive use, with a time-span of between 2 to 6 months (Hagar and Lior). Third, all children seem to use person inflection productively around MLU-W 2, in line with Elisha (1997) who found that children with MLU-W as low as 2 are already attuned to inflectional affixation, specifically to tense and person, for distribution of null subjects in Hebrew (see, too, Chapter 7, Section 1.3.5). Finally, the higher MLU-W score, the smaller the gap between "first" and "productive" use.

Table 4.6 displays for each child, the age of first use of 1st, 2nd and 3rd person in past or future tensed verbs.

Table 4.6 Age of First Use of 1st, 2nd and 3rd Person

Child	3rd person	1st person	2nd person
Lior	1;7	2;0	1;10
Hagar	1;7	1;8	2;2
Smadar	1;6	1;7	1;10
Leor	1;9	1;9	2;0

Apart from Lior, all children started by inflecting verbs for 3rd person, then for 1st person and finally for 2nd person. Similarly, Armon-Lotem (1995) found that for Smadar and Lior, "2nd person in non-imperative forms is acquired only once person becomes a robust phenomenon". These findings are corroborated by findings from typologically different languages. Smoczynska (1985) notes that in Polish, 1st person emerges in opposition to 3rd person, and later on, 2nd person is also introduced, and that acquisition of deictic switching takes several months. Toivainen (1997) found that his Finnish-speaking subject first used 1st and 3rd person singular forms of the verb *go*. In Italian, Pizzuto and Caselli (1994) suggest that since the indicative present third-person singular of first and second conjugation verbs is homophonous with the verb stem (hence less marked than other forms), it may be acquired earlier than other

inflected forms. Matos, Miguel, Freitas and Faria (1997) report that in Iberian Portuguese, subject-verb agreement is acquired initially with the neutral 3rd person singular forms, then with other singular person markers, and finally with plural person markers. Stephany (1997) also found that in Greek, the unmarked 3rd person forms of verbs and personal pronouns form the starting point of development of the person category.

These findings do not correlate with trends reported for the development of personal pronouns as lexical items rather than bound inflections (for English, Charney 1980, Clark & Sengul 1978, Waryas 1973; for German, Deutsch & Pechmann 1978). These indicate (1) that the role of the speaker is acquired before that of the non-speaker, i.e., first person pronouns are acquired prior to second and third person pronouns, and (2) proximal deictic terms are acquired before nonproximal ones. That is, children first acquire pronouns for first and second person, and only subsequently for third person. Acquisition of person inflections in different languages also appears contradictory to findings for acquisition of personal pronouns in Hebrew (Armon-Lotem 1997, Berman 1990, Maoz 1986, Rom & Dgani 1985) which proceeds in the following order: 1st > 2nd > 3rd.

This contradictory evidence raises two questions: Why is 3rd person inflection acquired prior to 1st and 2nd person inflection and why is order of acquisition not the same for person inflection and for personal pronouns? This seeming inconsistency can either be due to methodological flaws, or it can be more principled.

A methodological explanation seems inadequate given the nature of my database and the multiple measures of acquisition applied to it (Chapter 2, Sections 1.1, 2.2.3). Besides, my findings for Hebrew are consistent with those for other languages.

Instead, the inconsistencies between the order of acquisition of person inflection and of personal pronouns can be attributed to the fact that they constitute two distinct phenomena and so need not follow the same developmental path. First, while personal pronouns are a fairly universal linguistic category, person inflection differs widely across languages. Also, structurally, personal pronouns are perceptually salient as separate words (in Hebrew, they receive some degree of stress), and can stand alone as lexical items in full sentences as well as in sentence fragments, as in answers to questions, e.g., *mi sham? ani* 'who's there? I', and *mi yelex itam? anaxnu* 'who will go with them? We (will)'. But in Hebrew as in many languages, person is bound by

affixation to the verb. Besides, emergence of pronouns correlates strongly with the productive use of tense/mood and precedes the mastery of person inflectional paradigm, in line with predictions based on Chomsky's minimalist program (Armon-Lotem 1997). Specifically, this suggests that while acquisition of AgrS is crucial for person inflection, it is not so for personal pronouns, which depend on the availability of a specifier of a Case checking functional head, i.e., TNS. Similarly, Speas (1995) argues that by an economy principle, AgrS, being a semantically contentless category, must have phonetic content either for its head or for its specifier. Under such an assumption, children might acquire AgrS first by phonetically filling its specifier, and only later, by filling its head by the agreement features, which, then, lead to use of null subjects. Morpho-syntactically, in Hebrew, as in other *pro-drop* languages (Hyams 1986, Pizzuto & Caselli 1994, Valian & Eisenberg 1996), subject pronouns are, to some extent, in complementary distribution with person inflection. When the verb is fully inflected (Hebrew 1st and 2nd person, past and future tense), personal pronouns need not or cannot occur.

Given that personal pronouns and person inflection should be treated as two separate phenomena in acquisition, the question remains as to why 3rd person inflection is acquired before 1st and 2nd person inflection.

MacWhinney (1985) notes that in Hungarian, verbs are often learned in the 2nd person singular imperative, although it is difficult to demonstrate productivity of these early inflections, while in other languages such as Polish, Italian, Finnish and Portuguese, 3rd person inflection is acquired first. This suggests that acquisition of 3rd person inflection before other person marking is language particular just like the actual occurrence and the paradigmatic uniformity of person inflections in a given language. That is, just as some languages mark person distinctions and others do not, certain languages mark these distinctions uniformly across the verbal paradigm (Italian) while others do not (English), so the acquisition of person inflections begins with 3rd person in some languages but not others. The next question is what factors in a particular language lead to the early acquisition of 3rd person inflection.

To address this issue, consider relevant psycholinguistic or "operating principles" (Slobin 1985), which may explain this phenomenon. Clark (1993) discusses the notion of "simplicity of form", noting that when children produce their first words, they typically take as their target only one shape for each word, and use it on all occasions, and that initially this shape will be a bare root or stem. According to

Clark, the fact that children's earliest innovations all make use of bare stems without affixes offers broad support for the influence of formal simplicity in early acquisition. Clark further notes that simplicity of form is relative to the typology of the language being acquired. Children grasp some typological properties early on and build on them. Slobin (1985) points out that children readily acquire person/number affixes on verbs, but where verb stems change for person, as in Romance, Germanic, and Slavic languages, children tend to use one form for all persons. For example, Spanish **tieno* for *tengo* 'have-1SG', retaining *tien-* stem of 2/3SG; German **habt* for *hat* 'have-3SG', retaining *hab-* stem of 3SG, 1/3PL, and infinitive; Russian **vidu* for *vižu* 'see-1SG', retaining *vid-* stem of other persons and infinitive. Simplicity is not the same as transparency, though, since the simplest new words are those based on roots alone, whereas the most transparent ones are those which differentiate between root and affix combinations. In this sense, a verb conjugated in the 3rd person masculine singular has the simplest, most basic, form in Hebrew, since it does not involve affixation. Against this background, I propose that Hebrew-speaking children acquire 3rd person inflection first, relying initially on a strategy of resorting to the morphologically simplest forms. For example, Berman (1990) notes that one of the children she studied, Assaf, took a long time to gain command of the 1st person past tense suffix *–ti*. As late as age 2;3 he typically uses the past-tense stem with no suffix, e.g., *ani nasa* 'I drove' (cf. *nasa-ti*), *ani shaxax* 'I forgot' (cf. *shaxax-ti*), and *ani ciyer* 'I drew' (cf. *ciyar-ti*). This is supported by data from different areas of language acquisition like the acquisition of deverbal nouns in Hebrew discussed in Berman (1985, 1999) and Clark and Berman (1984), and by data pertaining to other languages. For example, Bybee (1985) notes that in languages like Amoca and Maasai, changes in verb stem occur with the incorporation of 1st and 2nd person inflection, but not with 3rd person inflection.

Verbs in the 3rd person (the basic form in Hebrew) do not require person but only gender and number agreement with an antecedent. In contrast, verbs inflected for 1st and 2nd person require all three forms of agreement with their antecedents, cf. *hu axal* 'he eat-3SG-MS-PT' versus ***ani*** *axal-ti* 'I eat-1SG-PR', ***ata*** *axal-ta* 'you-2SG-MS eat-2SG-MS-PT'. Gender and number agreement are acquired prior to person agreement (Kaplan 1983, Armon-Lotem 1997), so that 3rd person inflection can be expected to be acquired prior to the other person inflections. Also, the fact that 3rd person masculine singular is in general the unmarked or basic form in Hebrew might

motivate the neutralization of the 1st person future prefix (ʔV-/) to 3rd person masculine singular prefix (/yV-/) in the future tense.

The early acquisition of 3rd person inflection is also affected by degree of **informativeness**. Levy (1980) notes that the small amount of errors in 3rd person feminine and masculine forms in her son's language is affected by the significant communicative role of gender distinction in 3rd person verbs. Since verbs in the 3rd person are used to refer to something or someone not present in the conversation, errors in 3rd person are more difficult to recover than in 1st or 2nd person. Along these lines, I propose that since 3rd person is used for entities not present in the conversation, it represents new information, and is therefore acquired before 1st and 2nd person inflections that present old information. Similarly, Allen and Schroder (in press) report that in Inuktitut, 1st and 2nd person arguments (represented through verbal inflection) are never pragmatically prominent. In contrast, only lexical and/or pragmatically prominent arguments are found where 3rd person arguments are used.

In sum, two factors seem to play a role in the early acquisition of 3rd person inflection in Hebrew: simplicity of form and degree of informativeness.

4.4 Tense

Infinitives, imperatives, and present tense were predicted to be acquired first, followed by past tense, and by future and imperatives in future tense form in that order (see section 3.1.4). The data (summed up in Appendix 4.II, Tables a-d) reveal the following trends: First, the use of "stemlike" forms (UC) decreases gradually with age, as does use of imperative forms. Second, there is a gradual increase in the use of future tense forms. Third, three of the children show a clear though gradual increase in use of past tense, in line with Berman and Dromi's (1984) cross-sectional sample. Fourth, infinitives show an unclear trend, with no clear change in amount across time. Finally, use of present tense remains more or less stable and extensive across development.

I predicted that initially, each tense would be used with a restricted range of verb lexemes. The match between a particular tense and specific verb lexemes is semantically motivated: verbs belonging to distinct semantic classes will initially be used with different tenses. As noted earlier, for example, verbs which denote a change-of-state like *npl1* 'fall down' or *šbr2* 'break' will be used in the past tense, whereas stative modal verbs like *rcy1* 'want', *ykl1* 'be able to' which are inherently

durative, will initially be used in the present tense. This was attested in my sample, and assessed by findings reported in other work (Armon-Lotem 1997, Berman 1978, Berman & Dromi 1984, Dromi 1987, and diary data from a boy named Uri, between the ages 1;6 - 2;2, collected for me by his mother).

Table 4.7 displays a list of verb lexemes from Smadar, showing only those lexemes for which she used at least two different tensed variations (different T/M variations) at two distinct periods of time.[41] For example, Smadar had four different tensed variations of the lexeme *akl1* 'eat' when she was 1;10, three different tensed variations when she was 2;0 and so on. Her usage shows that: (1) with age, there is an increase in the number of verb lexemes which are inflected in a variety of tenses; (2) most "general-purpose" verbs, as defined in Chapter 5, Sections 2.2.1 and 3.1 (lines shaded in dark gray in Table 4.7), are inflected for more than one tense; but counter-prediction, this is not the first nor the only class of verbs that is inflected for more than one tense; (3) between ages 1;10 - 2;3 there is a sharp increase in the number of lexemes used with more than one tense at a given age; and (4) certain verb lexemes are initially acquired with a particular tense and only later expand to other tenses.

41 For distribution of tensed (past, present and future), irrealis (infinitives, imperatives) and unclear forms in the data of all four children, see Appendix II.

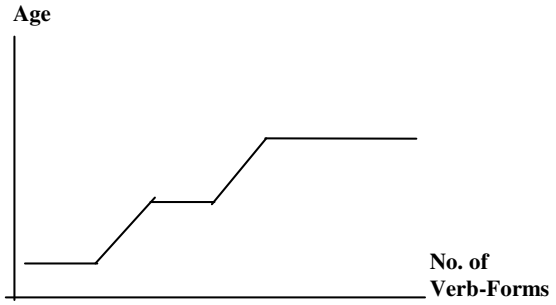
Table 4.7 Number of Different Tensed Variations by Lexeme and Age in Smadar's Data

Lexeme	1;6	1;7	1;8	1;10	1;11	2;0	2;1	2;2	2;3	2;4
akl1 'eat'				4		3		2	3	2
bky1 'cry'				2		2				
bny1 'build'						4		2		
bwa1 'come'	2			2	2				4	
bwa5 'bring'				2	3	4	2	4	3	
dbr3 'talk'					2			2	3	
hlk1 'go, walk'	2			2		2	3	2	3	
hyy1 'be'					2	2		2	3	
ibr1 'pass'									2	
isy1 'do, make'			2	2	3	4	5	4	3	
izr1 'help'						6	3			
kby3 'turn off'								2	2	
lqx1 'take'		2			2	2		2		
ngd5 'arrive'						2	5	5	3	
npl1 'fall down'	2	2				3				
nqy3 'clean'				2		2				
nsi1 'go away'						2	2			
ntn1 'give'							2	2	4	2
prq3 'take apart'						3	2			
ptx1 'open'						2			2	
qny1 'buy'						2	2	2		
ray1 'see'				4	2	4	2	5	2	
rcy1 'want'		2	2		2	3	2			
rkb5 'assemble'							4	3		
sgr1 'close'			2			2	3	3	2	
skl4 'watch'						2	2			
Smi1 'hear'							2	3		
spr3 'tell'				2	3	3	4	4	4	
sxq3 'play'				2		7				
sym1 'put'		2			2	4	5	2	2	
xps3 'look for'				2	2		2	2		
yrd5 'go down'			2			3				
yšb1 'sit down'		3		3	3	2				
yšn1 'sleep'			2					3		

The data for all four children (Appendix 4.II) show a constant decrease in unclear forms, as these forms seem to be replaced by tensed forms. As for the proportion of irrealis (nonfinite imperatives and infinitives), Hagar and Lior show a decrease in the use of irrealis forms in favor of tensed options, whereas Smadar and Leor show a relatively constant level of use of irrealis throughout. This is due to different strategies the children employ prior to productive use of tense. Lior, for example, makes extensive use of irrealis forms right from the start, so that when she acquires tense, tensed verbs replace her imperative or infinitive forms. In contrast, Smadar starts out with numerous unclear forms, so that when she acquires tense, tensed forms replace the unclear rather than the irrealis forms.

I predicted that with the acquisition of tense, each tense (present, past and future) would be used with an increasing variety of verb lexemes, and that if so, this can be taken as a measure of productivity for acquisition of tense. The data support this prediction only partially. True, an increasing number of verb lexemes are used in past tense, but this increase is not linear, nor does it point in any clear direction. It seems, rather, to result from a general increase in the number of verb lexemes with age. I, therefore, propose to use the number of different verb forms produced with a given tense at a given age as a criterion for "T/M productivity". The data reveal a gradual increase in the number of different verb forms produced with a particular tense. Recall that *verb form* is defined here as a unique configuration of gender, number, person and tense. This tendency continues up to a point at which the maximum number of possible verb forms for that tense is reached, when a steady state is observed. For example, Hebrew has a maximum of 5 different verb forms for present tense (masculine-singular, feminine-singular, masculine-plural, feminine-plural, and an impersonal form). Across acquisition, the number of verb forms used by child increases gradually. However, once they have completed acquisition of the present tense, their behavior will stabilize, so that the same maximal or near maximal number of different verb forms will be used for a long period of time. This is illustrated in Figure 4.9.

Figure 4.9 Pattern of Tense Development



Tenses vary in their developmental patterns as reflected by the onset of acquisition and by the length of the steady-state period. For example, future is acquired later than past or present. The steady state is longer for present than for past, since the number of different verb forms for present in Hebrew is smaller than for past or future. This pattern is illustrated in Tables 4.9 and 4.10 for acquisition of past tense

by the four children in my sample and for acquisition of past, present, and future by Smadar and Lior, respectively.

Table 4.8 uses color coding to mark different phases in the acquisition of past tense. The different degrees of shading mark the three levels of increase in the number of distinct verb forms.

Table 4.8 Phases in the Development of Past Tense in Four Children

Age	Smadar	Leor	Lior	Hagar
1;5			1	
1;6	2		2	
1;7	3		2	2
1;8	1		1	2
1;9		2	4	4
1;10	5	2	4	2
1;11	5	3	4	3
2;0	6	5	3	4
2;1	6	4	3	3
2;2	7	1	5	5
2;3	7	6	5	5
2;4	4	6	5	4
2;5		4	5	2
2;6		6	4	4
2;7		7	6	4
2;8		7	8	9
2;9		7	5	5
2;10		8		4
2;11		7		5
3;0		6	7	
3;1			7	

All children begin the process of tense acquisition (past, in this case) with one to two distinct verb forms (1-2), a state which remains unchanged for a certain period of time. Then, the number of different verb forms increases (3-5), followed by a steady state. Finally, a third increase in number of distinct verb forms takes place (6-9), again followed by a steady state. The Table reveals individual differences between the children both with respect to the time each one remains at a particular state, and the range of distinct verb forms used at each state. These differences may be partially due to methodology (e.g., the somewhat limited context provided by the recorded sessions), but they may also reflect true individual differences in linguistic development.

Table 4.9 uses different degrees of shading to display the patterns of acquisition of past, present, and future by Smadar and Lior between the ages 1;5 – 2;9.

Table 4.9 Phases of Tense Development in Two Children

	Smadar			Lior		
Age	**Past**	**Present**	**Future**	**Past**	**Present**	**Future**
1;5				1		
1;6	2			2	2	
1;7	3	2		2	2	
1;8	1	2		1	2	
1;9				4	1	
1;10	5	3	3	4	1	
1;11	5	4	4	4	1	1
2;0	6	5	5	3	3	2
2;1	6	3	6	3	3	2
2;2	7	4	5	5	2	3
2;3	7	4	5	5	3	3
2;4	4	3	4	5	5	3
2;5				5	4	3
2;6				4	3	5
2;7				6	4	5
2;8				8	4	7
2;9				5	2	2

The course of tense acquisition described here for the past holds across tenses, and across children. However, for any particular child, there are differences in the age when the child moves from one phase to another within different tenses; and between children, individual differences occur in the age when they move from one phase to another, both across tenses and within particular a tense.

I applied a productivity test to account for the order of acquisition of the three tenses (past, present and future). Tense was judged productive only if it was used with five different verb lexemes at a given age (see also Chapter 2, Section 2.1). Past and present tense seem to be acquired around age 1;10, while future tense is acquired around age 2.

The general process of tense acquisition can thus be described as follows: Initially, most verbs bear no tense-marking, since they are mostly unclear, "stemlike" forms; next, certain lexemes are used with one unique tense as frozen expressions, and finally, any given lexeme is used with multiple tenses. Acquisition of tense, which occurs around age 2, correlates with an increase in total number of lexemes in children's verb lexicons. This finding is in line with connectionist reports on the acquisition of English past tense (Plunkett & Marchman 1993, Marchman & Bates 1994). Such reports attribute the shift from rote-learning of past tense to a rule-governed process and the growing frequency of correct versus overgeneralized past tense verbs to the "critical mass effect" in vocabulary growth.

5. Root Infinitives

The use of Root Infinitives (RI's) in child language has been argued to crucially depend on the acquisition of inflectional morphology. This claim is examined here with data from child Hebrew.

Root infinitives (Armon-Lotem 1997, Rizzi 1994, Wexler 1994) refer to fully articulated infinitivals used as main clauses. They should not be confused with *bare infinitives* (Berman 1981, 1986a), which refer to infinitival forms without the infinitive marker *le-* 'to', as in *oci* 'take out' instead of *le-hoci* 'to take out', *ftoax* 'open' instead of *li-ftoax* 'to-open' or *shéve(t)* 'sit down' instead of *la-shevet* 'to sit down', similar to what are termed in Berman and Armon-Lotem (1996) *unclear* or *stripped* forms. In the current context, reference is to *root infinitives,* also termed Optional Infinitives (OI), since there is evidence that young children (up to around 2;6 – 3) sometimes produce them along with finite forms (Rhee & Wexler 1995). RI's occur in main clause declaratives, and in numerous irrealis contexts – commands, requests, wishes, prohibitions, and replies to questions with modal verbs. They occur freely in early child language but are prohibited in the adult language (Rizzi 1994, Wexler 1994). Examples of RI's from English and Hebrew are listed below (see, too, Chapter 7, Section 1.2).[42]

(1) It only write on the pad

(2) Patsy need a screw

(3) Where Penny go?

(4) The truck fall down

(5) *tapuax lishtot* (in reply to: *ma at osa?* what are you-FM-SG doing?)
apple to-drink = 'I want to drink an apple'

(6) *hu lehagid shalom* (in reply to: *ma ha-yeled ose?* what is the boy doing?)
he to-say good-bye = 'he says good-bye'

5.1 Previous Studies

Several attempts have been made to account for RI's in child language, all within the generative and minimalist frameworks. Most accounts assume that this phenomenon is parameterized, and results from the lack of certain functional categories or agreement features in early child language. For example, Wexler (1994) attributes the use of RI's in certain languages to richness of agreement. According to

him, languages with rich agreement (*pro-drop*) do not show RI's, while languages without rich agreement (*non-pro-drop*) do. Rhee and Wexler (1995) propose that in languages that do not have RI's, null subjects are syntactically licensed by INFL (e.g., Italian, Spanish), while in languages that have RI's null subjects are not syntactically licensed by INFL (e.g., the Germanic languages, French). Snyder and Bar-Shalom (1998) use evidence from Russian to support the Rhee-Wexler proposal that RI stages occur specifically in *non-pro-drop* languages, or in *non-pro-drop* contexts in mixed *pro-drop* languages like Hebrew. To them, children's RI's are true syntactic infinitives, rather than merely errors in surface morphology. That is, natural "default" verb forms that children employ as a "surrogate" whenever the features inserted in the inflectional system cannot otherwise be expressed.

Schuetze and Wexler (1996) argue that the RI phenomenon results from the optional specification of AGR and/or Tense. The omission of AGR and/or Tense features from the syntactic representation of the sentence will, in certain situations (depending on the morphology of the language), result in non-finite rather than finite spell-out. For example, underspecification of both Agreement and Tense always yields a root infinitive in English. Along similar lines, Rizzi (1994) argues that RI's occur when the clause is truncated below the Tense Phrase (TP) level. As a result, RI's do not occur in languages like Italian in which the verb is forced to raise to a position higher than T, for example, to AgrSP, as illustrated in Figure 4.10 below.

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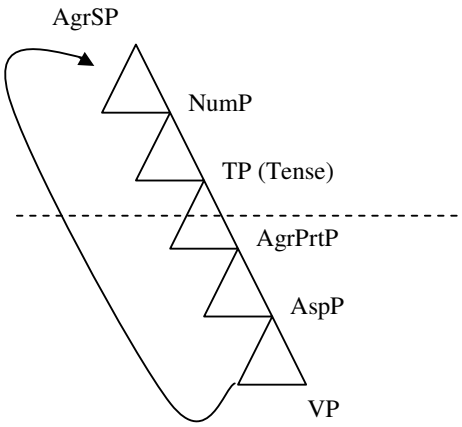
42 The English examples are taken from Harris and Wexler (1996), MacWhinney and Snow (1985), and Brown (1973) and the Hebrew examples are taken from Armon-Lotem (1997) and Rhee and Wexler (1995).

Figure 4.10 Blocking of Root Infinitives in Italian [Rizzi 1994]



Hoekstra and Hyams (1995) propose that RI's are produced in languages that show only an obligatory Number specification in their adult form. In these languages, the use of root infinitives is attributed to underspecification of Number in early grammar. Hoekstra and Hyams found that the Germanic languages and French exhibit robust RI-effects, with rates ranging from 26% to 78%, depending on the particular child and the particular language. In contrast, RI's do not occur in *pro-drop* languages since in these languages the verb will always carry Person marking, and Person precedes Number.

5.1.1 Root Infinitives in Hebrew

Rhee and Wexler (1995) examined the use of null and overt subjects in contexts of declarative RI's in a cross-sectional study of 26 Hebrew-speaking children aged 1;2 – 3;3. They found that RI's appeared almost exclusively in *non-pro-drop* contexts, and concluded that Hebrew-speaking children at a young age know which inflectional features license null subjects and which do not, and limit their RI's to that part of INFL that does not license null subjects.

Based on longitudinal data from three Hebrew-speaking children aged 1;6 – 3, Armon-Lotem (1997) divides the phenomenon of root infinitives in Hebrew into three distinct phenomena: (1) unclear forms like *foc* (cf. *li-kfoc* 'to jump') Lior [1;7], (2) replies to questions with modal verbs, e.g., *la-shevet* 'to sit down' produced by Lior [1;8;10] in reply to her mother's question "what do you want to do?", and (3) declarative root infinitives, e.g., *le-hadlik musika* 'to turn on (the) music' produced by Leor [2;0] in reply to the investigator's question "what did you do?". For Armon-Lotem, the correlation between root infinitives and null subjects is due to the

dependence of the two phenomena on richness of inflection. Specifically, children's partial use of X-bar trees may result in the lack of all or part of the tense features associated with T and C. This, in turn, affects the disappearance of RI's in declarative contexts which crucially depends on the acquisition of C and its content. Similarly, the occurrence of null subjects in *pro-drop* contexts depends on the acquisition of the inflectional paradigm.

Armon-Lotem describes the development of RI's in child Hebrew as follows. With acquisition of tense, unclear forms give way to finite verb forms, which suggests that they are not RI's but rather tenseless forms. There is also a gradual decrease in use of declarative root infinitives until they are almost abandoned after person morphology is acquired. Armon-Lotem notes that Hebrew-speaking children use most of their root infinitives with a grammatical irrealis reading (i.e., as commands, requests or wishes). This use of root infinitives is acceptable in the adult language, and is the last to disappear. Since Hebrew has no syntactic class of modals, the grammaticality of the modality reading in Hebrew is attributed to the existence of a null modal in TNS.

In another developmental study, Wexler, Schaeffer and Bol (1998) examined the phenomenon of root infinitives in Dutch normal and SLI children. They report that the production of RI's decreases as a function of MLU in both SLI and normally developing children, and as a function of age only in normally developing children.

In sum, all studies reported above relate the phenomenon of root infinitives to the lack of certain inflectional features. This suggests that root infinitives will occur mainly in the early phases of development, prior to the acquisition of morphology, and will disappear as the acquisition of this system is completed.

5.2 Findings

A breakdown of the different uses of main clause infinitives for the four children between ages 1;5 – 1;11 reveals that they use the vast majority of their self-initiated infinitival forms (100% - 60%) to express irrealis modalities (commands, requests, wishes), while realizing only a very small percentage as declaratives (0% - 13%). The rest of the infinitival forms are used as questions, e.g., *lirxoc yadayim?* 'to-wash hands?', or as answers to questions (see examples 7 – 9 below). All uses of main clause infinitives apart from their declarative use are grammatical in adult Hebrew. The match between the grammaticality of infinitival forms in the adult language and

its distribution in child language suggests that the early use of main clause infinitives may to a large extent be determined by input.

How to account for the few cases of declarative main clause infinitives that do occur in child Hebrew? It could be that these are simply instances of "missing modals", e.g., *Ma ha-yeled ose? hu (roce) lehagid shalom* 'What is the boy doing? He (wants) to-say hello' (Assaf 2;6, from Rhee & Wexler 1995, p. 391). That is, due to processing limitations, the child has to leave out certain information from the utterance, and the information excluded is the modal, which in this case constitutes old information. But this explanation cannot account for all occurrences of RI's in Hebrew, e.g., *lirxoc et ha-yadaim shel Roni, ken? Roni lishon* 'to-wash Roni's hands? Roni to-sleep' [Hagar 1;8]. Alternatively, it could be that children have not yet acquired Tense, and so they use infinitival verbs rather than the required tensed verbs. Where these verb forms have an irrealis meaning (commands, requests, wishes) they are grammatical, but where they have a descriptive meaning infinitival forms are ungrammatical. This gains support from the fact that initially Hebrew-speaking children were shown to use mainly unclear and nonfinite verb forms (imperatives, infinitives), and that across development, these forms were replaced by tensed verbs (Berman 1981, Berman & Dromi 1984, Berman & Armon-Lotem 1996, Armon-Lotem 1997, Section 4.4 of this Chapter). In this respect, the gradual disappearance of declarative main clause infinitives in child Hebrew can serve as a measure for acquisition of Tense.

Infinitives are also used as *complements* (COMP) in cases like *le'exol* 'to-eat' in *roce le'exol* 'want-SG-MS-PR to-eat', where they serve as complements of modal or aspectual verbs. Table 4.10 displays the distribution (in percentages) of infinitives (complements and main clause) in my sample by age. Main clause infinitives are marked in the Table as INF.

Table 4.10 Distribution (in percentages) of Infinitives by Child and Age

	Hagar			Lior			Smadar			Leor		
Age	**Total No.**	**INF**	**COMP**	**Total No.**	**INF**	**COMP**	**Total No.**	**INF**	**COMP**	**Total No.**	**INF**	**COMP**
1;5				1	100	0						
1;6				1	100	0	0					
1;7	12	100	0	2	100	0	8	100	0			
1;8	15	100	0	22	100	0	2	50	50			
1;9	15	100	0	12	100	0				2	100	0
1;10	11	100	0	6	83	17	5	40	60	15	40	60
1;11	36	64	36	17	88	12	11	64	36	29	59	41
2;0	42	60	40	7	100	0	44	66	34	36	44	56
2;1	22	59	41	20	70	30	20	40	60	44	68	32
2;2	13	38	62	14	79	21	31	47	53	16	6	94
2;3	25	60	40	54	39	61	36	14	86	57	77	23
2;4	8	38	63	10	50	50	5	40	60	84	50	50
2;5	6	33	67	18	39	61				51	63	37
2;6	10	30	70	26	46	54				18	89	11
2;7	8	13	88	41	39	61				32	66	34
2;8	37	24	76	20	25	75				67	55	60
2;9	35	20	80	0						19	79	21
2;10	2	0	100							15	80	20
2;11	12	17	83							12	42	56
3;0				7	43	57				12	67	33
3;1				16	13	88						

Table 4.10 shows that in the early phases of acquisition most infinitives are used in main clauses, a tendency that changes later on. This is expected, since the use of infinitives as verbal complements like *roce lakum* 'want-SG-MS-PR to get up' is only possible after the one-word stage. The figures also suggest that there is a gradual increase in the use of infinitival complements by the three girls (Lior, Hagar and Smadar). This finding is supported by similar results from Berman and Dromi's (1984) cross-sectional sample. Leor's data fail to observe this developmental pattern: the proportion of his infinitival complements remains smaller than that of root infinitives throughout. This may be due to the nature of the interactions between Leor and his aunt. Most of their interactions involve question-answer exchanges in which the aunt asks questions (i.e., WH-questions) which Leor answers (in one session, for example, eleven out of the thirteen root infinitives were answers to questions). Examples of such interactions are given in (7) – (9) below.

(7) Aunt: *ma lasim?* 'What to-put?'
Leor: *lasim xitul* 'to-put (a) diaper'

(8) Aunt: *ma la'asot?* 'What to do?'
Leor: *lakum* 'to get up'

(9) Aunt: *ma ata roce?* 'What do you want-SG-MS-PR?'
Leor: *lasim/laredet/kadur lesaxek* 'to-put/to-get down/to play ball'

The short interchanges in (7) and (8) are examples of WH-question/answer pairs, and the interchange in (9) is an example of a modality question/answers pair. Root infinitives that are used to answer modality questions are grammatical in Hebrew both in adult and child speech (Armon-Lotem 1997).

6. Acquisition of Verb Morphology

In relating to verb morphology, the term "mastery" refers to an advanced phase in which children demonstrate that they have internalized a rule-system. This system governs (a) inflection of tense and agreement (gender, number, person); (b) the *binyan* conjugation of the verb in terms of transitivity and voice; and (c) lexical convention and discourse appropriateness. Mastery is determined by correct usage. Children are assumed to reach mastery of verb morphology at their own pace, usually around late pre-school age of 5 to 6.

This raises several questions: What phases of development precede mastery? Do these intermediate phases apply to all inflectional categories in the same order? And do they characterize other domains of language acquisition as well?

The data in the present study suggest that in acquiring verb-inflection, children go through a number of developmental steps, outlined in Figure 4.11 below. Along the lines of Berman (1986a, 1988a), the term "step" indicates developmental segments which may be of varying length. These characterize the acquisition of all (but not only) categories of verb inflections, although each category is acquired independently, at its own pace. The developmental steps proposed here apply in a bottom-up fashion, first to each category and then to the system as a whole. Children move along a continuum from an initial state of no productivity to a final state of mastery (of verb morphology as of other language modules).

Figure 4.11 Developmental Steps in Acquisition of Verb Morphology

	Step	Process	Description
I	**No productivity (no-inflection)**	Rote	Bare verbs, stemlike forms, with no clear inflectional marking
II	**Non-productivity (one-to-one)**	Rote	Unanalyzed amalgams, a single inflectional form per lexeme
III	**Semi-Productivity (Many-to-one)**	Rule	Initial productivity, different forms within each inflectional category (NUMBER: singular, plural) in complementary distribution with each other, multiple uses of a particular form across lexemes
IV	**Full Productivity**	Rule	Inflection is fully productive, multiple forms of any given inflectional category per lexeme, overextension
V	**Mastery**	Rule	No overextension, appropriate lexical and conversational usage

The first two steps, which are not characterized by any process of rule-formation, are bound by MLU. Verbs that enter the child's lexicon prior to MLU 2 undergo steps I and II and then proceed to steps III-V. In contrast, verbs which enter the child's lexicon after MLU 2 do not undergo the first two steps, and exhibit a morphological development characteristic of the three later steps. In this sense, step III represents a "critical period" for the acquisition of verb morphology.

Steps II and III serve as a "training period" for those which follow (see Chapter 1, Section 3.1.1). This is in line with connectionist accounts (e.g. Elman 1990), which demonstrate that a long initial period is essential to learning since at first, a network's predictions are random, but with time it learns to predict. The network moves progressively from processing mere surface regularities to representing something more abstract.

Figure 4.12 Berman's (1986a) Five-Step Developmental Model of Language Acquisition

	Step	Developmental Phase	Description
I	**Rote knowledge**	Pregrammatical	Initial acquisition of individual items as unanalyzed amalgams
II	**Early alternations**	Pregrammatical	Initial alternations, a few very familiar items are modified contrastively
III	**Interim schemata**	Grammatical	Transitional, non-normative but partly productive rule application
IV	**Rule knowledge**	Grammatical	Grammaticization, with strict adherence to rules plus some inadequate command of structural and lexical constraints.
V	**Mature usage**	Conventionalized	Rules constrained by adult norms and conventions, with variation in style and register reflecting individual background and specific discourse context.

In many ways, my model resembles that of Berman (1986a, 1998a) summarized in Figure 4.12. But I add a preliminary step of no-inflection to describe the initial state of acquisition. More importantly, I unify Berman's steps II and III (i.e., early alternations and interim schemata) into a single step termed "Semi-productivity", for two reasons. First, both steps constitute a transition from rote-learning to rule-governed behavior and as such serve as a "training period" for the following steps. Second, in terms of productivity, in both steps children show only partial productivity.

I propose a three-partite division into developmental phases. (a) A **pre-morphological phase** (steps I and II), where acquisition and use of inflection is based largely on individual items or entails only limited formal alternations. (b) A **phase of morphology-acquisition** (steps III and IV), where gradual rule-application across items takes place in terms of linguistic structure, and where different inflectional categories are interrelated within more general paradigms. (c) A **phase of morphological-mastery** (step V), where formal rules of inflection are augmented by increasing proficiency in usage, and by the application of conversational norms. Further, the acquisition of verb morphology is initially affected primarily by pragmatic and situational factors (necessary conditions), which are subsequently supplemented by the construction of a formal rule-system (sufficient conditions).

Note that reference to the initial phase of acquisition as the "pre-morphological phase", is not the same as the distinction made by Dressler and Karpf (1995) and Ravid (1997) between "pre-morphology" and "proto-morphology" as two stages of morphological development (section 2.2). Unlike theirs, my model is not dichotomous but rather continuous. It assumes a dynamically fluctuating system, where for each individual learner and across learners, transitions from one step to another inside of the various developmental phases are independent both within and between inflectional categories until full productivity is achieved.

The proposed model allows for individual differences in the acquisition of morphology. First, children differ as to which gender they initially acquire depending on their own sex. Second, ata given MLU, children may differ in how extensively they use a particular inflectional category. For example, one child may use a particular category in 45% of its obligatory contexts while another may use it 55% or even 60% of the time. Third, there are individual variations in the rate but **not** in the order of acquisition of grammatical morphemes. That is, child A may acquire the plural morpheme earlier than child B, yet both will acquire this morpheme later than the

singular morpheme. Finally, children use different "compensatory" strategies (e.g., in the acquisition of tense one child initially uses more imperatives and infinitives, while another child uses more unclear forms).

The proposed model is crucially relevant to the acquisition of VAS, as discussed in Chapter 6 (Section 3.1) below. Children use verbs acquired after MLU 2 with some or all of their required arguments in marked contrast to verbs acquired prior to that period. Also, most missing arguments prior to the "critical period" tend to be unlicensed, while most missing arguments that occur afterwards tend to be licensed pragmatically, semantically, or morpho-syntactically.

Finally, the model proposed to account for acquisition of verb inflections, should, in principle, apply across the board to acquisition and development of a range of linguistic subsystems.

Chapter 5: Verb Semantics

The acquisition of verb meaning is an important aspect of verb acquisition, and so of language acquisition in general. Researchers from different perspectives including Bowerman (1996c), Clark (1993), Gleitman (1990), Pinker (1984, 1989), Pye, Frome-Loeb and Pao (1995), Rappaport-Hovav and Levin (1998) have examined a range of questions pertaining to the effect of verb semantics on the acquisition of verbs and VAS. This chapter focuses on verb semantics at the word-level, leaving the interaction between verb semantics and verb-syntax for later. The following topics are discussed: The effects of semantic regularity on verb and VAS acquisition (Section 1), the effects of semantic specificity on the early make-up of children's verb lexicon (Section 2), and the role of semantic generality in verb acquisition (Section 3).

1. Verb *Aktionsarten*

In work on verb semantics (for example, Comrie 1976, Dowty 1972, 1991), the term "aspect" is used to refer to the inherent nature of verbs (*Aktionsarten*), that is, to the kind of situation denoted by the verb, such as state or activity. Vendler (1967) was the first to divide verbs into four major semantic categories. These were later extended in Dowty's (1979) aspectual semantics analysis and in Van Valin's (1990) functional syntax (Role and Reference Grammar). Vendler (1967) distinguished two major types of verbs by their temporal distribution: **States** and **nonstative situations**. **States** are defined as qualities or states of affairs that do not undergo a change over time. Such situations have duration, and include verbs that are homogeneous and static (e.g., *be, like, know, want*). **Nonstative situations** include two groups of verbs that change over time. (a) **Events –** nonextended dynamic situations that occur momentarily in time, where a punctual transformation or change of state is involved; (b) **Processes –** extended dynamic situations that endure through time, where different phases of the situation may differ from one another. This group is further divided into three subgroups: **activities**, **accomplishments**, and **achievements**. **Activity** predicates refer to an actor performing an activity that is extended in time, and has no clearly demarcated end point (*dance, play, run, work*). **Accomplishment (cause-change-of-state)** predicates are extended over time, but are defined by the fact that they terminate in attainment of some state (e.g., *build a house, draw a circle, sing a song*). **Achievement (change-of-state)** predicates refer to the instant at which a state is

attained. In these predicates the process and end point are linked (*break, die, forget, tear, win a race*). This division is considered universal, and is assumed to affect the order of verb acquisition (e.g. Slobin 1981, 1985, Smiley & Huttenlocher 1995).

Hebrew provides an interesting test case for these claims, since in Hebrew, verb *Aktionsarten* is realized to a large extent through the verb-pattern system. That is, verbs in each verb-pattern tend to belong to a particular semantic class, as illustrated in Table 5.1.

Table 5.1 Transitivity and Semantics of Hebrew Verb Patterns [Berman 1993a]

Pattern	**Typical Transitivity Value**	**Semantics**
P1 *qal*	+/–	Activity [-transitive] Accomplishment [+transitive]
P2 *nif'al*	–	Achievement
P4 *hitpa'el*	–	Achievement, Reflexives, Reciprocals
P3 *pi'el*	+	Causative Accomplishment
P5 *hif'il*	+	Causative Inchoative

How does semantic regularity, as realized by the links between semantic content and morphological form (verb-pattern), affect verb and VAS acquisition? In principle, a one-to-one mapping between morphological form (verb-pattern) and semantic content might facilitate the acquisition of verbs and VAS for Hebrew-speaking children. However, unlike grammatical inflections which typically reflect a regular one-to-one mapping between morphological form and grammatical category, there is only a partial fit between predicates in the four classes of *Aktionsarten* and Hebrew verb patterns as is to be expected in the case of derivational morphology (Berman 1993b, Bolozky & Saad 1978). That is, a particular semantic class may occur in different verb patterns, and a single verb-pattern can be used for more than one semantic class. For example, Hebrew statives occur in P1 (e.g., *ahav* 'love') and in P5 (e.g., *hirgish* 'feel'); activity verbs occur in P1 (e.g., *rac* 'run'), P3 (e.g., *bishel* 'cook'), or P5 (e.g., *hoci* 'take out'). Accomplishment verbs occur in P1 (e.g., *sagar* 'close'), P3 (e.g., *tiken* 'fix'), or P5 (e.g., *hirkiv* 'put together'); and achievement verbs occur in P1 (e.g., *kafa* 'freeze'), P2 (e.g., *nishbar* 'break'), P4 (e.g., *hitkavec* 'shrink'), and P5 (e.g., *higia* 'arrive', *hofia* 'appear'). Conversely, P1 has several achievement predicates, e.g., *nafal* 'fall'; P2 has activity verbs like *nixnas* 'go in', P3 has activity verbs, e.g., *tiyel* 'go for a walk', *sixek* 'play', *ciyer* 'draw', P4 has activity

verbs, e.g., *histakel* 'look', and P5 has achievement verbs, e.g., *hit'alef* 'faint'. In fact, some of the verbs that contradict the most general *binyan* - *Aktionsarten* matches (e.g., *nafal* 'fall', *higia* 'reach', *nixnas* 'go in') are common in early child Hebrew.

A study of the semantics of early verbs in Hebrew (Berman & Armon-Lotem 1996) indicates that Hebrew-speaking children start out by using verbs in a variety of semantic classes.[43] Most early verbs listed there are **activity** verbs – motion (*zwz1* 'move'), directed motion (*yrd1* 'get down', *yca1* 'go out'), less common - manner of motion (*rwc1* 'run', *iwp1* 'fly'), activities such as crying (*bky1*), sleeping (*yšn1*), eating (*akl1*) or throwing (*zrq1*). The list also included verbs denoting **states** – modals (*rcy1* 'want', *ykl1* 'can, be able to'), stative verbs (*kav1* 'hurt'); verbs of posture (*qwm1* 'get up', *yšb1* 'sit'); **change-of-state** verbs – *npl1* 'fall down', *gmr2* 'finished, alldone', *šbr2* 'broken down', *pcc4* 'blow-up'; **cause-change-of-state** verbs **–** transfer-of-location verbs for giving (*ntn1*), taking (*lqx1*), putting (*sym1*), opening (*ptx1*): used to refer to opening objects which form an enclosure, removal/separation (untying shoe laces); and **aspectual** verbs (*clx5* 'manage, be able to'). This semantic distribution corroborates earlier findings of a cross-sectional study of Hebrew-speaking children (Berman 1981).

Figure 5.1 shows the semantic distribution (in percentages) of the first twenty verbs in the lexicons of the four children in this study (combined). A total of 34 semantic types were identified in my analysis, due to partial overlap in use of certain types by the four children. For example, **activity**:directed-motion and **activity**:emission-of-sound, **state**:perception and **state**:modal constitute four distinct types.

43 Berman and Armon-Lotem (1996) describe the inventory of the first twenty verbs recorded for six Hebrew-speaking children (Lior, Smadar, Leor, Youval, Keren and Shelli) aged 14 – 25 months.

Figure 5.1 Distribution of Semantic Verb Types in the Lexicon of Four Children (Combined)

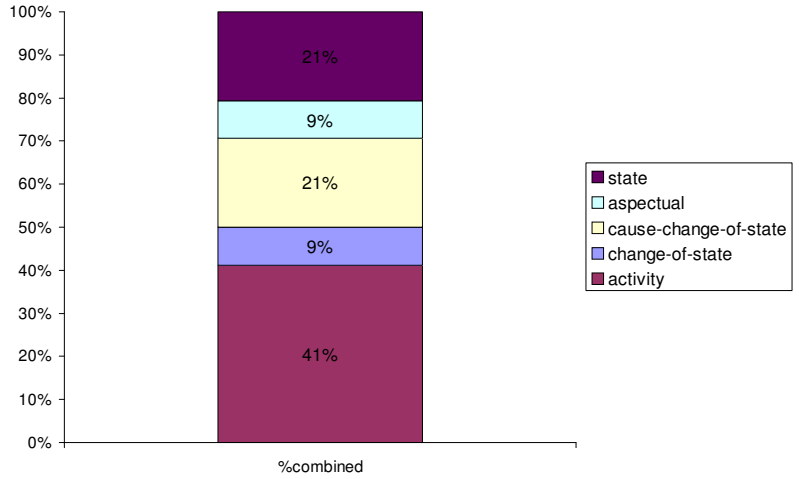


Figure 5.1 shows that the bulk of early verbs are variations of activity verbs (41%), followed by state and cause-change-of-state verbs (21%), and by aspectual and change-of-state verbs (9%). This is in line with the proposals of Slobin (1985), Smiley and Huttenlocher (1995), and Berman and Armon-Lotem (1996). Figure 5.1 also shows that children do not start out with verbs from a single semantic class, but that they use verbs in a variety of semantic classes from the beginning.

Figure 5.2 shows the distribution of tokens (in percentages) by semantic class for each child.

Figure 5.2 Distribution (in percentages) of Verb Tokens by Semantic Class and Child

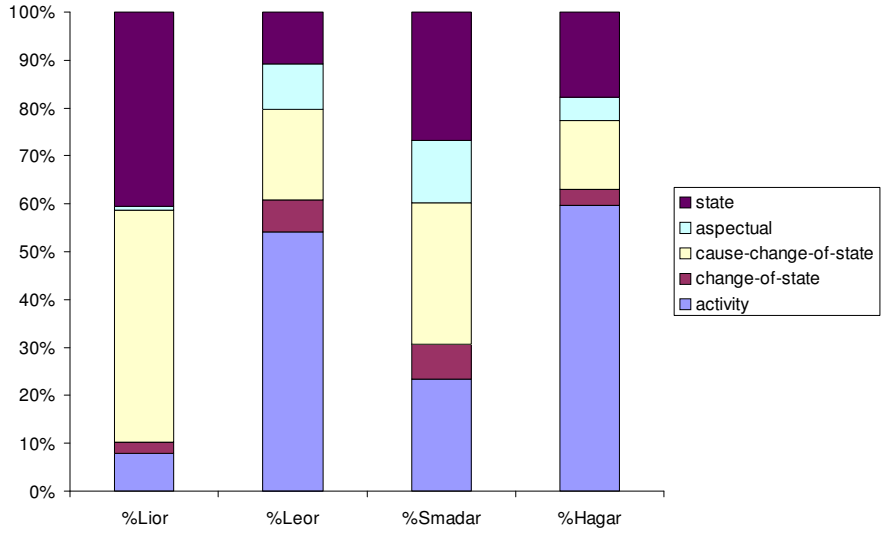


Figure 5.2 shows individual variation in the distribution of verb tokens. Lior uses mostly state and cause-change-of-state verbs, Leor and Hagar use mostly activity

verbs, and Smadar uses activity, state, and cause-change-of-state verbs rather evenly. This is probably due to differential input to each of the children.

A qualitative examination of the data suggests that initially most occurrences (tokens) of a particular semantic class are due to multiple uses of a single verb. For example, the category **state**:modal occurs in Leor's data 40 times, all realized by the verb *rcy1* 'want'; similarly, the category **cause-change-of-state**:transfer-of-location occurs in Smadar's data 30 times, 90% (N = 27) of which are realized by the verb *sym1* 'put'. Children "know" these items in the sense that they use them correctly. For example, they will not say *wash* for eating. But they have not achieved any level of semantic generalizations as yet. For example, they may say (the Hebrew equivalent of) *gimme* in order to make a request without having internalized a more general notion of requesting, or they may say *bring* without connecting it to *put* and *give* as members of the transfer class.

Recall that most of the children's early verbs are in the P1 pattern, regardless of semantic content (Chapter 3, Section 1.4). P1 has no specific semantic or functional bias, and verbs in P1 can refer equally to activities or states, with or without a specified patient or location. It alone includes intransitive, transitive, and weak transitive verbs governing oblique objects (e.g., *ba'at ba-kadur* '(he) kicked on the ball = he kicked the ball'). The most frequent form-meaning associations are thus partial and probabilistic rather than across-the-board.

This suggests that the match between verb semantics and verb form (verb-pattern) might not, in fact, facilitate the acquisition of VAS. Older speakers may well and probably do associate verb-pattern morphology and verb semantics, once they have accumulated a large enough repertoire of lexical exemplars. But children must initially learn what form these associations take, and the syntactic consequences they involve (for example, that an alternation in transitivity requires a change in verb morphology). Thus, the specific way in which verb *Aktionsarten* are realized in Hebrew morphology alone cannot itself launch children into the acquisition of VAS, nor does it account for the make-up of their early verb lexicons. The next section proposes an alternative explanation for the make up of children's early verb lexicons.

2. The Make-up of Children's Early Verb Lexicon

How does semantic specificity affect the order of verb acquisition? Do children initially acquire semantically general or semantically specific verbs? What motivates

the use of particular verbs in the initial phases of acquisition? These questions have occupied acquisition research from different perspectives in recent years (e.g., Berman & Armon-Lotem 1996, Bloom 1991, Clark 1993, Pinker 1989, Tomasello 1992, Tomasello & Merriman 1995).

Researchers working in different analytical frameworks agree that semantically general verbs like *be, do, make, get, go, come, put, give, take* and *bring* have a privileged status in acquisition, and possibly in the lexicon in general (Clark 1978, 1993, Pinker 1989, Hollebrandse & Van Hoot 1995, 1996, Ninio 1999). Clark (1978), for example, observes that these are often among the first verbs that children use to talk about actions, since they designate meanings that are remarkably similar to those associated with argument structure constructions.[44] Clark cites other studies which show that words corresponding to these concepts are among the first to be used crosslinguistically as well, and that even children with Specific Language Impairment rely heavily on general purpose verbs (Rice & Bode 1993). This class of verbs has also been noted as the first for which combinatorial rules are learned (Ninio 1999).

Other researchers argue, instead, that semantically specific verbs are the ones that children acquire in the initial phases of acquisition. For example, P. Brown (1997, 1998) notes that in Tzeltal, children rely mostly on semantically "heavy" (i.e., specific) verbs (particularly verbs for eating different kinds of things) in early combinations with transitive argument structure, and that "although some of the putative universally general verbs are among these shared early words…, the fact that more than half of the children's early verb repertoires are not shared already suggests child-specific and context-specific word learning" (1998, pp. 721 – 723).

I propose that the early lexicon of Hebrew-speaking children is confined neither to semantically general nor to semantically specific verbs, but rather includes both, and that this variation is driven by universal, typological, and situational factors. This gains support from acquisition of early verbs in typologically different languages like Tzeltal (Brown 1998), and from other areas of lexical acquisition such as types of novel verb coinages and ways of expressing the undoing of an action in different languages. Thus, children acquiring English and German rely more extensively on

44 The term *construction* is used here in the sense of Fillmore (1985) and Goldberg (1995) to refer to form-meaning correspondences that exist independently of particular verbs. That is, constructions are assumed to carry meanings independently of the words in a given sentence. For example, a "Ditransitive" argument structure construction carries the meaning of X CAUSES Y TO RECEIVE Z independently of whether the verb in this construction is *give*, *send* or *fax*.

particles than speakers of French, while French children rely more heavily on affixation for innovating verbs or to express the reversal of an action (Clark 1993).

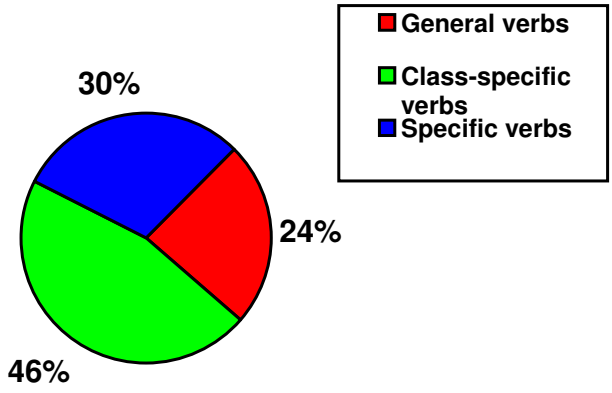
To test these claims, I examined the "early verbs" of Lior, Smadar, and Hagar; that is, different verb forms that are in the naturalistic speech of children at the one-word stage and in transition to early word combinations (Tomasello 1992, Berman & Armon-Lotem 1996). I set the age boundary for this class of items at 1;11, the age at which I found evidence for initial productivity of morphological inflections and for use of overt subjects. During the sampling period, the three girls moved from the single-word stage to early word combinations, a transition accompanied by an increase in their MLU-W score by one word. This qualitative change made it possible to detect developmental trends in the early make-up of their verb lexicons. The fourth child, the boy Leor, had already moved beyond the single-word stage when his "early verbs" were recorded (ages 1;9 – 1;10), and was therefore excluded from the sample.

2.1 Semantic Specificity

The total of 1226 verb tokens that were recorded (Lior – 276, Smadar – 494, and Hagar – 456) were divided into three groups by level of semantic specificity: general, class-specific, and specific. By "semantic specificity" I refer to how informative and restricted the meaning of a verb is, that is, the extent to which its meaning depends on verb-external factors like the arguments it takes and the extent that it can be considered generic or inclusive of other verb-meanings. Values for degree of specificity were based on findings of prior research on lexical composition among adults and children alike (Berman & Armon-Lotem 1996, Bloom 1993, Clark 1993, Talmy 1985, Slobin 1981, 1985, 1997). **General verbs** are those whose meaning is the least restrictive and the least informative, in line with what Clark (1978) terms "general-purpose" verbs; **class-specific verbs** include verbs that exemplify characteristics of a particular class, like prototypical verbs (e.g., *rcy1* 'want' is the prototypical modal verb), and **specific verbs** are ones with a very narrow or restricted sense like *chew* (= eat in a certain way) and *shave* (= cut in a particular manner). For example, a verb like *la'asot* 'make/do' as in *la'asot ambatya* 'make a bath = take a bath' was classified as general, a verb like *lehitraxec* 'to wash (oneself)' as class-specific, and a verb like *laxfof* 'to wash-hair, shampoo' as specific. Figure 5.3 shows the distribution (in percentages) of verb tokens by verb specificity in the

lexicons of the three girls (combined) between ages 1;5 – 1;11, out the 1226 recorded verb tokens.

Figure 5.3 Distribution of Verb Tokens by Verb Specificity in the Lexicon of Three Children



General verbs account for around a quarter (24%) of the verb tokens examined, and include the verbs *hyy1* 'be', *isy1* 'do, make', *hlx1* 'go, walk', *bwa1* 'come', *sym1* 'put', *ntn1* 'give', *lqx1* 'take', and *bwa5* 'bring'. **Class-specific verbs** account for nearly half (46%) of the verb tokens, and include the verbs *akl1* 'eat', *bky1* 'cry', *gmr1* 'finish', *npl1* 'fall', *ptx1* 'open', *qpc1* 'jump', *rcy1* 'want', *yeš* 'be-existential', and *yrd1* 'get down'. **Specific verbs** constitute the remaining third (30%), and include several groups of verbs, as follows: (a) Verbs like *rwc1* 'run', and *qlp3* 'peel' that were used extensively by only one child in the sample; (b) verbs like *qpc1* 'jump', and *kns5* 'put in' that were used a small number of times by two or three children in the sample (these two groups of verbs are listed in Appendix 5.I); and (c) verbs that occurred only once in the transcripts of only one child for the period examined. These include: *asp1* 'collect, gather', *dlq5* 'light, switch', *glgl3* 'roll+TR', *glx3* 'shave+TR', *iwp1* 'fly+INTR', *lbš1* 'wear, put on', *mšk1* 'pull', *ngi1* 'touch', *psq5* 'stop+TR', *pzr4* 'scatter+INTR', *šmi1* 'hear', *srq4* 'comb+INTR', *sxq3* 'play', *tqn3* 'fix', *txl5* 'start', *xba4* 'hide', *xky3* 'wait', *xly1* 'be-sick', and *ydi1* 'know'. These verbs are not listed in Appendix 5.I, since they do not characterize the shared group of "early verbs". Yet they are quite common, everyday verbs, they appear in the subsequent verb lexicon of all four children in the sample, and they are typical of Hebrew-speaking children's early preschool vocabulary.

Table 5.2 displays the distribution (in percentages) of verb tokens by level of specificity and child.

Table 5.2 Distribution (in percentages) of Verb Tokens by Specificity and Child

	General	Class-specific	Specific
Lior	16%	53%	32%
Smadar	26%	50%	24%
Hagar	28%	37%	36%
Three girls (combined)	**24%**	**46%**	**30%**

Table 5.2 shows that there are individual differences in how much each child uses verbs of different levels of specificity. All three use class-specific verbs (tokens) the most, but they vary in the extent to which they use general and specific verbs. Lior uses more specific verbs, while Smadar and Hagar prefer general verbs.

Table 5.3 shows the mean number of tokens per type in the early verb usage of the three girls (combined) for each level of semantic specificity.

Table 5.3 Mean Number of Early Verb Tokens per Type by Level of Specificity

Verb Group	No. of Tokens	No. of Types	Mean Tokens per Type
General verbs	298	8	37.2
Class-specific verbs	485	15	32.3
Specific verbs	437	60	7.2

Table 5.3 shows that general and class-specific verbs are used more extensively than specific verbs like *shave*, *chew*, *peel,* and *comb,* and this is reflected in the higher proportion of tokens-per-type for these verbs. This suggests that general and class-specific verbs are shared across children, and evidently across languages. A thorough investigation of typologically different languages might, however, reveal differences in the encoding of these verbs analogous to what Bowerman (1992) found for the expression of spatial distinctions in Korean and Tzeltal.[45] Also, the similarity in mean number of tokens-per-type for general and class-specific verbs suggests that children use both to begin the process of verb acquisition.

2.2 Factors Affecting the Early Make-up of Children's Verb Lexicon

What motivates the use of particular groups of verbs in early acquisition? Qualitative analysis suggests that this is determined by a combination of universal, language particular, and situational factors, which cut across the three groups of verbs

45 I could not find analyses along similar lines for the distribution of general purpose verbs in other, more "exotic" languages including those which have been studied for VAS (e.g., Allen 1998 for Inuktitut, Choi 1998 for Korean, Pye, Frome Loeb & Pao 1995 for K'iche').

(general, class-specific, and specific). That is, verbs of a particular level of specificity may be motivated by different factors so that the extensive use of class-specific verbs cannot be accounted for in a single way. It can be accounted for in different ways as follows: (1) A **semantically** motivated explanation relates to the nature of certain verbs as "prototypical" (e.g., *rcy1* 'want', *npl1* 'fall'). For example, the verb *rcy1* 'want' forms the basic modal verb triggering other modals such as *yaxol* 'can, able to', and *carix* 'should, have to', as well as other stative verbs like *kis1* 'be angry', *kav1* 'hurt', *ray1* 'see' and *ydi1* 'know', while the verb *npl1* constitutes the basic change-of-state (unaccusative) verb.[46] (2) A **pragmatically** motivated explanation concerns the world of early child experience, for example, the verbs *bky1* 'cry' and *akl1* 'eat' describe basic activities in children's early life experience. And (3) a **typologically** motivated explanation concerns the nature of Hebrew as a "verb-framed language" so that semantic content expressed by particles in "satellite-framed" languages like English or German are incorporated in the verb stem in Hebrew, e.g., verbs of directed-motion *yrd1* 'go down', *kns2* 'go in', or completion *gmr1* 'finish up', *hlk1* 'go away', *zrk1* 'throw away').

2.2.1 Universal Factors

Universal factors refer to the properties of particular verb groups that make them cross-linguistically favored for early acquisition, e.g., semantically general verbs termed variously "general-purpose" verbs (Clark 1978, 1993), "light" verbs (Pinker 1989, Hollebrandse & Van Hoot 1995, 1998), or "pathbreaking" verbs (Ninio 1999). What motivates the use of these verbs in early acquisition is firstly that their meanings are nonspecific: they do not specify the kind of event that they denote in isolation, but in combination with a complement. As such they often function only as tense-carriers or verb-slot-fillers in phrasal expressions whose objects carry most of the meaning of the predicate (e.g., *take a bath*, *take a picture*, or Hebrew *osa lixlux* 'make (a) mess' in Hebrew.[47] Second, they are lexically underspecified, since they introduce a particular verb-frame, but do not specify the semantic roles of the phrases in their argument slots. For example, the expression *take a shower* denotes a *bathing* event in

46 An *unaccusative* verb is a verb that allows a postverbal subject like *npl1* 'fall', e.g., *ha-kadur nafal* 'the ball fell' as compared with *nafal ha-kadur* ' (down) fell the ball'.

47 This is particularly true in a more analytic or isolating language like English, although in Modern Hebrew, too, general-purpose verbs serve a similar function. This was not the case in Biblical Hebrew, nor to this day in normative Hebrew, where information is encoded inside the verb, e.g., *lehitkaleax* 'shower' vs. *la'asot miklaxat* 'take a shower', *liknot* 'shop' vs. *la'asot kniyot* 'go shopping'.

which the subject is a *bather*, and not a *taking* event in which the subject is a *taker*. Third, certain general-purpose verbs are syntactically multifunctional since they appear with many different complements, and they may function both as auxiliaries and as main verbs, compare, for example, *anaxnu* ***holxim*** *le'exol* 'we're **going** to eat' with *anaxnu* ***holxim*** *habayta* 'we are **going** home'.

As noted, certain class-specific verbs like *akl1* 'eat', *yšn1* 'sleep', *bky1* 'cry' describe basic activities in the experience of young children, and are presumably shared across children and cultures.

2.2.2 Typological Factors

Typological factors refer to language particular properties that yield cross-linguistic variation in encoding particular situations. Children who speak a certain language will use more or fewer verbs, or different kinds of verbs, to talk about particular scenes, and this will affect the early make-up of their verb lexicon. And in certain languages like Korean and Tzeltal, verbs rather than nouns predominate in early acquisition for typological reasons (Brown 1998, Choi 1998, Gopnik & Choi 1995).

Typological factors account mostly but not only for use of certain class-specific verbs. The verb *yrd1* 'get/go down' can illustrate the function of typology. Talmy (1985) proposed two distinct ways in which languages allocate information between the main verb and supporting elements ('satellites') in a clause (see, too, Berman & Slobin 1994, Slobin 1997). A Germanic language like English uses verb particles to specify direction, e.g., *walk* ***in***, *get* ***down***; a Romance language like Spanish encodes this information in the verb, e.g., *entrar* 'enter', *bajar* 'descend', as does a Semitic language like Hebrew, e.g., *nixnas* 'enter', *yarad* 'get down'. English is generally characterized as a **satellite-framed language**, since it is the satellite (the verb particle) which conveys information on direction of movement, where languages like Spanish or Hebrew are **verb-framed**, since this information is generally conveyed by the verb stem alone. Children begin to talk about motion in space early in acquisition (Clark 1993). In a satellite-framed language like English they do that by using particles like *up* and *down*, while in a verb-framed language like Hebrew they are forced to use a verb to express directed motion. A specific example of this typological difference was noted in the speech of Berman's bilingual daughter, Shelli. At the one-word stage, Shelli used either the English particle *down* or the Hebrew verb form *éde*

= *larédet* 'to get down' when she wanted to get down from her high chair or out of bed (Berman, personal communication). This could explain why Hebrew-speaking children use semantically specific motion verbs earlier than English-speaking children, including directed motion verbs in my sample like *ily1* 'go up', *yca1* 'go out', *kns2* 'go in', *izb1*'go away'.

Consider next the verb *gmr1* 'end, finish'. Early child Hebrew includes some unanalyzed inflected forms of verbs that can best be described as fulfilling an aspectual function, since Hebrew lacks grammaticized marking of aspect. Two forms of the root *g-m-r* 'end, finish' are used to express 'completive' in Hebrew child language. First, the form *gamarnu* 'finish-1PL-PT = we (have) finished, ended' is often used when children finish performing an activity, or when they want to say that they have had enough of something, and they want it to stop. Another example is *nigmar* 'finish-3SG-MS-PT = is-finished, be-over' which occurs in the intransitive P2 pattern in the sense of 'be/get finished', in contrast to the more basic transitive *gmr1* = 'end, finish (something)'. This is used when something is finished, over and done with. While Hebrew-speaking children use a verb to express completive aspect, where English-speaking children can use expressions like 'allgone' and 'alldone' for the same sense. As a result, the early Hebrew lexicon looks different than the English. Another example of a verb that fulfills an aspectual function in Hebrew is that of the basic verb *go* which is used to mark lative aspect as in *lalexet le'exol* 'go-INF eat-INF = go to eat', analogously to, but not the same as English *gonna.*

Another factor that affects early lexical make-up involves prototypicality, in the sense of events or scenes that regularly occur as part of frequent and salient activities and perceptions, and so are the basis for elaboration and use of other verbs (Bowerman 1978, Clark 1993, Slobin 1985). As noted, in the Hebrew data, the verb *rcy1* 'want' forms the basic modal verb triggering other modals such as *carix* 'should, have to', *yaxol* 'can, able to', and other states, while the verb *npl1* 'fall down' prototypically forms the basic change-of-state verb. These verbs are prototypical in the sense that they are the first, and for a considerable period of time, the only verbs used by the children to express these particular semantic notions. Prototypical notions like separation and removal, modality, or change-of-state are presumably crosslinguistically shared. However, they may be encoded differently in different languages, for example, by a lexical verb, by affixation, or by verb particles. As a

result, children acquiring some languages will have more prototypical verbs in their early lexicon than in others.

Take as an example the verb *ptx1* 'open' which is used prototypically to denote the semantic categories of separation or removal. These categories may be encoded grammatically in other languages by using prefixes such as *un-* in English or *de-* in French, or particles such as *off* and *out* in English. Clark (1993) notes that *open* is the verb typically used by children in requesting or offering access. As such, it also typically marks the removal of a constraint or an obstacle to access. Berman and Armon-Lotem (1996) report that *ptx1* 'open' was used by their subjects to refer to opening objects which form an enclosure as well as to denote removal or separation. The data in my corpus supports these distinctions, as shown in Table 5.4.

Table 5.4 Various Uses of *ptx1* 'open' by Four Hebrew-SpeakingChildren [1;5 – 3]

Semantic Category	Example
Cause-Change-of-State: move from a position of shut to open, from closed to ajar	*liftoax delet* 'to open door' *tiftax et ha'aron* **open**-2SG-MS-FI ACC-the closet = 'open the closet'
Cause-Change-of-State: remove or separate, from being attached (on) to being removed (off)	*niftax et ha-Daniella* **open**-1PL-FI ACC-the Daniella = 'open/remove the cover of the yogurt' *tiftexi et ha-kufsa shel ha-kaletet* **open**-2SG-FM-FI ACC-the cassette-case of the cassette = 'open the case of the cassette'
Cause-Change-of-State: activate, operate, switch from off to on	*ftexi televisia* **open**-2SG -FM-FI television = 'turn on the TV' *ptax meavrer* **open**-2SG-MS-IMP fan = 'turn on the fan' *roce tiftax radio* want-2SG-MS-PR **open**-2SG-MS-FI radio = 'want (you) (to) turn on the radio' *tiftax or* **open**-2SG-MS-FI light = 'turn on the light'
Cause-Change-of-State: produce an aperture from closed to open	*iftax et ha-eynaim* **open**-UC ACC-the eyes = 'open (your) eyes' cf. normative *lifkoax*

In sum, two main factors affect early lexical acquisition under this heading: the distinction between satellite- and verb-framed languages, and prototypicality. The former factor has a differential effect on different languages. For example, since Hebrew is a verb-framed language, the early lexicon of Hebrew-speaking children will have more verbs than that of children who speak a satellite-framed language like

English. The effect of the latter factor, on the other hand, does not depend on the type of language involved. That is, for any language, use of prototypical verbs suggests that for a certain period of time, children use a small group of verbs to express a wide range of meanings.

2.2.3 Pragmatic Factors

Certain verbs enter the early lexicon as a result of a particular caretaker-child interaction. These verbs not only distinguish the verb lexicons of speakers across languages, but also the lexicons of individual speakers within a given language. Most of these verbs belong to the group of specific verbs. Figure 5.4 shows the distribution of specific verbs for each of the three girls.

Figure 5.4 Distribution (in percentages) of Specific Verbs for Three Children [1;5 – 1;11]

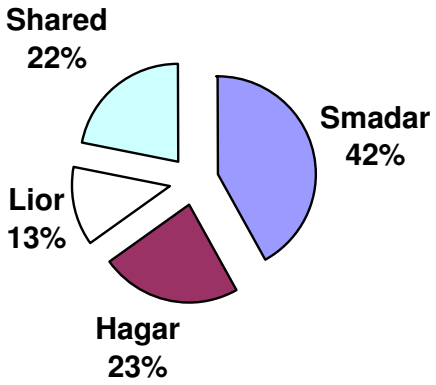


Figure 5.4 shows that out of all the specific verb types in the data, Smadar used most (42%), Hagar – fewer (23%), and Lior – the least (13%). The remaining 22% were used by two of the girls a small number of times, mostly only once. In this sense, they are not typical of the inventory of early verbs in Hebrew.

Specific verbs occur mainly as a result of caretaker imitation or the one-time use of a frozen expression or a nursery rhyme and so are not at all characteristic of the inventory of early verbs in Hebrew. These particular contexts accounted for 58% of all occurrences of specific verbs in Hagar's data, 48% in Lior's, and only 35% in Smadar's. Example (1) illustrates how Hagar and Smadar use the verbs *pzr4* 'be-scattered, be spread around' and *srq4* 'comb (one's own hair'), respectively, in imitating their mothers' utterances.

(1) **Examples of Idiosyncratic Verbs in the Early Lexicons of Hagar and Smadar**

Child	Utterance
Hagar (1;7;24)	Mother: *hitpazru ha-xaruzim* scattered-3PL-PT the beads = 'the beads scattered' Hagar: *pazru* [: *hitpazru*] [*] *uzim* [: *xaruzim*] [*] scattered-3PL-PT beads = '(the) beads scattered'
Smadar (1;6;20)	Mother: *ze ha-yalda mistareket* it the girl comb-FM-SG-PR = 'it (is) the girl combing (her hair)' Mother: *ma osa ha-yalda*? what do-SG-FM-PR the girl = 'what is the girl doing?' Smadar: *keket* [: *mistareket*] [*] comb-SG-FM-PR = 'combing (her hair)'

The remaining occurrences of specific verbs were self-initiated, but they were not repeated in later sessions, because of being dependent on a specific context or situation in the interaction.

In sum, as in other areas of acquisition, there is no single explanation for a given phenomenon, in this case, the semantic categorization of "early verbs". Some do indeed seem to represent basic or primitive predicating elements corresponding to what have been called "general purpose", or "light" verbs in Hebrew as in languages like English, Dutch and German. Other verbs are favored for typological reasons, such as in the verb-internal versus verb-external expression of direction of motion. Use of yet other verbs is neither semantically nor typologically motivated, but is determined by the pragmatics of early child experience or idiosyncratically by the linguistic input to which particular children are exposed.

3. The Special Status of General-Purpose Verbs

"General-purpose" (Clark 1978, 1993), "light" (Pinker 1989, Hollebrandse & Van Hoot 1995, 1996), or "pathbreaking" verbs (Ninio 1999) may not be the first verbs that children acquire, nor the only verbs in their early lexicon. Still, these verbs have unique characteristics that make them particularly amenable to early acquisition. In depth analysis of these properties may shed light on the strategies that children use in acquiring these and other verbs in their early lexicon.

3.1 Characteristics of General-Purpose Verbs

General-purpose verbs are polysemous, that is, they have a range of semantic readings. Clark (1978, 1993) calls them "general-purpose", since she assumes that

children use them to talk about many different activities, as illustrated by *make* in Example (2).

(2) **Various Meanings of *make* [Clark 1993, p. 29]**

Verb	Utterance	Context and Gloss
MAKE	Make name!	Telling adult *to write* the child's name
	Make a dog.	Telling adult what *to draw* next
	Make that.	Asking adult *to move* the clock-hand
	I make a little doggie.	As he *cuts* a dog-shape from playdough

Hollebrandse and van Hout (1995, 1996) and Ninio (1999) characterize "light" or "pathbreaking verbs" as generic and transparent since they tend to have a general meaning, and so are favored candidates for initial encoding of their associated argument structure. For example, *give* and *sell* share the same argument structure in Dutch, English and Hebrew as three-place predicates (NP___NP to NP), but *give* appears before *sell* in that same argument structure in all three languages. The verbs *come* and *arrive* (Hebrew *bwa1* and *ngi5*, respectively) also have the same argument structure (NP___), yet, *come* preceedes *arrive* in children's usage. Pinker (1989) notes that "light verbs" may correspond to semantic configurations that are encoded by affixes in other languages (e.g. causative *make* or French *faire*). Besides, as noted, these verbs often function as little more than tense-carriers or verb-slot-fillers in expressions with objects that carry the semantic burden of the predicate (e.g., *make love*, *take a bath*, *go crazy*).

Syntactically, Ninio (1999) proposes that "pathbreaking verbs" play a major role in the syntactic acquisition of argument structure and that these verbs begin the acquisition of novel syntactic rules. Children first learn new combinatorial rules for these few verbs in a piecemeal fashion, and then begin to extend these rules as more general and abstract principles to other verbs, so that applying the same combinatorial rule to new verbs becomes progressively easier. Although Ninio notes that the specific pathbreaking verbs may vary with each major step in syntactic development, in each case they set the path for other verbs to follow, without the latter having to undergo the same difficult process of learning everything from scratch. Pinker (1989), likewise, notes that these verbs are syntactically multi-functional, since they may function both as auxiliaries and as main verbs, e.g., we are **going to** eat, we are **going** out.

Despite their semantic and syntactic generality, general-purpose verbs typically show only partial overlap in different languages. For example, the Hebrew verb *isy1*

'make/do' corresponds to the meanings of both English *do* (e.g., *ma ata ose?* 'what you-2SG-MS do-SG-MS-PR?' = 'what are you doing?'), and *make* (e.g., *ani osa migdal* 'I make-1SG-FM-PR tower' = 'I'm making a tower'). French, like Hebrew, has a single verb *faire* covering the two English verbs 'do' and 'make', but in French this verb also functions syntactically as a basic means of forming causative constructions, but this is **not** the case for its Hebrew counterpart.

3.2 General Purpose Verbs in the Early Lexicon of Hebrew

General-purpose verbs such as *hyy1* 'be', *ntn1* 'give', *isy1* 'make/do' and *bwa1* 'come' were used polysemously in the Hebrew database, as shown by the range of semantic classes applicable to each of these verbs in different contexts of speech output. Table 5.5 illustrates this polysemy with examples from Lior, where each verb has several meanings depending on the specific context of use, and on the complements that it takes (in the Table, arguments are marked in bold, and verbs are underlined).

Table 5.5 Examples of Semantically Polysemous Verbs in the speech of Lior [1;5 – 3]

Lexeme	Semantic category	Example	Gloss
bwa1 'come'	Motion: telic	***mi*** *ba?*	'Who came?'
		boi *la-safari*	come-2SG-FM-IMP to-the-safari = 'Come to the Safari'
	Motion: deictic	***boi*** *ima*	come-2SG-FM-IMP Mommy = 'Come here, Mommy'
	Mood: hortative	*bo nesaxek*	come-2SG-MS-IMP play-1st-PL-FT 'Let's play'
	State: affective	*loh ba* ***li***	not come-3SG-MS-PT to-me = 'I don't feel like it'
hyy1 'be'	State: equational	***ani*** *roca rak lihyot* ***savta***	I want-SG-FM-PR only to-be grandma = 'I only want to be grandma'
	State: existential	***mi*** *haya sham?*	'Who was there?'
	State: modal	***ze*** *yaxol+lihyot*	It can to-be = 'Could be, maybe'
	State: possessive	***ze*** *yihye* ***la-tinok shel tal***	it will-be to-the baby of Tal = 'That will be for Tal's baby'
		ve haya ***lanu glida*** *ba-bayit*	and was to-us ice-cream at home = 'And we had ice-cream at home'
	State: predicational	*loh yihye* ***lax*** *xam*	not will-be to you-SG-FM-FUT hot = 'You won't be hot'
isy1 'do/make'	Activity: general	***ma ata*** *ose?*	what you-2SG-MS-PR do-SG-MS-PR = 'What are you doing?'
	Activity: construction	***ani*** *osa* ***migdal***	I make-SG-FM-PR tower = 'I am making a tower'
	Activity: creation	***hi*** *osa* ***dubi panda***	she makes Panda bear = 'She's fixing a Panda bear'

Lexeme	Semantic category	Example	Gloss
ntn1 'give'	Cause change of state: transfer of possession	***klaf axer ani*** *eten* ***lax***	card other I give-1SG-FUT to-you-SG-FM = 'I'll give you another card'
	Activity: enablement	***ni****ten* ***laxem*** *le'exol*	we-give-1PL-FUT to-you-PL to eat = 'We'll feed you'
		tni ***li*** *lanuax kcat*	give-2SG-FM-IMP to-me to rest little = 'Let me rest a bit'
	Activity: violent contact	*titni* ***maka le-Nicanush***	give-2SG-FM-FI a spank to Nican = 'Give a spank to Nican'

The polysemous nature of general-purpose verbs suggests that these verbs are semantically 'weak', and so more prone to serve as "pathbreakers" into syntax. Olsen and Resnik (1997) argue that the ability to appear in a clause with an implicit object is associated with verbs that have strong selectional constraints. That is, the more tightly a verb selects its object, the more information it (the verb) carries, and so the more the direct object replicates information provided by the verb. For example, the verb *drink* selects for its direct object only NPs that are liquid and drinkable, and so the direct object can be left out, and the resulting sentence (e.g., *Dan is drinking*) is still grammatical and semantically transparent. Since general-purpose verbs are 'semantically-weak', carrying little semantic content of their own, they require an overt complement to specify their meaning. For example, the verb *ntn1* 'give' has a general meaning of TRANSFER, but its complements specify the kind of transfer involved, e.g., *natan banana* 'give-3SG-MS-PT banana = gave a banana', *natan maka* 'give-3SG-MS-PT spank = hit', *natan lalexet* 'give-3SG-MS-PT to go = allowed to go'. Children will thus tend to use general-purpose verbs with overt complements earlier than more specific verbs (compare Brown's [1998] findings for Tzeltal).

Against this background, I propose that the major role of general-purpose verbs in the acquisition of Hebrew is to overcome language particular difficulties. In Hebrew, as noted earlier, transitivity and voice are encoded in verb patterns (see, too, Chapter 3, Section 1.4). To alter a verb's valency, children need to extract a consonantal root and insert it into a pattern that denotes the requested transitivity value. Children learn to use this major verb-creating device of Hebrew only at around age 3 or 4 (Berman 1982, 1993). Consequently, in early acquisition, general-purpose verbs constitute a more analytic and transparent option for word formation in Hebrew, since children can use these verbs with a specific noun to convey the required meanings, e.g., *asiti pipi* 'I did wee-wee' [Lior 2;2] vs. *hishtanti* '(I) peed'. These verbs mark the transition from isolated (V+NP) to arguments that are morphologically

encoded in the verb, e.g., *osa ra'ash* 'make (a) noise' [Lior 2;3] to *mar'isha* 'make-noise' with the shared root *r-i-š*. This proposal is in line with Clark (1993) and Berman (1993a) who note that across development the use of general-purpose verbs decreases, as children add more specific verbs to their repertoire.

Tables 5.6a and 5.6b list examples of children's early use of general-purpose verbs. Table 5.6a lists examples of [general-purpose verb + specific noun] that have a corresponding specific verb in adult Hebrew which is morphologically related to the noun.

Table 5.6a Examples for the Early Use of General-Purpose Verbs

Verb	General Purpose Verb + Specific Noun	Semantically Specific Verb - Morphologically related to Noun
isy1 'make/do'	***asiti ta-harkava*** [Smadar 1;10] 'I made the puzzle'	*leharkiv* 'to assemble (a puzzle)' <*rkv5*>
	eyze ***balagan asiti*** [Smadar 1;11] 'What a mess I made'	*levalgen* 'to-make-a-mess' <*blgn3*>
	asinu kniyot [Smadar 2;1] 'We did = went shopping'	*liknot* 'to shop' <*qny1*>
	hu ***ose miklaxat*** [Smadar 2;2] 'He makes = takes (a) shower'	*lehitkaleax* 'to shower' <*qlx4*>
	asinu *ecel savta Matilda* ***gilgulim*** [Smadar 2;2] 'We made somersaults at grandma Matilda's'	*lehitgalgel* 'to roll-around' <*glgl4*>
	ani ***osa et ha-hitamlut*** *sheli* [Smadar 2;2] 'I am doing my exercises'	*lehit'amel* 'to exercise' <*iml4*>
	asiti gilush *al ha-maglesha* [Smadar 2;2] 'I made a sliding on the slide'	*lehitgalesh* 'to slide' <*glš4*>
	ze sha'on ***ose tik tak*** [Leor 2;1] 'This is a clock	*letaktek* 'to tick' <*tqtq3*>
	natna *lanu* ***oxel*** [Leor 2;8] 'Gave us food'	*leha'axil* 'to feed' <*akl5*>
	natati *lax* ***makot*** [Leor 2;11] '(I) gave you spankings'	*lehakot* 'to hit' <*nky5*>
	ani ***notenet neshika*** [Hagar 2;6] 'I give a kiss'	*lenashek* 'to kiss' <*nšq3*>
	lasim xitul [Leor 1;10] 'To put on a diaper'	*lexatel* 'to diaper' <*xtl3*>
	sama *li* ***na'al*** [Leor 2;11] '(She) put me my shoes'	*lin'ol* 'to-wear (shoes)' <*nil1*>
	samti devek [Hagar 2;9] 'I put glue'	*lehadbik* 'to paste, stick on' <*dbq5*>

Table 5.6b lists examples of [general-purpose verb + specific noun] that have corresponding suppletive verbs (i.e., non-related morphologically) in adult Hebrew.

Table 5.6b Examples for the Early Use of General-Purpose Verbs

Verb	General Purpose Verb + Specific Noun	Semantically Specific Verb – Suppletive Verb
isy1 'make/do'	*aba loh* ***ose*** *lax* ***rosh*** [Lior 2;1] 'Daddy doesn't do your head'	*laxfof* 'to shampoo'
	ha-banot ***asu*** *levad* ***tova*** [Smadar 2;1] 'The girls petted (someone) themselves'	*lelatef* 'to pet, caress'
	ta'ase balonim [Leor 2] 'Make baloons'	*lenapeax* 'to inflate, blow up'
	ze ***ose ru'ax*** [Leor 2;6] 'It makes wind'	*le'avrer* 'to ventilate, air out'
	ani ***osa migdal*** [Lior 2;4] 'I am making a tower'	*livnot* 'to build, construct'
	osim igul *im ha-ceva* [Lior 2;5] 'Making a circle with the coloring-stick'	*lecayer* 'to draw, paint'
	asiti greps [Lior 3;1] 'I burped'	*legahek* ' to burp'
	aba ***ose oxel*** [Hagar 2;0] 'Daddy is making food'	*levashel* 'to cook'
	osim bay bay [Hagar 2;5] 'Doing bye bye = waving good bye'	*lenofef* 'to wave'
ntn1 'give'	***titen*** *li* ***yad*** [Leor 2;7] 'Give me a hand'	*lehaxzik* 'to hold'
	loh ***natnu*** *la* ***mayim*** *ve loh* ***natnu*** *la* ***oxel*** [Hagar 2;8] '(They) didn't give her water and didn't give her food'	*leha'axil* 'to feed', *lehashkot* 'to water = give-to-drink'
sym1 'put'	***lasim sinor*** [Leor 1;10] 'To put on a bib'	*lilbosh* 'to-wear, put on (clothes)'
	lasim kova [Leor 1;10] 'To put on a hat'	*laxvosh* 'to-wear, put on (hat)'
	lasim mishkafa'im [Leor 2;4] 'To put on glasses'	*leharkiv* 'to wear (glasses)'
	samnu batariyot *axerot* [Leor 2;7] 'We put different batteries'	*lehaxlif* 'to replace'
	samu *li* ***plaster*** [Leor 2;7] '(They) put a bandage on me'	*laxvosh* 'to bandage'

Tables 5.6a and 5.6b show that most [verb + noun] combinations occurred with the verb *isy1* 'make/do', and to a lesser extent with *ntn1* 'give' and *sym1* 'put'. The children rarely used the corresponding morphologically encoded forms to denote the relevant meanings, supporting my claim for the role of general-purpose verbs in early acquisition. This trend reflects a growing tendency in current Hebrew to prefer analytical to more synthetic forms of expression. For example, adults often use *la'asot tmuna* 'to make a picture = to take a picture' instead of normative *lecalem* 'to photograph', *la'asot miklaxat* 'to make = take a shower' for l*ehitkale'ax* 'to shower', *la'asot seder* 'to make = put in order' for *lesader* 'to arrange', *latet dugma* 'to give an example' for *lehadgim* 'to illustrate', *lekabel haxlata* 'to receive = make a decision' for *lehaxlit* 'to decide', and *latet eca* 'to give advice' for *leya'ec* 'to advise'. It also characterizes adult speech to children, as shown by the following examples from Lior's mother, recorded when Lior was 1;6.[48] These examples are also of two kinds.

48 Her mother is a schoolteacher who speaks highly educated, even normative Hebrew.

In the first case (5.7a), the combination of [general-purpose verb + specific noun] can be replaced by a semantically specific verb that is morphologically related to the noun, while in the second (5.7b), it can be replaced by a suppletive verb.

Table 5.7a Use of General-Purpose Verbs in Adult Speech to Children

General-Purpose Verb + Specific Noun	Semantically Specific Verb – Morphologically Related to Noun
natat *li* ***maka*** 'Gave me a spank'	*lehakot* 'to hit'
ani ***eten*** *lax* ***neshika*** 'I will give you a kiss'	*lenashek* 'to kiss'
axshav ***niten*** *lo* ***le'exol*** 'Now we'll give him (something) to eat'	*leha'axil* 'to feed'

Table 5.7b Use of General-Purpose Verbs in Adult Speech to Children

General Purpose Verb + Specific Noun	Semantically Specific Verb – Suppletive Verb
yahsanti shalosh shaot, ***asiti numi numi*** '(I) slept for three hours, I did night night'	*lishon* 'to sleep'
ma at ***osa kolot shel ze'ev****?* 'What are you making sounds of a wolf?'	*leyalel* 'to howl'
at roca ***la'asot migdal*** *me-kubiyot?* 'You want to make a block tower?'	*livnot* 'to build'
at roca ***la'asot kaki*** 'You want to do poo-poo'	*lexarben* 'to crap'
tizreki la-pax…lexi ***lasim ba-pax*** 'Throw to the garbage can… go put (it) in the garbage can'	*lehashlix* 'to throw away'

In light of these characteristics of general-purpose verbs, I would include the verb *roce/roca* 'want-SG-MS/FM-PR' in this category in Hebrew. It is acquired early, it is highly frequent in usage, and for a long time, serves as the prototypical modal verb in children's early lexicon (see Section 2.2.2). It is also the first verb that children use with a variety of argument structures, and so serves as a "pathbreaking" verb in the sense of Ninio (1999). Examples (3a) to (3f) illustrate the use of *rcy1* with a range of different argument structure configurations.

(3) **Early Argument Structure Configurations with *rcy1* 'want'**

a. ***roca****?* [Hagar]
want-SG-FM-PR = 'Want?'

b. *ani* ***roca*** [Smadar]
I want-SG-FM-PR = 'I want'

c. ***roca*** *sakin* [Smadar]
want-SG-FM-PR knife = 'want (a) knife'

d. *ani* ***roca*** *kafe* [Hagar]
I want-SG-FM-PR coffee = 'I want coffee'

e. *ani* ***roca*** *lir'ot* [Smadar]
I want-SG-FM-PR to-see = 'I want to-see'

f. ***roca*** *she ani elbash otam* [Smadar]
want-SG-FM-PR that I wear-1SG-FUT them-3PL-MS = 'Want that I'll wear them'

Interestingly, in the picturebook narratives (Berman & Neeman 1994), the 3 year-olds used the verb *rcy1* 'want' far more than other verbs in Hebrew as in the following excerpt from a story told by a child aged 3;10.

(4) *…"ha-kelev* ***roce*** *litpos et ze. Gam ha-kelev ha-ze metapes… hu* ***roce*** *letapes. Ve ha-kelev ha-ze hu gam* ***roce*** *letapes. …kan hu* ***roce*** *la'a lot"*
… 'the dog wants to-catch ACC it. This dog too is climbing… he wants to-climb. And this dog, it also wants to-climb. …here he wants to go up'.

In this text, the verb 'want' was used in 4 out of 24 clauses in the narrative (16%). In contrast, the corresponding English database included almost no cases of the verb *want* used as a general modal, or helping verb. Instead, the English-speaking children used the verb *try* to fulfill a similar function (Berman & Slobin 1994, Chapter IIIa). This suggests that the group of general-purpose verbs may vary across languages.

4. Conclusion

What kind of semantic knowledge do children start out with? It might be with the universal semantic categories of activity, state, achievement, and accomplishment, which in Hebrew tend to be linked to particular verb patterns, e.g., P5 – causative, P2 – achievement, P1 [-transitive] – activity, and so on. Findings of this study show, however, that at first Hebrew-speaking children do not rely on verb form-meaning correspondences (the partial match between *binyan* patterns and verb semantics) as a cue to acquisition of either individual verbs or classes of verbs (see, too, Berman 1993a). This can be accounted for as follows: The *binyan* system is known to be in large part lexically motivated, rather than strictly grammatically regular and fully rule-bound or productive in terms of form-meaning relations. To be able to make use of the partial regularities in the morphology-semantics interaction in this system, speakers need to have a much larger and more varied range of verb types and tokens in their own output and input than the young children in my study.

How, then, to account for the acquisition of verb semantics? In line with Clark (1993), Slobin (1981, 1985), and Smiley and Huttenlocher (1995), I assume that children do not have to learn semantic notions like MODALITY, MOTION, TRANSFER, CHANGE-OF-STATE, and CAUSALITY. These broad subcategories of the four major semantic classes of predicates are there from the start, and serve to mediate between

quite general and highly specific knowledge of verb meaning and verb-usage. Progress from one level of knowledge to another can be explained by children's reliance on a prototype strategy.

According to prototype theory, as developed by Rosch and her associates (Rosch 1973, 1978), the meaning of words is not a set of invariant features, but rather a set of features that captures family resemblances. Some objects will be more typical of its meaning by sharing more of the word's features than others, so that certain features are more important in determining class membership than others, although none is obligatory.

Anglin (1977) adapted this approach to children's acquisition of object terms, arguing that children form a perceptual schema or representation of an object based on their first experience with it. At first, the prototype is limited to the perceptual characteristics of the first instance so named, but it becomes generalized as more instances are encountered. Children start at an intermediate level, from which they proceed to more general and more specific meanings. Along similar lines, Bowerman (1978a) proposed that children often acquire a word in the particular context in which it is first heard and used, and later impose a featural analysis on the prototypical meaning of the word, so that some of its features can be recognized in other contexts.

Smith (1991) relates prototype theory to what she terms "situation-type" aspect (basically, *Aktionsarten* as contrasted with "viewpoint aspect"). To her, situation type concepts have a prototypical structure so that a cluster of properties characterizes members of a category and each category is organized around central exemplars. The temporal schemata of the situation type categories provide the cluster of properties central to that category. The members of a category differ in their properties, since some are more central and others more marginal. Central exemplars of a category have more of the characteristic properties than marginal exemplars. Similarly, the concepts associated with word meanings also have general and peripheral exemplars. A good exemplar of a STATE, for instance, is a situation where the static property is most salient, while a good example of an ACCOMPLISHMENT is a situation that has a clear process and a clear result.

The Hebrew database shows that most early instantiations of particular semantic classes (e.g., activity, state) can initially be attributed to highly frequent occurrences of a single verb. This finding can now be explained as follows. Each such verb is prototypical in being the first to encode semantic notions like MODALITY, MOTION,

TRANSFER, CHANGE-OF-STATE. Exposure to these verbs in repeated contexts allows children to link these lexical elements to their prototypical meanings. For example, if a child's caretaker uses the verb *nafal* 'fell' whenever an object is dropped or drops to the ground, the child will figure out that this verb denotes a change-of-state – from an object not being on the ground to its being on the ground. The child will then start to use this verb to relate to what s/he conceives of as change-of-state scenes and at the same time will identify this prototypical feature in other relevant verbs in the input, e.g., *nishpax* 'spilled', *nishbar* 'broke'. Later, with the increase in the child's verb vocabulary, s/he is also able to systematically associate a particular semantic feature with the corresponding verb patterns in Hebrew. This account is supported by the fact that most tokens in children's early verb lexicon belong to the "class-specific" category. That is, most verbs exemplify characteristics of a particular class, like prototypical verbs, e.g., *le'exol* 'to eat' versus *lil'os* 'to chew', *lenashnesh* 'to nibble' (as discussed in Sections 2.1 and 2.2.2 of this chapter).

How do children extend their semantic knowledge across development? A possible hypothesis would be that children start out with a limited group of general verbs and extend their early lexicon to include more specific verbs. The data reviewed in this chapter suggest that even in the early phases of acquisition, Hebrew-speaking children use verbs of different semantic classes, and of various levels of specificity. This particular make-up of children's early verb lexicon is affected by a combination of universal, language particular, and situational factors. This is consistent with a more general view of language acquisition underlying the present study, by which acquisition is driven by multiple linguistic and extralinguistic cues (Berman 1993a, Hirsh-Pasek & Golinkoff 1996, Maratsos & Chalkley 1981, Shatz 1987). Since children need to acquire a complex array of different types of knowledge on various levels, it makes sense that they will use bits of whatever they know about linguistic form and language use to learn more.

As for general-purpose verbs in early acquisition, I have found that children use these verbs to move from isolating, syntactic paraphrases to morphologically incorporated representation of arguments, e.g., *ose miklaxat* → *mitkaleax* 'take a shower → shower-INTR'. As noted earlier, their lack of semantic specificity makes general-purpose verbs syntactically transparent, and so favored by children for breaking into syntax (Ninio 1999). In the course of development, these verbs are

partially replaced by semantically more specific and syntactically more opaque alternatives. This points to a general developmental trend to a semantically more specified lexicon and to children's gradual internalization of the typological principles of Hebrew, where much information is encoded in the verb itself. This does not mean that specific verbs do not occur right from the start of acquisition. However, unlike late occurrences of these same verbs, early usage is nearly always based on rote learning (Section 2.2.3 of this chapter).

The effects of verb semantics on the acquisition of VAS are addressed separately in Chapter 7 (Section 2).

Sentence-Level Analyses
Chapter 6: Verb Argument Structure

Acquisition of Verb Argument Structure (VAS) marks the transition from single words to word combinations. Studying this process is thus important for understanding general processes in acquisition as well as aspects of linguistic theory. It can shed light on the topic of argument ellipsis as well as on more general issues like universal versus language particular effects in acquisition, and the interface between different linguistic modules (e.g., lexicon-syntax and syntax-semantics).

This chapter relates to the following questions. What motivates VAS acquisition? What is the course of development of VAS? Are the developmental trends revealed for Hebrew consistent with accounts of VAS acquisition in other languages? How do the various linguistic modules affect this process across development? And, what is the order of acquisition of verbs with different argument structures?

I argue that in its initial phases, VAS acquisition is verb-dependent rather than general, and that the process of VAS acquisition proceeds on the basis of linguistic experience with a particular target language, and I propose a developmentally motivated model to account for this process. In this model, verbs with different argument structures initially show a similar pattern of development, as follows. All early verbs first occur with no arguments, they are then augmented by one argument, and subsequently extend to two or more arguments. At each phase of this process, verbs differ with respect to the type of arguments they realize (i.e., subject, direct object, indirect object).

This chapter reviews previous research on the acquisition of VAS (Section 1), outlines my developmental model and its predictions for VAS acquisition (Section 2), describes findings from the Hebrew database (Section 3), and ends with a discussion of these findings and conclusions (Section 4).

1. Previous Accounts of VAS

This section extends the discussion of research on the acquisition of VAS in Chapter 1 (Section 2.2) by presenting a more detailed critical account. As in Chapter 1, I adopt Hirsh-Pasek and Golinkoff's (1996) broad classification of the available approaches into *Inside-out* and *Outside-in*.

1.1 Inside-out Accounts

Inside-out accounts assign children domain-specific linguistic knowledge, and emphasize grammar discovery rather than grammar construction. Two subtypes of *Inside-out* accounts are noted: *Structure-oriented*, and *Process-oriented*, as discussed in chapter 1. *Structure-oriented* accounts will not be discussed here in any detail, since they do not provide any comprehensive accounts of VAS acquisition.

1.1.1 Process-oriented Accounts

Process-oriented accounts are represented by two apparently contrasting accounts "semantic bootstrapping" (Grimshaw 1981, Pinker 1984, 1989), and "syntactic bootstrapping" (e.g., Gleitman 1990, Landau & Gleitman 1985). While both accounts share the assumption that children rely on innate knowledge, the former emphasizes the role of semantic information in the acquisition of verb syntax, while the latter stresses the role of syntactic information in the acquisition of verb meaning.

1.1.1.1 Semantic bootstrapping

Pinker's (1984, 1989) "semantic bootstrapping" account reduces early syntactic knowledge to the lexical semantics of particular verbs, learned from particular situations. In this account, the predicate-argument structures of verbs, as determined by their lexical semantics, projects onto the syntactic structure in accordance with a set of innate universal "linking rules" which associate particular arguments with particular syntactic positions as specified in the lexical entry of any verb.

For Pinker (1989), a verb's argument structure is directly dependent on the semantic structure of the verb, with argument structure alternations resulting from semantic operations. The arguments themselves are only specified as variables, with no semantic labels. A large part of a verb's meaning is defined by setting parameters for features such as [+/-movement], [+/-actor], [+/-liquid] to yield parameterization of idiosyncratic lexical information. On this basis, children will interpret all verbs that share the same feature setting as allowing the same argument structure.

Pinker identifies two types of linking rules (in the form of correspondences between thematic and syntactic functions): broad and narrow range rules. **Broad range lexical rules** are universal, they define what could be an argument structure in any language, and children apply them at a very young age. **Narrow range lexical rules** are language specific, they apply to narrow semantic subclasses of verbs, that is, they define subsets of the verbs that the broad range lexical rules could theoretically

apply to, and indicate what could be the argument structure of these verbs in a language. In this semantic account, children's errors in argument structure are explained by the overapplication of broad-range lexical rules, such as overgeneralizing a rule governing object deletion. Knowledge of syntactic functions like subject or direct object is assumed to be innate, and children rely on typical correspondences between semantics and syntax to determine which elements of the input strings instantiate various syntactic functions. For example, children look for constituents that specify agents in order to learn the position and other properties of subjects, since children's innate linking rules specify that agents are most likely to be subjects.

Pinker's "semantic bootstrapping" account has been criticized on several counts. Gleitman (1990), for example, attacks the hypothesis that children first fix the meaning of a verb by observing its real-world contingencies. She notes that "salience" and what is expressed in a speech act are not so easily recoverable as required by semantic bootstrapping, since many verbs refer to overlapping situations and parents do not necessarily use a verb when its conceptual correlates are present. Besides, some of a verb's features are in general unobservable. Along similar lines, Pye, Frome-Loeb and Pao (1995) argue that event perception cannot explain the syntactic behavior of the verbs *cut* and *break* in the acquisition of English, Mandarin and K'iche'. Children cannot simply view an event and extract the relevant semantic features that distinguish them, and indicate that they have a different argument structure. Nor do children rely on universal concepts to acquire word meaning.

Bowerman (1990) argues against Pinker's reliance on correspondences between semantic and syntactic categories. She uses crosslinguistic evidence to show that linguists do not fully agree on what constitutes the canonical mapping between thematic and syntactic functions, and that linking may not be universal. This is supported by evidence from Hebrew (see, further, Chapter 7, Section 2.3 below). Bowerman also argues that knowledge of linking rules may not be innate. For example, "canonical" linking errors begin only months or even years after the early stages of language development, and as such are easy to interpret as overregularizations of a learned pattern rather than as faulty application of innate linking rules. Also, the timing of acquisition of different kinds of verbs and the accuracy with which their arguments are mapped is inconsistent with what should be expected under the assumption that knowledge of linking is innate.

Nor do Bowerman's longitudinal data support the hypothesis that children receive selective help from innate linking rules. For example, she presents evidence that there is no advantage to prototypical over nonprototypical agent-patient verbs. As soon as children are ready to handle a verb plus two arguments, they handle a variety of verb types equally well. Children may particularly have problems in mapping thematic roles onto syntactic positions with just those verbs for which mapping should be the easiest if guided by innate linking rules, that is, in cases when the arguments are prototypical agents and patients. In addition, there are important crosslinguistic differences in the argument structure of the predicates that children may hear in a given context.

Just as Bowerman (1990) notes that constructs like "subject" may not, in fact, be applicable to all languages, Schlesinger (1994) and Slobin (1997) argue against Pinker's position that children innately possess basic syntactic categories such as sentence "subject" and "object" and innate linking rules. Schlesinger (1994) argues that innateness is not informative, since innateness of ability tells us nothing about the process involved in learning to exercise it. Slobin (1997) concludes that there can not be innate linking rules which are invariably reliable in indicating to all children, for all the world's languages, at all historical periods, how the meanings they need to understand and convey are linked to some innate set of abstract syntactic structures: there is simply too much variability across languages and across different forms of the same language over historical time.

Braine (1988) discusses a specific counter-example to an *a priori* correspondence between syntax and semantics. He points to an acquisition problem stemming from Pinker's (1984) classification of prelocatives like *there* as prepositions. Pinker (1984) assumes that *went there* in *John went there* is first analyzed as V + P and as a result rule (a) below is formed. Then, on contact with full PPs, rule (b) is acquired, from which (c) follows as a consequence of X-bar theory (Chomsky 1981, Jackendoff 1977).[49] In the configuration in (c), the NP is optional since it is a nonhead constituent. Given the formation of the extended rule VP→V + PP, and the assumption that a preemption mechanism is used to eliminate VP→V + P,

49 X-bar (=X') theory governs phrase structure configurations. In the X-bar schemata, X is a variable ranging over the various syntactic categories (N, V, A, P), functioning as the head of a phrase. The phrasal category containing X is termed X', and the phrasal category containing X' is termed X''. In English the head is the only obligatory category in an expansion, the categories which function as complements of the head are optional, and follow from independent principles of the grammar.

children will have difficulties in learning to utter only sentences like *John went there* and not PPs like **there the bed* parallel to *in the bed* in which the optional NP is realized within the PP.

(1) a. VP→V + P
b. VP→V + PP
c. PP→P (NP)

Pinker (1984, 1989) claims that children deal with the problem of overproductivity by gradually constructing narrow range conflation classes of verbs as participating or not in particular constructions. Braine and Brooks (1995) question his claims that verbs are assigned to narrow subclasses on the basis of idiosyncratic aspects of meaning, and that children acquire rules which characterize the permissible argument structures for each subclass (see, too, Ingham 1992). As noted, Bowerman (1990) observes that almost all sentence-level overgeneralization errors are made by children aged 3 to 4 years and older, whereas nativist theories would expect more overproduction earlier on, since children have not yet had time to construct all the necessary narrow-range conflation classes.

In sum, several major assumptions of the "semantic bootstrapping" account have been criticized above. The Hebrew data will be shown to support various aspects of this criticism, in particular, the claim that the linking mechanism responsible for mapping argument structure to syntactic positions may not be innate or universal.

1.1.1.2 Syntactic bootstrapping

In their "syntactic bootstrapping" account, Gleitman (1990), Landau and Gleitman (1985), and Lederer, Gleitman and Gleitman (1995) propose that children exploit certain regularities between verb meaning and sentence structure to narrow down the possible meanings of specific verbs. They argue that children rely heavily on early knowledge of argument structure to help them acquire the meaning of specific verbs associated with that structure. Specifically, they claim that a verb's subcategorization frames suggest to the child what the meaning of the verb may be in isolation. This enables children to choose between the several interpretations allowed by observation. For example, if a novel verb like *glorp* occurs in a [NP __ NP PP] configuration, it can be inferred to encode an action that causes an affected entity to move or change in a certain way, just like the verb *give*.

Syntactic bootstrapping presupposes children's ability to parse a sentence into a predicate and its arguments. This, in turn, implies that there are regularities between verb-syntax and verb semantics, that children are sensitive to these regularities, and that they can use them to make conjectures about meaning. In several experimental studies with nonsense verbs, Naigles and her colleagues (Naigles 1990, Naigles, Fowler and Helm 1992) examined the claim that children's choice of referent is a function of the syntactic structure in which the verb appears. Young children's interpretation of familiar verbs was found to be "frame compliant": unlike adults, children tended to assign a novel meaning to a familiar verb when presented in a frame in which it had not occurred before.

The syntactic bootstrapping account has also been subject to criticism. For example, Pinker (1994) argues that Gleitman's empirical arguments all devolve on experiments where children are exposed to a single verb-frame. Such limited context gives children only rough information about the semantics of the particular verb in that frame (such as number and type of arguments), and tells them nothing about the content of the verb root across frames.

Syntactic bootstrapping requires that a verb appear with all its overt arguments in order for the child to figure out its meaning. Languages that allow argument ellipsis may thus create a problem for this theory. Rispoli (1995) uses evidence from Japanese to argue that syntactic bootstrapping cannot play much of a role in early verb learning, since Japanese allows core arguments to be omitted. Also, despite the fact that Japanese children do not comprehend much of the case marking system in their language, they are remarkably successful at figuring out the meanings of verbs and at identifying the types of configurations in which they can occur. According to Rispoli, even English-speaking children will have difficulty in learning the argument structure of certain English verbs (for example, optional transitives like *eat* and *draw*, which they can interpret on the basis of pragmatic rather than syntactic knowledge. Similarly, Bowerman (1997) argues that in Korean the arguments of a verb are not always explicit, so that children might find it difficult to infer anything about a verb's argument structure.

Bowerman (1997) further argues that syntactic information is not sufficient for acquiring verb semantics. She notes that in some languages, *put* and *see* have the same number of arguments, so that children cannot distinguish their meanings simply by the number of their arguments. Also, some arguments change the meaning of the

verb – when added to intransitive verbs, they do not merely add a participant but cause a change in the meaning of the verb. This constitutes a problem for syntactic bootstrapping, since it leads to misinterpretation of verb meaning (as a transitive instead of an intransitive with a change of meaning).

In sum, two major nativist approaches have been proposed to explain how children acquire VAS. Both focus on initial entry into the system in terms of what type of knowledge helps children bootstrap into VAS, and both agree that there is a relationship between the semantic interpretation of arguments and their syntactic position. They differ on whether it is the syntactic position of an argument that determines its interpretation or the semantics of an argument that determines its syntactic position.

1.2 Outside-In Accounts

Outside-in accounts contend that children attend to salient objects, events and actions around them to construct their grammar. In this view, language acquisition takes place by means of domain-general procedures, and as a bottom-up process, no different from learning in other domains. *Outside-in* theories focus on the process of language acquisition, since they do not presuppose any *a priori* language structure. Hirsh-Pasek and Golinkoff (1996) identify two main sub-types of *Outside-in* theories: *Cognitive* and *social-interactional* (as reviewed in Chapter 1, Section 2.2). To these, I add two types of accounts – input-based, and distributionally-based accounts, in order to refine the distinctions within the various *Outside-In* approaches relevant to the model I am proposing.

1.2.1 Cognitive Accounts

Cognitive theories emphasize the role of children's prior understanding of events and relations in the nonlinguistic world together with children's general cognitive processing capabilities. Language is viewed as a particular kind of cognitive domain, accounted for in terms of general processes of cognitive development and information processing. In these accounts, language acquisition is considered in terms of form-function relations, as detailed in Chapter 1, Section 2.2. Goldberg's (1995) work on the theory of construction grammar is an important representative of cognitive accounts of VAS acquisition.

1.2.1.1 Construction Grammar

"Construction grammar" treats argument structures as constructions, where the meaning of an expression depends not only on the verb itself but also on the inherent meaning of the particular syntactic context and so too, the argument structure in which it occurs.

Constructions are defined as recurrent patterns of linguistic elements that serve some well-defined communicative functions. Prototypical constructions are Sentence-level patterns like imperatives, ditransitives, passives, resultatives, yes-no questions, and clefts. Argument structure constructions are a special subclass of constructions that provide the basic means of clausal expression in a language (Goldberg 1995, p.3). These abstract and complex constructions themselves carry meaning, independently of the particular words in the sentence. They encode event types basic to human experience (such as someone causing something, someone experiencing something, something moving, etc.), and are especially important since they correspond to the smallest linguistic units that can convey relatively complete communicative intentions.

In relation to language acquisition, proponents of "construction grammar" assume that children initially choose to talk about a limited set of events and states of affairs. They hear adults talk about these scenes using full linguistic constructions, or some partial forms appropriate to the discourse context, and this is what they attempt to reproduce. Thus, children's initial learning does not consist of small, abstract linguistic elements but rather of entire linguistic constructions that are large but concrete. Children's early linguistic constructions appear to be lexically specific and so at first are learned one by one. Only later in development do children's constructions become more abstract and category-based. This growing abstractness leads to argument structure overgeneralizations that are later constrained by several factors, including the semantic subclasses of verbs (Pinker 1989), preemption of overgeneralizations by alternative forms (Brooks & Tomasello 1999), and the entrenchment of particular verbs in particular constructions through repeated use (Brooks, Tomasello, Lewis & Dodson, 1999).

As concerns child language research, Tomasello (1998) argues that construction grammar provides a way of understanding language development as a whole, and not just particular aspects of the process. It relates language development to other domains of human cognition and allows for a view of language development as

gradual rather than instantaneous. Nontheless, problems arise for an acquisitional theory based on this approach.

One problem concerns the extent to which constructions are actually acquired in the early phases of acquisition. Pine and Lieven (1993) note that children sometimes learn and reproduce the whole prosodic contour of a construction with only some of its conventional elements, or else they learn a complex construction as a frozen expression without understanding how it is made up of its component elements. That is, these initial constructions are not as abstract and general as the corresponding adult constructions, and so must be learned one by one (Bowerman 1976, Braine 1976). At some point children begin to notice similarities in form and function of various subsets of "verb island" constructions (that is, whole units structured around particular verbs), and so move toward more adult-like, abstract, and verb-general constructions. They do this by means of pattern recognition, categorization, and schema formation that are common to many domains of cognitive development.

Another problem concerns construction size. Schlesinger (1998) argues that constructions cannot be learned in a top-down fashion, since such learning presupposes knowledge of the words that appear in them. Instead, he assumes that the child first learns concrete words and the semantic relations holding between them. (see Levy 1998 for a similar claim).

Yet another problem concerns learnability. Behrens (1998) argues that a construction grammar account fails to fully spell out how the child moves from concrete constructions to more abstract ones. She notes that toddlers do not direct their attention equally to all parts of an event, but rather, devote most of their attention to the agent. Also, 12-month-old children treat events similarly when they involve the participation of similar objects. That is, children first group events together on the basis of the similarity of the movements and changes of state in them, rather than grouping them together as, say, causal versus non-causal, as suggested by construction grammar. Relatedly, the range of "constructions" is also not explicitly specified. Thus, Clark (1998) suggests that, from as young as age two, children could be viewed as working on constructions inside words as much as on constructions made up of words. And Berman (1998b) points out that there is little explanation of how different constructions might be related together or generalized in some way.

Finally, there are problems concerning language typology. Bavin (1998) argues that languages encode grammatical categories in language-specific ways, and so

different developmental paths can be expected across languages, depending on the particular constructions available and the accessibility of these constructions. For example, in a language that allows argument ellipsis, children might not have enough available data to detect the argument structure of a given verb.

In sum, in marked contrast to accounts motivated by generative and other formal models of grammar (Section 1.1), a construction grammar approach to verb-learning assumes that children initially acquire entire linguistic constructions rather than lexical items plus abstract rules for their assembly. As reviewed above, this proposal raises certain problems of principle. To avoid these problems, while taking advantage of the explanatory power of a construction-based account, I use the notion "construction" in my developmental model of VAS in a somewhat modified way, as discussed in Section 2 below.

1.2.2 Input-Based Accounts

Under this heading, I consider analyses that reject any assumption of innate linguistic knowledge to account for acquisition of VAS. These include different orientations: Semantic (e.g., Bowerman 1973, 1982; Schlesinger 1988); lexical (e.g., Braine & Brooks 1995, Clark 1993, Ingram & Thompson 1996, Tomasello 1992), and distributional (e.g., Bates & MacWhinney 1978, 1987, 1989; Brent 1994, Elman 1990).

1.2.2.1 Semantically-oriented accounts

Bowerman (1973) notes that regardless of the language being learned, children's first sentences revolve around a restricted set of meanings that have to do with agency, action, location, possession, existence, recurrence, nonexistence and disappearance of objects. These semantic commonalities suggest that early syntactic development consists of children's discovery of regular patterns for positioning words whose referents play relational roles like "agent", "action", and "location". These reflect the way children come to conceptualize the structure of events during the sensorimotor period of development. In this account, children's earliest rules for word-combination specify where to position words that function in these different semantic roles. Eventually, children achieve a grasp of abstract, meaning-free syntactic relations when they come to recognize that noun phrases which perform a variety of semantic roles may all be treated equivalently with respect to position and other syntactic properites.

In a later account, Bowerman (1982) suggests that children link a particular kind of syntactic categorization with an abstract semantic configuration. This semantic-syntactic correspondence is apparently not grasped from the beginning of sentence construction, but instead is established only after children can use a verb in an adultlike manner. This means that children's formulation of semantic categories relevant to syntactic relations is not limited to the very earliest stages of word-combination. Rather, working out the semantic categories of a particular language requires extended experience with the language, and may in fact be accomplished only well after the syntactic forms to which these categories correspond seem to have been acquired.

Schlesinger's (1988) account of "semantic assimilation" argues that grammatical relations in early child language are semantic in nature. However, unlike semantic bootstrapping (Pinker 1984), Schlesinger proposes a non-nativist account of the origin of syntactic categories. He assumes that children start with relational categories that are extremely narrow in scope, and are likely to be verb specific. These expand into syntactic categories through a process of semantic assimilation. For example, at some early point, children have an Agent-Action sentence schema, which they then use to analyze novel NP-VP strings, even though these may not be strictly Agent-Action sequences. The Agent and Action categories progressively expand beyond their original semantic nucleus to yield a broadly extended or "generalized agent" category. As the "generalized agent" category assimilates the subjects of intransitive, stative, and experiential verbs, it transmutes into the grammatical function of **Subject**. For Schlesinger, already acquired rules or patterns are used to analyze new input.

1.2.2.2 Lexically-oriented accounts

Tomasello (1992) proposes the *Verb Island Hypothesis* according to which children learn the combinatorial rules of grammar verb-by-verb, and this knowledge becomes fully systematized only later (see, too, Merriman & Tomasello 1995, Ninio 1988). Along similar lines, Clark (1993) proposes that children learn verbs one by one, perhaps in relative isolation from one another. They do not initially make generalizations about structures or argument configurations, but rather gradually expand the structure associated with each separate verb.

Braine and Brooks (1995) also argue that verb argument structures are learned on a verb-by-verb basis. If children have had experience with a verb, they may use it in an unattested frame provided that its meaning is compatible with the general semantics of the frame. However, once argument structures for a verb have been "solidly learned" (i.e., observed frequently and recently enough), unattested argument structures will be judged inappropriate. Children form constructions on the basis of exposure to many exemplars of similar utterances from which they extract commonalities of both form and function. That is, as children hear a particular verb used repeatedly in one or more constructions – and fail to hear it in other constructions – they begin to infer that these are the only constructions in which that verb may conventionally participate. Under this analysis, children's overgeneralizations are primarily one-shot innovations created under discourse pressure to focus attention on particular participant roles.

Ingram and Thompson's (1996) *Lexical/Semantic Hypothesis* assumes that children's early learning is lexically based, and that early inflectional forms are first acquired as isolated lexical items. In this view, early word combinations can be explained by semantically oriented accounts, to the effect that children assign distinct semantic functions to distinct grammatical forms. Bowerman (1990) similarly proposes that the typical mappings between thematic roles and syntactic functions are not innate, but rather learned on the basis of linguistic experience with a particular target language. For her, thematic roles no longer form a fixed list that can be ordered in a hierarchy. Instead, each thematic role is associated with its own linking rule, and forms a position in a "decompositional" representation of verb meaning: for example, AGENT is the first argument of CAUSE, PATIENT is the second argument of CAUSE, etc.. Bowerman (1997) also argues that constructions of predicate meaning are not innate, but rather based on observation of adult usage of predicates over time. Thus, the first few verbs are acquired based on input, but once children have established a preliminary set of verbs, they pay attention to language typology, and use it to constrain the acquisition of verb meaning and to speed it.

1.2.2.3 Constructivist Accounts

Tomasello, Akhtar, Dodson and Rekau (1997) propose that in the early phases of acquisition, young children do not primarily construct a lexical category of *verb*. Rather, they construct different types of schemas or constructions, with particular

verbs as their central organizing elements, initially on a verb-by-verb basis. These schemas are productive from the outset in that once a "slot" for a particular semantic role in a particular event has been created, any noun that makes sense, even if newly learned, may be placed in that slot and thus play that role.

Similarly, Tomasello and Brooks (1999) argue that from a constructivist perspective, children only gradually acquire linguistic competence in the particular language they are learning. They begin with concrete linguistic structures based on particular words and morphemes, and use a variety of verb island constructions correctly for an extended period of time before they formulate any generalizations. Subsequently, they build up to more abstract and productive structures based on various types of linguistic categories, schemas, and constructions. To learn the adult pattern, children must make appropriate generalizations about the verbs that may and may not occur in particular constructions, and deal with various idiosyncrasies along the way. Children's progress toward adult-like constructions is mostly driven by the adult language they hear, either as independent models of utterances or as discourse replies to their child-like utterances.

1.2.2.4 Distributionally-Based Accounts

Distributionally-based accounts assume that children use distributional evidence in the input to piece together the grammar of their language. Minimal language structure is given from the start, and acquisition is carried out by general-purpose cognitive mechanisms like pattern detection, distributional learning, induction, and hypothesis testing, and these processes are sufficient to guarantee successful grammatical learning.

Bates and MacWhinney (1978) characterize language as a system devised for the purpose of communication and therefore semantic and pragmatic considerations should be preeminent in its structure. Specifically, they propose that the "prototypical" English sentence pattern includes an agent in initial position, followed by a relational term and a patient of the action. In their view, English-speaking children acquire patterns of subject usage like number agreement and pronominal usage earlier for sentences that fit this semantic pattern.

Bates and MacWhinney's (1987, 1989) "Competition Model" is based on connectionist-type learning mechanisms, in which the child looks for form-function mappings through the use of such constructs as "cue validity" and "cue strength" (as

defined in Chapter 1, Section 2.3.3.2). A particular cue will be weighted more heavily if it has high cue validity. Thus, for English, preverbal position tends to be a highly reliable and often available cue for agency. It will correspondingly be assigned greater cue strength than it would in a language like Italian, where word order is less rigidly constrained and semantic roles are marked in other ways.

Maratsos and Chalkley (1981) argue that grammatical constructions draw flexibly and easily from all kinds of analyses – distributional, semantic, pragmatic and phonological. They describe children's earliest speech as a collection of different types of semantic-distributional formulae, with children first analyzing the semantic-distributional behaviors of individual relational terms, without analyzing them as part of a possibly large category. If children apply rules, they initially do so only to those specific terms to which the rules are "directly connected". There is thus little evidence from children's early speech that they are actively attempting to analyze language in terms of underlying well-developed notions of grammatical subject and predicate properties.

Maratsos and Chalkley (1981) suggest instead that children hear terms in certain patterns, and gradually build up a network of patterns and the terms that can appear in them. The interconnections among the various patterns through a particular set of terms constitute the basis for accurate specification of which relational terms can enter into a given semantic-distributional pattern. If a term is recognized as appearing in a given pattern, and if that term is identical to one which has previously appeared in the same semantic-distributional pattern, the bond between the pattern and the term is, in some abstract way, strengthened. If a term appears for the first time in a pattern, the representation of that term now becomes concrete. The essential information children need about a term is at least one semantic-distributional pattern in which it can occur. This will enable them to know which other patterns are also appropriate for that term. Over time, strongly represented patterns become linked with greater strength to a large number of specific lexical items. Finally, children learn that a certain set of terms may appear in correlated uses, so that they need to encode and represent the necessary interconnections among patterns in order to achieve productivity. This is supported by evidence from child language which suggests that children use the participation of terms in shared grammatical patterns to regulate the grammatical usage of these terms, and to make reasonable novel generalizations like *runned* and *knowed*.

Elman (1990) used a computer simulation to examine whether distributed representations could be used to encode grammatical relations. The results of his simulation suggest that networks of the sort he studied can support compositional relationships. His simulation also demonstrated that a long initial period is essential to learning since at first, a network's predictions are random, but with time it learns to predict. The network moves progressively from processing mere surface regularities to representing more abstract information.

Finally, Brent (1994) argues that children can learn verb subcategorization frames from sentences whose meanings they do not fully understand by using approximate local surface cues rather than global constraints to determine syntactic structure. He notes in particular the ability to detect the ends of utterances and knowledge of a few function morphemes and proper names. His simulation experiments on naturally occurring, child-directed English show that these cues combined with the proper inference mechanism do surprisingly well at discovering subcategorization frames. Alternatively, Steedman (1994) found support for the claim that children acquire subcategorization and other aspects of syntax on the basis of semantic and contextual cues, but he also notes that statistical techniques like Brent's can reduce the consequences of errors and misanalyses.

Despite differences in perspective of these various input-based accounts, all share the assumptions that verb and VAS acquisition proceeds in a bottom-up fashion, and initially, on a verb-by-verb basis. All emphasize the role of input and the use of general cognitive strategies in acquisition. These general principles also lie at the base of the developmental model proposed in this study.

1.2.3 Social-Interactional accounts

Social-interactional theories emphasize the communicative aspect of language acquisition. They are identified mainly with pragmatically oriented researchers like Bruner (1983), Ninio (1988), and Ninio and Snow (1988), who hold that the social interactions in which children participate pave the route into language acquisition by emphasizing those aspects of events that will be translated into linguistic forms. Thus, children's knowledge of language evolves through interaction with others as part of a socialization process based on general communicative skills.

On this basis, Ninio and Snow (1988), for example, propose a pragmatic theory of speech production. Their starting point is that the speaker has an intention to carry

out some social communicative act by verbal means. The speaker's *communicative intent* forms the communicative "deep structure" of the utterance he utters in order to carry out his intention. Young children's speech production is also governed by a set of selection rules that selectively reduce the communicative "deep structure" of their utterances.

1.2.3.1 Emergentist Accounts

Hopper (1998) and Thompson and Hopper (1997) propose an "Emergent Grammar" approach to VAS, based on the idea that structure, or regularity, derives from discourse and is shaped by discourse in an ongoing process. Thus, a structure that is emergent is never fixed, or determined, but is constantly open-ended and in flux. Grammar is not uniform, but relative to context, and language is not governed by internalized mentally represented rules, but by preexistent material from which discourse can be devised. To learn a language is thus to expand a repertoire of communicative contexts, so that children do not learn sentences, but rather, they adapt their behavior to increasingly complex surroundings, since the idea of 'verbs' choosing their 'arguments' is inappropriate for most clauses in conversation. Thompson and Hopper's (1997) analyses reveal that most predicates do not have associated real world "scenes", and that the semantic role of many of their arguments is not obvious. They thus argue that argument structure is not a fixed property of predicates in the mental lexicon, but is rather flexible and adaptive to conversational goals. The more frequent a predicate, the less likely it is to have a fixed number of argument structures.

1.2.3.2 Discourse Motivated Accounts

Du Bois (1985, 1987) takes a discourse-functionalist approach to the acquisition of VAS in proposing the notion of Preferred Argument Structure (PAS) to predict the development of VAS. PAS predicts that initially only one lexical argument will be present per clause, and that overt arguments will appear predominantly in S (subject of intransitive), and O (object position), but not in A (subject of transitive verb). Similarly, Clancy (1993) and Allen and Schroder (in press) use PAS to account for the phenomenon of missing arguments in Korean and Inuktitut child language. Their findings indicate that speakers consistently produce only one core lexical argument per clause, which typically appears as S or O but not as A. They attribute this pattern

to pragmatic factors, since only S and O but not A are positions that allow new information to be introduced into discourse.

Social-interactional accounts emphasize the role of communication and social interaction in the acquisition of verbs and VAS. In the model I propose I make a similar claim, with two reservations. I argue, first, that social-interactions and communicative intent are not the only triggers for early acquisition of VAS, and second, that the role of these extralinguistic factors changes across development (see, below, Chapter 7, Section 1.4.1).

In conclusion, the accounts of verb and VAS acquisition presented above differ from one another in important respects. However, as suggested by Hirsh-Pasek and Golinkoff (1996), they also have more in common than is generally assumed, so that they should be viewed not as dichotomic, but as ranging along certain continua. One is a continuum from "linguistic" to "cognitive/social" skills, suggesting that all theories rely on early sensitivities to aspects of language and environment. Another is a continuum concerned with the "mechanism for language learning", suggesting that all theories have some mix of domain-general and domain-specific mechanisms. A third is a continuum from innate to constructed, which suggests that all theories require certain types of information to be available to the learner (Hirsh-Pasek & Golinkoff 1996, pp. 42 - 43). As noted in Chapter 1 (Section 2.2), the model proposed in this study adopts the non-dichotomous approach that all accounts inherently share certain characteristics. In my view, children are assumed to move along the various continua with development, so that, for example, the extent to which they use cognitive as opposed to linguistic skills in acquisition not only differentiates one account from another, but also distinguishes between different developmental phases within a particular account of acquisition. That is, as further detailed below, I aim to incorporate developmental variables as critical factors in evaluating the relative impact of different elements on verb and VAS acquisition.

1.3 Acquisition of VAS in Hebrew

Berman (1993b) argues that, initially, children acquire verbs with one specific argument structure. Use of a verb in a different argument structure demands a morphological operation on the form of the verb. This knowledge builds up as follows: (a) Each verb has a single argument structure; (b) a single verb form can be

used with more than one argument structure; (c) when the initial argument structure of (a) changes, the verb form must change.

Armon-Lotem (1997) examined the order of argument acquisition of three specific verbs: *rcy1* 'want', *ntn1* 'give' and *npl1* 'fall', which show already at the one-word stage. She also examined all verb-containing utterances in the longitudinal data of three Hebrew-speaking children for the first occurrence of each argument structure. Armon-Lotem notes that the heaviest load of VAS acquisition is achieved before age two, with some complex structures showing up after that. Less complex arguments are acquired before more complex ones, and children start with a single argument (subject or object) and gradually extend the number and type of arguments they acquire. She proposes the following order of acquisition: Frozen forms > a single argument (subject or object) > occasional use of more than one argument > bitransitive verbs are used with all three arguments. The phase of "occasional use" is characterized as follows: Indirect objects occur without a preposition, more verbs are used in a frozen form with a prepositional clitic (*tavi li* 'bring me', *tni li* 'give me', *bo elay* 'come to-me'), unaccusatives are used with a subject, and bitransitives are used with a prepositional clitic and a direct object.

Along similar lines, I argue below that VAS acquisition is cumulative, since children initially acquire bare verbs, followed by one argument, and only later by additional arguments.

2. A Proposed Model of VAS Acquisition

The proposed model is "phase-based" in the sense of Karmiloff-Smith (1986, 1992, 1994) and Berman (1986a, 1998a), as outlined in Chapter 1 (Sections 2.3.2.2 and 3), and is motivated as follows. First, the onset of verb acquisition (in terms of chronological age) may vary from one child to another, as is the case for other lexical categories. Also, individual children acquire the different linguistic modules involved in this process at different levels of complexity, and at different rates (see also Berman 1986a, 1997). Certain verbs are acquired earlier than others, so that a particular developmental phase may apply to some verbs before others, and as such it must be recurrent. In this view, input itself undergoes constant analysis, reconstrual, and reorganization, as children proceed from partial, item-based knowledge to adultlike command of the grammar of their native language.

This phase-based model is multi-faceted, and assumes that the acquisition of argument structure is affected by a variety of factors whose relative impact alternates across development. *A priori* correspondences between syntactic and semantic categories are not taken to constitute part of the child's initial knowledge. This type of multi-tiered analysis allows for a highly specified set of form-function correspondences, and takes into account the influence of factors such as morphological complexity and discourse setting in describing the hypotheses that guide children en route to acquisition and mastery of linguistic knowledge.

In what follows, two conceptual issues relating to acquisition of VAS are considered (Section 2.1). My developmental model of verb and VAS acquisition is described, and its predictions are outlined (Section 2.2). Evidence from acquisition of VAS in Hebrew is presented to support my model (Section 3), and the implications of the model for the theory of language acquisition are discussed (Section 4).

2.1 Conceptual Issues in VAS Acquisition

Two major conceptual questions arise concerning acquisition of VAS: How to determine the argument structure of a particular verb, and how the child generalizes different argument configurations of a particular verb into a single lexical entry. These questions have far-reaching theoretical and methodological implications. They are essential for determining whether the argument structure of a given verb has been acquired and for deciding whether argument ellipsis has taken place, since it is only relative to some abstract notion of argument structure that both acquisition and ellipsis can be assessed.

2.1.1 Determining Argument Structure

"Before a child can refer to her linking hierarchies, if she has them, to decide how to handle the arguments of a predicate systematically, she has to know how many arguments the predicate has and what their thematic roles are" (Bowerman 1990, p. 1258).

How can the argument structure of a particular verb be determined? To understand how hard it is to answer this question, consider the following examples from Thompson and Hopper (1997). They give examples from English to show that actual discourse contains many instances of transitive verbs used intransitively, e.g., *That's the best time* ***to find out***, as well as many extensions of argument structure,

e.g., *You can* ***send me $5 to the department*** (cited from Goldberg 1995).[50] Based on these and other data, they argue that transitivity is "indeterminate", in the sense that there are many instances in discourse where the decision whether to call a verb "transitive" or "intransitive" is arbitrary. As a result, it is equally arbitrary whether a verb is assigned a "transitive" or 'intransitive' argument structure if the verbal expression is dispersed across a variety of environments.[51] Thompson and Hopper go so far as to argue that the extent to which a predicate has any argument structure at all is a function of frequency: the more frequent a predicate, the less likely it is to have any fixed number of argument structures (And see, too, Napoli 1993). Such an account creates great difficulties for both the child, who has to acquire VAS despite the indeterminacy of the input, and for the researcher, who has to decide whether a particular verb or verb-class has been acquired based on such confusing data. At the other extreme, nativists like Pinker (1984) or Gleitman (1990) argue that verb argument structures are listed in the lexical entries of particular verbs right from the start, and children uncover them using innate semantic or syntactic knowledge. Each of these proposals gives rise to specific problems (as discussed in Section 1.1.1).

Another relevant factor concerns the perspective from which this question is addressed – child or adult. An adult-based account must yield theoretically different conclusions concerning VAS acquisition than accounts based on children's perspective. A top-down, adult perspective, along the lines of construction grammar and certain generative accounts (e.g., the Full Competence Hypothesis, Poeppel & Wexler 1993) may raise the following problems. First, such accounts avoid the question of how the child moves from concrete to more abstract constructions and from the initial state to the end-state. Second, they presuppose that child grammar is identical to adult grammar, but this is not necessarily the case. On the other hand, a bottom-up, child-oriented perspective, along the lines of Tomasello (1992), raises other problems. For example, it fails to explain children's ability to deal with phenomena like progressive verb morphology on a verb-general basis (Pine, Lieven & Rowland [in press]).

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50 Another related issue in child language is overextension of intransitive verbs to transitive contexts like "causative constructions" as in *I'm gonna* ***fall this paper down*** (Bowerman 1982, and see also Berman 1984, 1993a,b, Lord 1979, Pinker 1989).

51 This discussion is an extension of Hopper and Thompson's (1980) original analysis of transitivity as a continuum. In their earlier analysis, the foci of high and low transitivity are said to correlate with the independent discourse notions of foregrounding and backgrounding, respectively.

Two interrelated conceptual issues are thus relevant to determine the argument structure of particular verbs: theoretical framework (e.g., nativist, emergentist), and perspective (child, adult). On the one hand, I will argue in principle for a bottom-up acquisition of VAS, according to which children acquire argument structures gradually, initially on a verb-by-verb basis. On the other hand, procedurally, I also adopt an adult-based perspective as a yardstick for interpreting children's linguistic performance as well as the goal that they need to achieve.

There is a danger of circularity in determining a verb's argument structure(s) by the data, and then reanalyzing these same data for argument structure. To get around this problem, I adopt the notion of *argument structure patterns*: idealized, fully spelled-out sets of argument structures that include all the obligatory arguments required by a particular verb. For example, the argument structure patterns of a ditransitive verb like *give*, for a transitive verb like *wash*, and for an intransitive verb like *arrive* are SVOI, SVO and SV, respectively. These are defined on the basis of prior linguistic analyses of VAS in Hebrew (Berman 1982, Armon-Lotem 1997, Stern 1979, 1981), and on my intuitions as a native speaker.

The same surface verb may have several different argument structure patterns. For example, *rcy1* 'want' is specified as having the following three argument structure patterns: SVO as in *ani roca tapuax* 'I want-SG-FM apple = I want an apple', SVV(X) as in *ani roca le'exol (tapuax)* 'I want-SG-FM to eat (apple) = I want to eat (an apple)', and SVC as in *ani roca she telxi habayta* 'I want-SG-FM that go-2SG-FM-FUT home = I want you to go home'. Contextual information determines which of the possible argument structure patterns applies to a given utterance. For example, *loh roca* 'not want-SG-FM-PR = (I) don't want' uttered by a child is analyzed as having two missing arguments, a subject and either a direct object, an infinitival complement, or a sentential complement. Given a conversational context in which the child's utterance is an answer to the question *at roca le'exol banana?* 'you-SG-FM roca-SG-FM-PR to eat banana = (do) you want to eat (a) banana', the missing argument in post-verbal position is analyzed as an infinitival complement (cf. *ani loh roca le'exol banana* 'I not want-SG-FM-PR to eat banana = I don't want to eat (a) banana'), see, too, Chapter 2, Section 1.4.4.1.

2.1.2 Generalizing Argument Structure

The second question is how children generalize from individual occurrences of argument structure configurations to the argument structure(s) of a particular verb or verb-class, that is, how they unify different configurations of a particular verb into a single lexical entry. This issue is complicated by several factors. First, certain verbs have multiple options for realization of their argument structure, but not all of these surface structures are well-formed, as illustrated in (2) below (adapted from Clark 1993, p. 38).

(2) The door opened.
The key opened the door.
The man opened the door with the key.
*The man opened.
*The key opened.

A second complicating factor is that the argument structure of a particular verb may not be fully realized in discourse, so children may not be exposed to the full range of arguments a verb can take until later in development (Thompson & Hopper 1997). Third, initially children associate verbs with lexical elements that are not arguments, like functors or adverbials (e. g., *roce od* 'want-SG-MS-PR more'), and these need to be distinguished from arguments at some point.

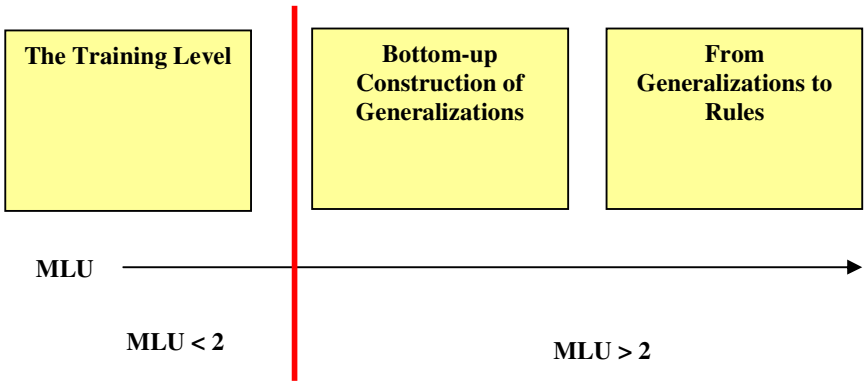
Different approaches have been taken to this question. At one extreme, emergentist accounts claim that no generalizations are possible, since argument structures are indeterminate (e.g., Thompson & Hopper 1997). At the other, lexicalist accounts assume a set of general principles for the generation of argument structure, to avoid the problem of multiple lexical entries for a particular verb (e.g. Rappaport-Hovav & Levin 1998).

The view I propose lies between, or combines these two. Although proponents of "emergent grammar" provide impressive evidence for their claim, I cannot accept that the argument structures of a given verb are indeterminate. Nor do I assume innate principles for generating argument structures. Rather, I argue that bottom-up and top-down approaches need to be combined and integrated. To start with, children construct VAS on the basis of exposure to and experience with individual verbs. These argument structures are initially very concrete and partial, but with time they become more abstract as more occurrences of each verb are encountered and as new verbs enter the children's lexicon.

2.2 A Phase-based Developmental Model of VAS Acquisition[52]

Acquisition is thus viewed as beginning with an initial *input-based period* (early acquisition), followed by an intermediate period of *rule-formation and application* and a subsequent period of *integration between internal rules and external data* (late acquisition), as outlined in Chapter 1 (Section 3). The initial data-driven phase of VAS acquisition as outlined schematically in Figure 6.1, consists of three qualitatively distinct periods: a *Training level* is followed by a period of *Bottom-up construction of generalizations*, and this is followed by a transitional period from *generalizations to rules*.

Figure 6.1 Initial Phase of VAS Acquisition



The *Training Level* constitutes a distinct level, it applies across linguistic modules, is non-recurrent, and has a clear upper bound (MLU 2) since verbs acquired prior to MLU 2 are qualitatively different from those acquired afterwards. This period thus constitutes a kind of "critical period" or "sensitive period" for verb and VAS acquisition. The uniqueness of this initial period has been noted in previous studies of Hebrew (e.g., Dromi 1986, Elisha 1997, Levy & Vainikka 1999) as well as other languages (e.g., Brown 1973 for English, Pizzuto & Caselli 1994 for Italian, and Valian & Eisenberg 1996 for Portuguese).

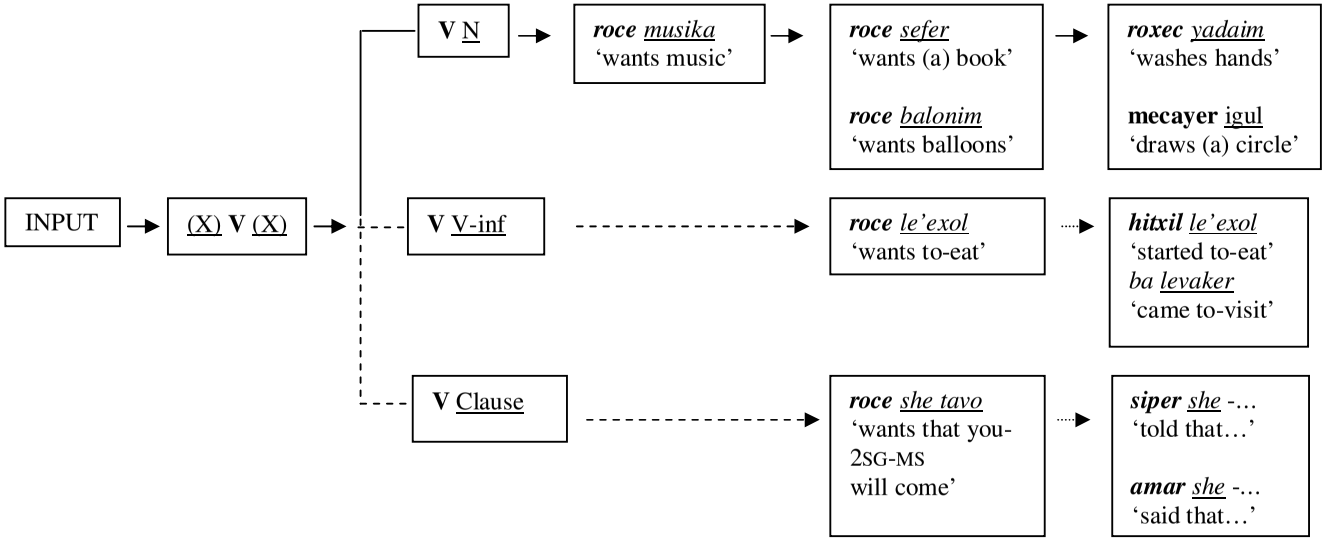
52 The assumption is that this model applies across linguistic systems, not only to VAS acquisition, the focus domain of this study.

Following the *Training Level* is a period of *Bottom-up construction of generalizations*. This period forms an intermediate link between the initial period of VAS acquisition and the period of rule-formation. Unlike the *Training Level*, where there is no explicit evidence for data analysis, reference to *generalizations* suggests that during this period children do analyze and organize linguistic data in a variety of formats (formulae, schemes), but they do not yet formulate rules. In this sense, the initial organization of input into structures is a process of approximation, or schema formation (Bybee and Slobin 1982), one – which unlike what happens later – involves a **bottom-up** construction of generalizations (e.g., Berman 1993a, Braine 1976, Schlesinger 1988, Tomasello 1992, Chapter 1, Section 3.1.2).

Children start out with a particular form, where *form* refers to a possible realization of a category, e.g., plural is a form, a possible realization of the category NUMBER. They later extend both the number of contexts for a particular form and the inventory of forms for a given category. For example, children gradually extend the use of plural to many different verbs, and at the same time start using both singular and plural forms with the same verb. This is illustrated in Figure 6.2 below for the verb *rcy1* 'want'. The verb is marked in bold, and its complements are underlined. Broken arrows mark later development.

Figure 6.2 shows that VAS acquisition begins with the formation of a schema like "*attach a complement to the verb*". The schema does not specify whether or not the complement should be an argument of the verb, or whether it should be attached pre- or post-verbally. This schema yields formulae of the sort [*verb X*] or [*X verb*], initially realized for specific [verb + complement] combinations like [V + N] as in *roce musika* 'want music'. Later, the range of lexical items in this particular context is extended, e.g., *roce musika/sefer/balonim* 'want music/book/balloons'. And, each verb is used with a wider range of complement types (N, V-inf, Sentence), e.g., *roce*

Figure 6.2 Bottom-up Construction of Generalizations



musika 'want music', *roce le'exol* 'want to-eat', *roce she-tavo* 'want that you-will-come = wants you to come'. Subsequently, a particular formula is applied to a wide range of verbs, e.g., *roce musika* 'want-SG-MS-PR music', *roxec yadayim* 'wash-SG-MS-PR hands', *and mecayer igul* 'draw-SG-MS-PR circle'. The transition from individual [verb + complement] combinations to more general formulae, followed by further extension of these formulae indicate that children are beginning to construct more abstract representations of VAS.

Following the period of *Bottom-up Construction of Generalizations* there is a transition *from Generalizations to Rules.* This transition constitutes an important milestone in acquisition, since it marks the shift from partial to full productivity in verb and VAS knowledge (and by extension, in other linguistic modules). Before this period, children tend to replicate the structures modeled by individual verbs in their repertoire. From this period on, acquisition proceeds top-down, since children associate now abstract argument structures ("*meta-argument structures*", as defined below) from their repertoire with new verbs that enter their lexicon. This period is one when innovations and overextensions will occur, to be resolved as children encounter more exemplars while at the same time becoming more proficient in other relevant linguistic modules like morphology and semantics.

VAS is thus represented at three levels of abstraction, that of *realized argument structure*, *argument structure*, and *meta-argument structure*. The first refers to use in actual discourse, while the second and the third refer to mental representations. *Realized argument structures* are those portions of the verb's argument structure that speakers express overtly in discourse, and as such they may include the full argument structure or only part of the argument structure of a particular, and this, too, may vary with each use. The argument structure realization that children produce initially is determined to a large extent by the frequency of the form in the input, and by the context in which the verb is used (see further Chapter 7, Section 1.7). In contrast, *argument structures* are "first round" surface structure representation of different syntactic environments in which a particular verb can occur, that constitute an intermediate level of representation mediating between actual representations and abstract syntactic structure. Finally, *meta-argument structures* refer to underlying, deep-structure representations which are purely formal or categorical, and may also contain semantic, that is, thematic-role generalizations, and are free of specific lexical

content. As such, they are abstract representations of the set of all possible argument structures for a particular verb.[53]

Figure 6.3 Realized Argument Structure, Argument Structure, and Meta-Argument Structure

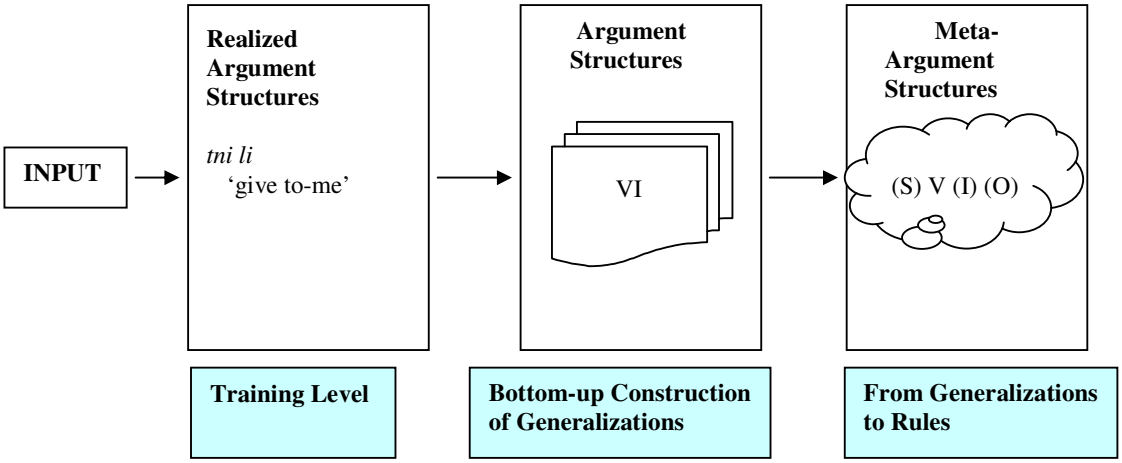


Figure 6.3 provides a specific example to describe Phase I of VAS acquisition with the Hebrew verb *ntn1* 'give'. The initial argument structure of 'give' includes only one combination a [verb + complement] in post-verbal position – VI; this is then extended to include more argument structures, e.g., SVO, SV, VIO, SVIO, and then eventually converge into a more general representation – the verb's meta-argument structure – SVIO.

This characterization of the early phase of VAS acquisition is consistent with both input-based accounts (e.g., Bowerman 1990, 1997, Clark 1993, Tomasello 1992) and predicate-based accounts of argument structure (Borer 1994) as follows. To start, children hear and presumably store a range of verbs from the input; soon after, they start to produce verbs in isolation; and they then proceed to [verb + complement] combinations. The latter are initially rote-learned and characteristic of individual verbs, which are first associated with particular properties that specify what kind of arguments belong in each slot, and what meaning is conveyed by each verb-frame or construction (cf. Clark 1995, Tomasello 1992). As noted, children's early [verb + complement] combinations may involve a [verb + argument] or a [verb + adjunct/functor], e.g., both *roce tapuax* 'want (an) apple' or *roce kaxa* 'want like-that'. I assume that at first children are not aware of the difference between these two

53 It is no coincidence that the terms "surface structure" and "deep" or "underlying" structure call to mind earlier generative analyses (Chomsky 1965, Katz & Postal 1964). However, unlike the essential innatist construals of such notions in generative accounts, the corresponding notions in my model are viewed as being "constructed" in a process of generalization.

types of complements, and that the relevant categorical distinctions emerge only later. Children do, however, know from the very beginning that verbs need not occur alone, but the elements that accompany them are initially semantically and syntactically unspecified.[54] During the *Training Level*, children engage in distributional analyses that help them come up with approximations of argument structures for particular verbs. After encountering enough verbs of varying valency values, they can generalize argument structure representations to entire classes of verbs. As more and more verbs interact with more and more sites to achieve a "critical mass" (Marchman & Bates 1994, Plunkett & Marchman 1993), knowledge becomes increasingly top-down and "constructionist" rather than bottom-up and lexical.[55] From this point on, children assign meta-argument structures from their established repertoire to new verbs that enter their lexicon.

The general progression is thus bottom-up to top-down, from specific items to linear stringing of constructions in which these items occur to hierarchical structures, from most concrete to most abstract, from item-specific to construction-based.[56] This progression is complemented by a "regression", in the sense of retreat from overgeneralization (e.g., Bowerman 1982). Eventually, a full match is achieved between meta-argument structure and verb argument structure, except for cases where speakers make deliberate, knowledge-based, overextensions to unconventional contexts.

For each new level of knowledge to be achieved, it must first attain a "critical mass" as input. This may take several forms – a large enough number: of tokens of a particular verb, of verb types that enter into a given "construction", or of verbs with different valency values. An important issue is whether all of these are sufficient and/or necessary requirements for achieving the level of meta-argument structure. In fact, this is a key issue for acquisition as a whole, beyond the specifics of VAS. A well-motivated answer lies beyond the scope of this study, and would require large-scale longitudinal sampling,[57] supplemented by structured-elicitations and experimental designs.

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54 In fact, Hebrew verbs can occur alone as complete sentences, e.g., *higati* 'arrived-1SG-PT = I have arrived', *nafalti* 'fell-1SG-PT = I fell down'.
55 The term "constructionist" is deliberately used ambiguously as between a constructionist approach in linguistics (Goldberg 1995) and Piagetian constructionism in psychology (Karmiloff-Smith 1992).
56 In some ways, this analysis echoes Berman's (1988, 1995) account of narrative development.
57 Possibly along the lines of the MacArthur Communicative Development Inventories (CDI) cross-sectional studies (see, too, Chapter 2, Section 2.2.1, Chapter 3, Section 1.1).

What is the order of VAS acquisition? In principle, children could acquire VAS in any one of the following orders. (a) They could begin by acquiring bare verbs, proceed to acquire the subject of all verbs in their lexicon, then the direct object of transitive verbs, and so on. (b) They could start by acquiring bare verbs, then proceed to the acquisition of one additional argument for each verb (either subject or direct object), and only later proceed to the acquisition of other arguments. (c) Each verb could be acquired with its complete argument structure right from the start; or (d) the number of arguments initially acquired, and their order of acquisition might depend on the specific verb in each case.

As noted, I argue that children start out with bare verbs, and soon afterwards begin to use unanalyzed [verb + complement] combinations as amalgams. At this early period, VAS acquisition derives from individual verbs. It is not governed by discourse-based principles like Du Bois's (1985, 1987) Preferred Argument Structure (PAS), or by the number of potential arguments a particular verb may have. Thus, verbs with a single argument, like intransitives, are not necessarily acquired before verbs with multiple arguments, like transitives or bitransitives. Instead, children choose which arguments to realize mainly on the basis of what they hear, and on their particular communicative needs. The assumption that early VAS acquisition is input-based can explain the differential order in which children may realize the arguments of verbs with similar meta-argument structures (e.g., *give* and *bring*). It also explains how different children realize the arguments of such verbs. The fact that initially one child uses a particular verb with a subject while another uses it with a direct object can be attributed to differences in the input to which they were exposed. In a similar way, an input-based account handles crosslinguistic variation in VAS realization for particular verbs. That is, if the argument structure of a particular verb is realized differently in different languages, then children who are exposed to that verb in the input will also realize its argument structure as it is used in their target language. After experience with a large amount of data, children's frozen [verb + complement] combinations are replaced by [verb + one-argument] combinations. Now, in addition to the effects of input, principles like PAS become relevant, as demonstrated by the systematicity of argument acquisition beyond the initial, item-based period of learning. That is, at the single-argument phase, intransitive verbs will realize their subject first, transitive verbs their direct objects, and bitransitive verbs their indirect objects (Du Bois 1985, 1987). Eventually, [verb + one-argument] combinations

extend to two or more arguments. Across development, other linguistic modules, particularly morphology and semantics, increase their effect on VAS acquisition. For example, with the acquisition of morphology, the number of null subjects that are morpho-syntactically licensed increases; that is, more subjects are correctly elided in "pro-drop" contexts – 1st and 2nd person past and future tense than in present tense (see, too, Chapter 7, Sections 1.1, 1.2, and 1.6.4).

3. Findings for Phase I

A major problem, both principled and procedural, for any research program is how to relate theory to data and vice versa. That is, what constitutes evidence for a given claim – in the present case, for the proposed model. I try to cope with this dilemma by means of a model that aims to combine the most productive features of current theories of acquisition with a solid basis of authentic language data. The data I rely on seem to be sufficiently varied to prevent context bias, with sampling that is frequent enough to reveal developmental trends that appear generalizable across children and possibly across languages.

3.1 Early Acquisition of Verb Argument Structure

Early acquisition of VAS is analyzed below in relation to the *Training Level* (Section 3.1.1), *Bottom-up Construction of Generalizations* (Section 3.1.2), and *From Generalizations to Rules* (Section 3.1.3).

3.1.1 The Training Level

The initial period of VAS acquisition was characterized as a distinct level. Two types of evidence for the boundedness of the *Training Level* are presented: First, as detailed in Chapter 3 (Section 1.3.1) above, prior to MLU 2 a large percentage of children's verb forms are unclear. Second, as discussed in Chapter 7 (Section 1.6.4) below, most null arguments in children's production are ungrammatical. The present section provides other, qualitative evidence for the boundedness of the *Training Level*.

Consider the development of two early verbs, *gmr1* 'finish' and *lqx1* 'take', in the lexicons of Lior and Smadar, respectively. The data are listed in order of occurrence in the girls' repertoire before and after MLU 2. Verb forms are marked in bold, and arguments are underlined.

(3a) **Occurrence of the Verb *gmr1* 'finish' as Used by Lior before and after MLU 2**

MLU	***gmr1* 'finish' [Lior]**
< 2	***gamarnu*** 'all done'
	gamarta *ima/ima* ***gamarta*** finish-2SG-MS-PT Mommy = 'finished Mommy/ Mommy finished'
> 2	*gam* *ani* ***gamarti*** *kvar* *gan* also I finish-1SG-PT already kindergarten = 'I finished kindergarten already, too'
	gamarti *la-gan* finish-1SG-PT to kindergarten = 'I finished (going) to kindergarten'
	nigmor *et ha-marak* finish-1PL-FUT ACC the soup = 'we'll finish the soup'
	hu ***gamar*** he finish-3SG-MS-PT = 'he finished'
	ani ***egmor*** *et ha-glida* I finish-1SG-FUT ACC the ice-cream = 'I'll finish the ice-cream'
	gamarti *et ha-glida* finish-1SG-PT ACC the ice-cream = 'I finished the ice-cream'
	gamarti *im beyt-shimush* finish-1SG-PT with toilet = 'I finished (using) the toilet'
	at ***gamart*** *et ha-mic* you-2SG-FM finish-2SG-FM-PT ACC the juice = 'you finished the juice'

(3b) **Occurrence of the Verb *lqx1* 'take' as Used by Smadar before and after MLU 2**

MLU	***lqx1* 'take' [Smadar]**
< 2	***kxi*** take-2SG-FM-IMP = 'take!'
	ima ***kxi/kxi*** *ima* Mommy take-2SG-FM-IMP = 'Mommy take/take Mommy'
	ima ***kax*** *teyp*/***kax*** *teyp* *ima* Mommy take-2SG-MS-IMP tape = 'Mommy take (the) tape/take (the) tape Mommy'
	kxi *buba* take-2SG-FM-IMP doll = 'take (a) doll'
	kax *sus* take-2SG-MS-IMP horse = 'take (a) horse'
	kxi *od* *domino* take-2SG-FM-IMP more dominoes = 'take more dominoes'

MLU	***lqx1* 'take' [Smadar]**
> 2	***kxi*** *et ha-teyp shelax* take-2SG-FM-IMP ACC the tape of-you = 'take your tape'
	gam Rolf, ani ***lokaxat*** also Rolf, I take-1SG-PR = 'I'm taking Rolf, too'
	kxi *et kol ha-koxavim* take-2SG-FM-IMP ACC all the stars = 'take all the stars'
	ani ***lokaxat*** *shteyhen* I take-1SG-PR both-of-them = 'I'm taking both'
	tixki *sha'on ima* take-2SG-FM-FI watch Mommy = 'take (a) watch Mommy'
	kxi *et ze* take-2SG-FM-IMP ACC it = 'take it'
	ve az ***lakaxti*** *otam* and then take-1SG-PT them = 'and then (I) took them'
	ani ***ekax*** *et ha-tik* I take-1SG-FUT ACC the bag = 'I'll take the bag'

The two girls show similar developmental trends independently of one another, and independently of the verb being acquired. **Before MLU 2**, each verb is first acquired with no arguments in a unique morphological-form, and then it is used in that early form with a single complement. Initially, a particular complement occurs in different positions (i.e., pre- or post-verbally), and then different members of a particular lexical category (Noun, in this case) occur in the same syntactic position (e.g., direct object position). **After MLU 2**, verbs are used in a variety of morphological forms (e.g., *gamarti*-1SG-PT, *nigmor*-1PL-FUT, *gamar*-3SG-MS-PT, *kxi*-2SG-FM-IMP, *lakaxti*-1SG-PT, *lokaxat*-SG-FM-PR, etc.), with variety of complement types, and with different arguments (with an overt subject, direct object or both, etc.).

(4) lists examples of verbs that entered the children's lexicon prior to MLU 2 as compared with other verbs that entered their lexicon after MLU 2.

(4) **Verbs Used by Smadar, Leor and Lior before and after MLU 2**

MLU	Verb
< 2	***osim*** [Leor] make/do-PL-MS-PR = '(they are) making'
	megaleax [Leor] shave-SG-MS-PR-TRNS = '(he is) shaving'
	loh ***(li)goa*** [Leor] not touch-INF = '(do) not touch'
	ten [Smadar] give-2SG-MS-IMP = 'give!'
	ftax *kan yofi* [Smadar] open-2SG-MS-IMP here good = 'open here! good'
	(hicl)axti [Lior] manage-1SG-PT = '(I) managed'
> 2	***ne'elam*** *ha-mocec shel ha-dod* [Smadar] disappear-3SG-MS-PT the pacifier of the man = 'the man's pacifier disappeared'
	axshav Benc al Arik nora ***koes*** [Smadar] now Benc at Arik (is) very angry = 'now Benc is very angry at Arik'
	ani meod ***ozeret*** *lax* [Smadar] I a lot help-SG-FM-PR to-you = 'I'm helping you a lot'
	ani roca ***la'azor*** *lax* [Smadar] I want-SG-FM-PR to help to-you = 'I want to help you'
	ima ***ta'azri*** *li* [Smadar] Mommy help-2SG-FM-FI to-me = 'Mommy help me!'
	ani ***e'ezor*** *lax* [Smadar] I help-1SG-FUT you = 'I'll help you'
	axshav ani ***aklit*** [Smadar] now I record-1SG-FUT = 'now I'll record'
	ve hine hi ***arza***…[Smadar] and there she pack-3SG-FM-PT = 'and there she packed'
	oto ***mecafcef*** [Leor] car honk-SG-MS-PR = '(a) car is honking'
	ze ***mecafcef*** [Leor] it honk-SG-MS-PR = 'it is honking'
	roce *axar-kax lehadbik* [Leor] want-SG-MS-PR later to paste = 'wants to paste (something) later'
	ta'asof *et kol ha-ca'acuim* [Leor] collect-2SG-MS-FI ACC all the toys = 'collect all the toys!'
	ta'azvi *et ze* [Leor] leave-2SG-FM-FI ACC it = 'leave it!'
	ba-gan shel Yonatan ani ***gar*** [Leor] in-the kindergarten of Yonatan I live-SG-MS-PR = 'I live in Jonathan's kindergarten'

These examples show that verbs acquired prior to MLU 2 are qualitatively different from ones acquired later in one major respect. Early verbs occur with **no** overt arguments, yielding ungrammatical utterances. Later verbs, on the other hand,

occur with **null arguments** (i.e., missing arguments in *pro-drop* contexts), or with arguments in a range of configurations (see, further, Chapter 7, Sections 1.6.4, 1.6.6 below, also Armon-Lotem 1997, Berman 1990).

Examples (5a) and (5b) illustrate early interactions between Keren Dromi (1;5;28, MLU 1.57) and her mother, taken from the CHILDES database.[58] In both, Keren uses a plural verb form to talk about a singular subject. In the first interaction (5a), she uses a plural verb form to talk about her parents just as she does to talk about her aunt Merav. When her mother refers to the aunt in the singular form, Keren corrects her by offering the plural verb form.

(5a) **Example of an Early Interaction between Keren Dromi and her Mother**

Keren *ima aba* ***bou***
Mom Dad come-**2PL**-IMP = 'Mom and Dad come!'

Mother *at mesaperet la-teyp she ima ve aba* ***bau***
You-2SG-FM tell-SG-FM-PR to-the tape that Mom and Dad come-**3PL**-PAST =
'you are telling the tape that Mom and Dad came'

Mother *le-mi at mesaperet she ima ve aba* ***bau***
To whom you2SG-FM tell-SG-FM-PR that Mom and Dad come-**3PL**-PAST =
'Whom are you telling that Mom and Dad came'

Keren *Meravi* ***bau***
Meravi-3SG-FM come-**3PL**-PAST = 'Meravi came'

Keren *Merav* ***bau***
Merav-3SG-FM come-**3PL**-PAST = 'Merav came'

Mother *Meravi gam* ***ba'a****?*
Meravi also come-**3SG**-FM-PT = 'Meravi came, too?'

Keren ***bau****…*
come-**3PL**-PAST = 'came'

Mother *at omeret le-Meravi* ***bou***
you say to Meravi come-**2PL**-IMP = 'you say to Meravi: come!'

In the second interaction (5b), Keren uses the plural verb form to call a dog. When her mother uses the singular form, she starts using the same singular verb form herself, imitating her mother.

58 Examples from an extremely detailed diary study of a Hebrew-speaking child (Dromi 1986) given in (5a) – (5b) show the advantage of the case-study data collection. However, this method is not straightforwardly generalizable across children and across languages as noted for English by Clark (1993), Karmiloff-Smith (1979).

(5b) **Example of an Early Interaction between Keren Dromi and her Mother**

Keren *kelev* ***bou****!*
dog come-**3PL**-IMP = 'come dog!'

Mother *kelev* ***bo*** *el Kereni!*
dog come-2SG-MS-IMP to Keren = 'dog come to Keren!'

Mother ***bo*** *kelev!*
come-**2SG**-MS-IMP dog = 'come dog!'

Keren ***bo****!*
come-2SG-MS-IMP

Mother ***bo****!*
come-2SG-MS-IMP

These two interactions suggest that Keren first rote-learned the verb 'come' in a particular morphological form, and later changed it (as a result of parental input). A similar example for the use of the verb *gmr1* 'finish, end' is illustrated by the following interaction from my database between Lior (1;11;13, MLU 2.07) and her mother (6).

(6) **Use of *gmr1* 'finish' in an Early Interaction between Lior and her Mother**

Mother *ima* ***gamarta****?*
Mom finish-2SG-**MS**-PT = 'Mom, did you finish?

Mother *ma* ***gamarti****, ken.*
What finish-**1SG**-PT yes = 'what did I finish, yes (I did)'.

Lior ***gamarti*** *ima.*
finish-**1SG**-PT Mom = 'I finished Mom'

Mother *ken,* ***gamart****, ima* ***gamart****, loh* ***gamarti****,* ***gamart****.*
yes, finish-**2SG**-FM-PT, Mom finish-**2SG**-FM-PT, not finish-**1SG**-PT, finish-**2SG**-FM-PT = 'yes, finished, Mom finished, not I finished, finished'

Lior ***gamarti*** *ima?*
finish-**1SG**-PT Mom = 'I finished Mom?'

Mother ***gamart*** *ima?*
finish-**2SG**-FM-PT Mom = 'Are you finished Mom?'

Lior ***gamarti****?*
finish-**1SG**-PT = 'Am I finished?'

Mother ***gamart*** *ima? tagidi od pa'am.*
finish-**2SG**-FM-PT Mom say one more time = 'are you finished Mom? Say (it) one more time'

Lior ***gamart*** *ima.*
finish-**2SG**-FM-PT Mom = 'you're finished Mom'

Mother *ken,* ***gamarti****.*
yes finish-**1SG**-PT = 'yes, I'm finished'

Lior ***gamarti****.*
finish-**1SG**-PT = 'I'm finished'

At the beginning of the interaction, Lior addresses her mother with a masculine 2nd person verb form. Her mother replies in the 1st person, which Lior then incorrectly

repeats to confirm her mother's finishing of some action. Lior's mother tries to correct her by introducing the 2nd person feminine verb form, but Lior repeats the 1st person verb form again. After two additional corrections, Lior correctly uses the 2nd person feminine verb form to address her mother. But when her mother replies in the 1st person, the child incorrectly repeats this form again to talk about her mother. This example, too, shows that the child learns a particular verb form for *gmr1* 'finish', and uses it regardless of the required gender and person agreement, and that any changes in this verb form are the result of imitating parental input rather than through applying a subject-verb agreement rule.

Along similar lines, (7a) – (7f) display a group of other typical examples for the early use of [verb + complement] combinations.

(7) **Typical Early [Verb + Complement] Combinations**

a.	**Lior [1;6]**	Mother:	*ma ze, Lior, ma* ***at osa****?* what this, Lior, what you-2SG-FM do-2SG-FM-PR = 'What's this, Lior, what are you doing?'
		Lior:	***tusa [: at osa].*** you-2SG-FM+do-2SG-FM-PR = 'you+do'
b.	**Lior [1;7]**	Mother:	*ani* ***e'ezor*** *lax?* I help-1SG-FUT you-2SG-FM = 'I'll help you'
		Lior:	***azor [: la'azor] lax.*** help-INF you-2SG-FM = 'to help you (instead of *me*)'
c.	**Lior [1;8]**	Mother:	*ma* ***nafal****?* what fall-down-3SG-MS-PT = 'What fell down?'
		Lior:	***fal [: nafal] la.*** fall-down-3SG-MS-PT to-her = 'fell down to her'
d.	**Lior [1;9]**	Lior:	***tora [: at roa].*** you-2SG-FM+see-2SG-FM-PR = 'you+see'
		Mother:	*ani loh roa, ani loh yoda'at le-ma at mitkavenet, at omeret li:* ***at roa****.* I not see-2SG-FM-PR, I not know-2SG-FM-PR to what you mean-2SG-FM-PR, you say-2SG-FM-PR to-me: you see-2SG-FM-PR = 'I don't see, I don't know what you mean, you say to me: you see'
e.	**Hagar [1;9]**	Hag:	***ni li, ni li [: tni li].*** give-2SG-MS-IMP to-me give-2SG-MS-IMP to-me = 'gimme, gimme'
f.	**Hagar [1;9]**	Hag:	***bo elay.*** come-2SG-MS-IMP to-me = 'come to-me'

Examples (7a) and (7d) show that children pronounce some of these configurations as morpho-phonological amalgams, for example, *torá* 'you+see' instead of *àt roá* 'you see'. Example (7b) shows that children do not inflect pronouns for the correct person, as in *azor* ***lax*** 'help you': Lior repeats the 2nd person pronoun used by her mother to talk about herself (cf. *azor* ***li*** 'help me'). Example (7f) shows

that children use excerpts from nursery rhymes, e.g., *bo elay* 'come to-me' is part of a nursery rhyme in which a child asks a butterfly to come and sit on her hand. These early configurations are each used with a single verb in a unique morphological form and with a single pronoun. Their constituent order is fixed, and they do not extend to other verbs or other lexical items. Also, children use these configurations very frequently. For example, Lior used the amalgam *azor lax* in 69% of all occurrences of the verb *izr1* 'help' before MLU 2 (N = 29), and *fal* 'fell' in 63% of all occurrences of the verb *npl1* 'fall' (N = 16). Smadar used the amalgam *sim po* 'put here' in 68% of all occurrences of the verb *sym1* 'put' before MLU 2 (N = 25). This suggests that children initially use each verb-argument configuration in isolation, as unanalyzed amalgams, and that they do not generalize from one configuration to another. These data corroborate findings on the acquisition of inflectional morphology, early word combinations, and causative verb usage in other languages (MacWhinney 1978, 1982, Bowerman 1974, 1982). They are also in line with evidence that early verbs are initially acquired in a unique morphological form, and that at first Hebrew-speaking children do not use a particular consonantal root in more than one verb-pattern (Chapter 3, Sections 1.3.2, 1.4).

During the *Training Level*, children engage in distributional analyses to help them come up with approximations of argument structures for particular verbs. Table 6.1 uses a specific example to support this claim. The Table shows the distribution of early VAS for the verb *spr3* 'tell' in data from Lior and her mother before and after MLU 2 (*I* stands for Indirect Object and *C* for Sentential Complement).

Table 6.1 Distribution of Early VAS for *spr3* 'tell' in Lior and her Caregiver's Data

Verb Form	MLU	Speaker	v	sv	vo	vi	vc	svi	svo	vio	vic	svio	svic	Total
tesapri	≤2	Mother				2					1			3
tell-2SG-FM-FI		Lior												0
	>2	Mother				15	2			7	5			29
		Lior				2								2
mesaperet	≤2	Mother	1					2	1				3	7
tell-SG-FM-PR		Lior		1										1
'(she's) telling'	>2	Mother		1	1			1	2			4		9
		Lior				2		1	1					4
siparti	≤2	Mother												0
tell-1SG-PT		Lior												0
'I told'	>2	Mother												0
		Lior				2		1		1	1			5
Total tokens	all	Mother	1	1	1	17	2	3	3	7	6	4	3	48
		Lior	0	1	0	6	0	2	1	1	1	0	0	12

The data show a correlation between the distribution of particular argument structures in the input and their subsequent use by Lior. This suggests that Lior is attentive to her caretaker's input, and that she processes this input to produce similar patterns, much like what was found for children's early choice of verb morphology. As noted, children "record" the extent to which a particular verb form is used in the input, and initially favor forms that occur more frequently to less frequent uses, suggesting that they may be engaged in distributional analyses (Chapter 3, Section 1.3.2).

3.1.2 Bottom-up Construction of Generalizations

During the period of *bottom-up construction of generalizations* children are still not engaged in rule-formation – most of their [verb + complement] combinations are verb-specific, and characteristic of individual children (see, too, Chapter 1, Section 3.1.2). This is supported by the following data showing that children first use a particular verb form with a specific lexical item a large number of times. For example, Leor uses the cluster *roce musika* 'want-SG-SM-PR music' in nine out of ten occurrences of the verb *rcy1* 'want', and *sagarnu or* 'turn-off-1PL-PT (the) light' in eight out of twelve occurrences of the verb *sgr1* 'turn off' prior to MLU 2 (see, too, example (7) above). These data suggest that children's early [verb + complement] combinations are not productive.

Their preliminary attempts at forming some kind of generalization occur when they use unanalyzed verb forms with a specific complement interchangeably in pre- and post- verbal positions. For example, Lior alternates *ima gamarta* 'Mommy finish-

2SG-MS-PT = Mommy, you finished' with *gamarta ima* 'finish-2SG-MS-PT Mommy', and Smadar alternates *nafal domino* 'fall-3SG-MS-PT domino' with *domino nafal* 'domino fall-3SG-MS-PT = (the) domino dropped'. These alternations indicate that children start hypothesizing on the possible positions of verb-complements in their language. This is similar to the "groping patterns" noted by Braine (1976), as follows: "the child is groping to express a meaning before he has acquired a sufficient set of rules for its expression" (p. 10). He notes that children produce these patterns with an apparently free word order, in a small number of combinations, and often with uncertainty and effort. A groping pattern typically exists for a short time, it is the first attempt by a child to express a particular meaning with the lexical items that make up that pattern, and over time, it is replaced by a positional productive pattern (characterized by non-free word order and productivity).

Along with a brief use of "groping patterns", children start using [verb + one-argument] combinations, which are initially restricted to particular verbs, differing across individual children. Unlike early [verb + complement] clusters, these include a particular verb form followed by a wide range of lexical items, much like Braine's "positional productive patterns". This is illustrated in (8a, b) with data from Smadar and Leor (MLU = 2).

(8a) **Examples of Smadar's Early [Verb + One Argument] Combinations**

Verb	**Examples**
lqx1 'take' [V N]	***kxi*** *buba* take-2SG-FM-IMP doll = 'take (a) doll' ***kax*** *sus* take-2SG-MS-IMP horse = 'take (a) horse' ***kxi*** *od domino* take-2SG-FM-IMP more dominoes = 'take more dominoes'
npl1 'fall' [N V]	*sefer* ***nafal*** book fall-3SG-MS-PT = '(a) book fell' *Pigi* ***nafal*** Piggy fall-3SG-MS-PT = 'Piggy fell' *Gonzo* ***nafal*** Gonzo fall-3SG-MS-PT = 'Gonzo fell' *domino* ***nafal*** Dominoes fall-3SG-MS-PT = 'dominoes fell'
npl1 'fall' [V N]	***nafal*** *moceci* fall-3SG-MS-PT pacifier = '(the) pacifier fell' ***nafal*** *domino* fall-3SG-MS-PT dominoes = 'dominoes fell' ***nafal*** *Kushi* fall-3SG-MS-PT Kushi = 'Kushi fell' ***nafal*** *mixse* fall-3SG-MS-PT lid = '(the) lid fell'

Verb	Examples
isy1 'make/do'	***ose*** *esh*
[V N]	make-1SG-MS-PR fire = 'makes fire'
	ose *anan*
	make-1SG-MS-PR cloud = 'makes (a) cloud'
	ose *hav hav*
	goes-1SG-MS-PR woof woof = 'goes woof woof'

(8a) shows examples from Smadar for [verb + one-argument] combinations. Smadar uses each of the verbs *lqx1* 'take' and *isy1* 'make/do' and *npl1* 'fall' in a particular morphological form (*kxi*-2SG-FM-IMP, *ose*-SG-MS-PT, *nafal*-3SG-MS-PT), with a single argument – either subject or direct object. Each argument position is filled with a wide range of nouns. However, unlike the two other verbs, the unaccusative verb *npl1* 'fall' is used in **two** syntactic patterns SV ~ VS, as permitted in Hebrew.

(8b) **Examples of Leor's Early [Verb + One Argument] Combinations**

Verb	Examples
sgr1 'turn off'	***sagarnu*** *or*
[V N]	turn-off-1PL-PT light = '(we) turned off (the) light'
	sagarnu *sefer*
	close-1PL-PT book = '(we) closed (the) book'
	sagarnu *ha-meavrer*
	turn-off-1PL-PT the fan = '(we) turned off (the) fan'
rcy1 'want'	***roce*** *mayim*
[V N]	want-SG-MS-PR water = 'wants water'
	roce *psanter*
	want-SG-MS-PR piano = 'wants (a) piano'
	roce *tmuna*
	want-SG-MS-PR picture = 'wants (a) picture'
	roce *sefer*
	want-SG-MS-PR book = 'wants (a) book'
	roce *tushim*
	want-SG-MS-PR coloring pens = 'wants coloring pens'

Leor also uses each verb in a particular morphological form – *sgr1* 'close, turn off' in the 1st person plural past, and *rcy1* 'want' in the singular masculine present form, each with a single argument in direct object position, instantiated by a range of nouns. A similar pattern was reported by Braine (1976) for another Israeli girl named Odi, recorded in weekly play sessions from 23 to 26 months, MLU about 1.4. Odi used the verbs *ntn1* 'give,' and *ray1* 'see' in a particular morphological form, with a single argument. Braine notes that *ten/tni li X* 'give-2SG-FM/MS-IMP' was used with nouns like *kova* 'hat', *mayim* 'water', *oto* 'car', *ze* 'it', *kacefet* 'whip cream', and *te* 'tea' as a formula for request forms. *tire/tiri X* 'SEE-2SG-FM/MS-FI' was used with *kos* 'glass', *susim* 'horses', *ofanayim* 'bicycle', *rakevet* 'train', *kise* 'chair', *buba* 'doll', and *kova* 'hat' to indicate or identify things. Odi also used *eyn* 'there isn't' (*tipot-af* 'nose-

drops', *masmer* 'nail'), and *ose* 'make/do-SG-MS-PR' (*nadned* 'swing', *bayit* 'house', *brr*) in a few [verb + direct object] combinations.

In sum, these examples show that even though each of the children used a different group of verbs, they used each verb in a particular morphological form, and with a single argument. The lack of lexical and morphological variation, and of flexibility in argument position (i.e., each verb occurs with a single argument either in subject or direct object position but not in both, except for Smadar's *npl1* 'fall'), suggest that children's behavior is of limited scope, and therefore not rule-bound. On the other hand, certain phenomena suggest that children do form some kind of generalizations about VAS, and no longer use rote-learned combinations. These phenomena include the wide range of nouns used in each argument position, the attested positional consistency of the arguments (unlike the "groping pattern"), and the non-random SV ~ VS alternation, which is permitted in Hebrew with unaccusative verbs like *npl1* 'fall'. These early generalizations are formed bottom-up, initially for a limited set of verbs. But, with exposure to a larger mass of input, their number increases and they become more abstract, as will be discussed in the following section.

3.1.3 From Generalizations to Rules

I argued earlier that as more verbs interact with more sites to achieve a "critical mass", knowledge becomes increasingly top-down and constructionist rather than bottom-up and lexical. That is, children associate meta-argument structures from their already established repertoire with innovated verbs, as illustrated in (9).

(9) **Examples of InnovativeVerbs Used in Familiar Argument Structure Configurations**

a. Mother: *hine, ma ani osa?*
'there, what am I doing?'

Smadar: ...***megida*** *et ha-shafan.*
megida-SG-FM-PR ACC the bunny

Mother: *ve ma ha-shafan ose?*
'And what does the bunny do?'

Smadar: ***mangid*** *et acmo.*
mangid-SG-MS-PR ACC himself

Mother: *ve ma ani osa im ha-barvaz?*
'And what am I doing with the duck?'

Smadar: ***mangida*** *oto.*
mangida-SG-FM-PR him

Smadar [2;0]

b. Mother: *hine, tir'i, ma ani osa?*
'There, look, what am I doing?'

Smadar: *at* ***bodeshet*** *et ha-pil.*
you are **bodeshet**-SG-FM-PR ACC the elephant

Smadar [2;1]

c. Smadar: *ve ani ve Miryam ve Yael* ***higadnu*** *la-ponim lehitra'ot.*
and I and Miriam and Yael **told**-1PL-PT to-the ponies see-yea

Smadar: ***higadti*** *lo she hayinu ba-yam.*
told-1SG-PT him that we-were at sea

Smadar: ***higadti*** *le-aba she hitraxacnu.*
told-1PL-PT to-daddy that we-washed (ourselves)

Smadar [2;1]

d. Smadar: *Yael* ***higida*** *li masheu.*
Yael **told**-3SG-FM-PT to-me something

Smadar: *shamatem she* ***higadeti*** *lo shalom?*
Did you hear that I **told**-1PL-PT to-him good-bye?

Smadar [2;3]

e. Leor: *ma savta* ***mebabashet****?*
what grandma ***mebabashet***-SG-FM-PR

Aunt: *ma savta ma?*
'What grandma what? = Grandma does what?'

Leor: ***mibabeshet****.*
mibabeshet-SG-FM-PR

Aunt: *savta mitlabeshet? savta loh mitlabeshet.*
'Grandma (is) getting dressed-FM? grandma (is)not getting-dressed-FM'

Leor: *savta* ***mibaybaesh.***
grandma ***mibaybaesh***-SG-MS-PR

Leor [2;3]

The verb forms in (9a, c) are derived from the common child language forms *tagidi* 'say-2SG-FM-FI' and *lehagid* 'say-INF', and overextend existing verb forms to fill a morphologically defective paradigm. Lexically, except in the future, imperative, and infinitive, a suppletive form is used for *say* (*amr1* 'say', or *spr3* 'tell'). Phonologically, the root initial *n* (which occurs in Smadar's *ma**n**gida*) does not, in fact, show up in any of the adult forms (cf. adult *nafal – yipol* vs. children's *nafal – yi**n**pol* 'fall down', *natati – nata**n**ti* 'give-1SG-PT', *esa – e**n**sa* 'go (by car)-1SG-FUT'). The verb form in (9b) is a genuine innovation based on a novel item presented to Smadar as a nonexistent input verb in an experimental design conducted by her mother (Alroy 1992, Braine, Brody, Fisch, Mara & Bloom 1990). Smadar used this form in her spontaneous output a day or two later. The verb form in (9e) is a blend of *mitlabeshet* 'gets dressed-FM and *mitbayeshet* 'is ashamed-FM'. These innovations demonstrate that children use novel or self-created verbs in familiar patterns, rather

than inventing new argument structures for such verbs. This suggests that children form these verbs by applying a rule rather than by rote-learning.

This period is also characterized by overextensions. Examples (10a) – (10c) illustrate this with the Hebrew particular phenomenon of morphological verb-pattern alternation for marking verb-transitivity (Berman 1980, 1982, 1986a, 1993a,b).[59] Examples (10a) – (10c) show Leor's uses of verbs from the root *n-p-l* 'fall down': (a) illustrates the basic or intransitive verb in the P1-pattern in a correct intransitive context; (b) shows the same verb form used as incorrect overextension to a transitive context; and (c) shows a correct shift of verb-pattern morphology to a causative pattern (P5) in a transitive context.

(10) **Development of Predicate-Argument Relations [Leor 1;10 – 3]**

a. ***npl1* 'fall-down-INTR'**

nafal [1;10]
fall-3SG-MS-PT = 'fell'

nafalti [2;4]
fall-1SG-PT = '(I) fell'

safta nafla [2;4]
grandma fall-3SG-FM-PT = 'grandma fell'

ani epol [2;4]
I fall-1SG-FUT = 'I will fall'

b. ***npl1* 'fall-down-INTR' Extended Incorrectly to Transitive-Causative Contexts**

ani epol otax [2;8]
I fall-1SG-FUT you-2SG-FM
'I will fall you = I'll drop you'

nopel otax [2;8]
fall-SG-MS-PR you-2SG-FM
'(I) fall you = I drop you'

c. ***npl5* 'drop' *(Alternates with P1)* Used Correctly as Causative**

hipalti otax [2;10]
make-fall-1SG-PT you-2SG-FM
'(I) dropped you'

ha-katar hipil ota [2;11]
the locomotive make-fall-3SG-MS-PT her
'The locomotive dropped her'

ani apil lax me-ha-rosh [3;0]
I make-fall-1SG-FUT to-you-2SG-FM from-the-head
'I will make-fall to-you from-the-head = I'll drop (something) off your head'

Leor first uses the root *n-p-l* in the P1 pattern for the intransitive verb 'fall'. Next, he overextends the use of intransitive *n-p-l* in the P1 pattern to denote the

causative action 'make-fall = drop' which is highly ungrammatical, and requires a change in verb-pattern to mark the switch from intransitive to transitive (cf. P5 *hipil*). The example in (b) shows that Leor already knows that he needs to use a transitive verb in order to form a causative sentence, but he still does not know how to encode causativity through morphology (i.e., by verb-pattern alternations). Only at around age 3 does Leor start to alternate the familiar P1 pattern (which he initially used with the root *n-p-l*) with the P5 pattern to yield the causative *hipil* 'drop'.

Another example of children's overextensions is from Leor at 2;8 in interaction with his aunt, Orly. Here, he overextends the use of *a-k-l* 'eat' in the P1 pattern (i.e., *oxelet* 'eat-SG-FM-PR') to denote the causative action 'feed' (cf. P5 *ma'axila* 'feed-SG-FM-PR').

(11) **Example of Leor's Overextended Use of *akl1* 'eat'**

Aunt: *ve ma doda Orly osa?*
and what aunt Orly do-SG-FM-PR
'And what's aunt Orly doing?'

Leor: ***oxel*** *et Leori*
eat-SG-MS-PR ACC Leor = 'eating Leori'

Aunt: *ma doda Orly osa?*
what aunt Orly do-SG-FM-PR
'What's aunt Orly doing?'

Leor: ***oxelet*** *et Leori*
eat-SG-FM-PR ACC Leor = 'eating Leor'

Aunt: ***oxelet*** *et Leori? Doda Orly* ***ma'axila*** *et Leori, loh* ***oxelet*** *et Leori, naxon? naxon Leori, ma doda Orly osa axshav?*
eat-SG-FM-PR Leor, aunt Orly feed-SG-FM-PR ACC Leor, not eat-SG-FM-PR ACC Leor, right? right Leor, what aunt Orly DO-SG-FM-PR now
'eating Leori? Aunt Orly is **feeding** Leori, not **eating** Leori, right? Right, Leori, what is aunt Orly doing now?'

Leor: ***oxelet*** *et Leori*
eat-SG-FM-PR ACC Leor = 'eating Leor'

Aunt: *ma doda Orly osa?*
what aunt Orly do-SG-FM-PR
'What's aunt Orly doing?'

Leor: ***oxelet*** *et Leori*
eat-SG-FM-PR ACC Leor = 'eating Leori'

Aunt: ***oxelet*** *et Leori?*
eat-SG-FM-PR ACC Leor = 'eating Leori?'

Leor: *ken*
yeah

59 These occurrences lie in the domain of derivational morphology, which has been noted to follow inflectional morphology (Berman 1993a,b; see, too, Chapter 3, Section 1.4 above).

As with the overextension of intransitive *n-p-l* 'fall down' in the P1 pattern (example (b) above), Leor already knows that he should use a transitive verb to denote the feeding action. This is evident from his use of the verb 'eat' with the accusative marker *et* followed by a direct object to describe a feeding situation. He still does not know that causativity is encoded in Hebrew through morphology (i.e., by verb-pattern alternation). As a result, he does not see the difference between *oxelet* 'eat-SG-FM-PR-INTR' and *ma'axila* 'feed-SG-FM-PR' to which his aunt draws his attention, and continues to use the overextended form. These examples are not limited to Leor. Hagar shows very similar patterns of development, as do other Hebrew-speaking children studied by Berman (1980, 1982, 1985, 1993a,b), who notes that Hebrew-speaking children recognize that the grammar of their language requires morphological marking of argument structure alternations, typically from around age 3, after simple clause structure is established. In sum, the following developmental pattern emerges: (1) Transitive or intransitive verbs are used in only one appropriate context (from age 1;9 to 2;7); (2) Intransitive verbs are overextended to transitive contexts and vice versa (around age 2;8); (3) Transitive and intransitive verbs are used in appropriate syntactic contexts, and with the required morphological alternation (beyond age 2;9).

3.2 Order of VAS Acquisition

Acquisition of VAS is cumulative: It starts with no overt arguments and ends up with multiple arguments. Children start with bare verbs or [verb + vocative] combinations (e.g., *ima, kxi!* 'Mommy, take!'), and soon begin to use frozen [verb + complement] combinations for individual verbs. Evidence for this was discussed in the previous section (see, too, Tomasello & Brooks 1999 for English). Berman (p.c.) notes that her daughter Shelli used [verb + vocative] combinations as a trigger for generating her early word combinations. Next, early [verb + complement] combinations are replaced by productive [verb + one-argument] combinations. Here, productivity is measured by the variety of elements of a particular lexical category in a given position, for example, number of different nouns in subject or direct object position. Finally, verbs extend the number of arguments to two and more. Table 6.2 illustrates this with data from Smadar (repeated here from section 3.1.1). The shaded area marks the period when MLU ≤ 2.

Table 6.2 Development of VAS for the Verb *lqx1* 'take' [Smadar]

Argument Structure Development	**Example**
Bare verb (no arguments)	***kxi*** take-2SG-FM-IMP *ima* ***kxi/kxi*** *ima* Mommy take-2SG-FM-IMP = 'Mommy, take!/Take, Mommy!'
Nonproductive V+complement combinations	*ima,* ***kax*** *teyp/****kax*** *teyp, ima* Mommy take-2SG-MS-IMP tape = 'Mommy take (the) tape/take (the) tape Mommy'
Productive V+one argument combinations	***kxi*** *buba* take-2SG-FM-IMP doll = 'take (a) doll' ***kax*** *sus* take-2SG-MS-IMP horse = 'take (a) horse' ***kxi*** *od domino* take-2SG-FM-IMP more dominoes = 'take more dominoes'
Multiple arguments	***kxi*** *et ha-teyp shelax* take-2SG-FM-IMP ACC the tape of-you = 'take your tape!' *gam Rolf, ani* ***lokaxat*** also Rolf, I take-1SG-PR = 'I'm taking Rolf, too' ***kxi*** *et kol ha-koxavim* take-2SG-FM-IMP ACC all the stars = 'take all the stars' *ani* ***lokaxat*** *(et) shteyhen* I take-1SG-PR ACC both = 'I'm taking both' ***tixki*** *sha'on ima* take-2SG-FM-FI watch Mommy = 'take (a) watch Mommy' ***kxi*** *et ze* take-2SG-FM-IMP ACC it = 'take it' *ve az* ***lakaxti*** *otam* and then take-1SG-PT them = 'and then (I) took them' *ani* ***ekax*** *et ha-tik* I take-1SG-FUT ACC the bag = 'I'll take the bag'

The proposed order of acquisition is supported by the development of VAS for eight high-frequency verbs in Lior and Smadar's data. These two girls were chosen since their data collection started before MLU 2, and could be followed from that early period until beyond MLU 2. Table 6.3 lists the transitivity value and number of occurrences of each verb by MLU in the data collected for the two girls.

Table 6.3 Distribution of Verbs by Transitivity and MLU for Lior and Smadar

Transitivity	Lexeme	Gloss	Number of Occurrences MLU ≤ 2	Number of Occurrences MLU > 2
Intransitive	*bky1*	'cry'	34	22
	bwa1	'come'	31	49
	npl1	'fall'	33	32
	ysb1	'sit down'	36	40
Transitive	*gmr1*	'finish'	25	30
	isy1	'make/do'	23	114
	ptx1	'open'	14	22
	rcy1	'want'	51	277

On the basis of an exhaustive search of utterances containing these verbs, the favored argument structure configurations for each of the intransitive verbs is specified by MLU in Table 6.4. *Other* stands for combinations like [V + Locative] sequences, e.g. *boxa ba-gan* '(she is) crying in kindergarten' [Lior 2;1], [V + V] sequences, e.g., *boi nesaxek* 'come (let's) play', *bo teshev* 'come sit (down)' [Lior 2;3], or [V + PN] sequences *ha-anashim yavou eleynu* 'the people will-come-to-us' [Lior 2;8].

Table 6.4 Distribution of Argument Structures of Intransitive Verbs by MLU

	MLU	Lexeme	Gloss	V	SV	Other
	<2	*bky1*	'cry'	21	8	
		bwa1	'come'	16	5	
		npl1	'fall'	14	17	1
		ysb1	'sit (down)'	26	3	
Total				**77**	**33**	**1**
	=2	*bky1*	'cry'	1	3	1
		bwa1	'come'	5	2	3
		npl1	'fall'	1		
		ysb1	'sit (down)'	5		2
Total				**12**	**5**	**6**
	>2	*bky1*	'cry'	9	12	1
		bwa1	'come'	3	23	23
		npl1	'fall'	6	15	11
		ysb1	'sit (down)'	10	19	11
Total				**28**	**69**	**46**

Table 6.4 shows that the distribution of verb complements (∅, Subject, *Other*) across verbs varies by MLU as follows. Before MLU 2, all verbs occur both bare and with an overt subject. At MLU 2, some verbs occur only bare, others occur both bare and with nonargument complements (e.g., *yšb1* 'sit (down)'), and still others occur in all three possible configurations – bare, with an overt subject, or with a nonargument complement. Beyond MLU 2, all verbs occur in all three configurations.

The distribution of total verb occurrences varies by MLU as follows. Before MLU 2 over two thirds of the verbs occur with no arguments (N = 77), and the remaining verbs occur in SV clusters (N = 33). At MLU 2 half the verbs are still bare (N = 12), but the rest are divided rather evenly between ones with an overt subject (N = 5) and ones with other complement types (N = 6). Beyond MLU 2, almost half the verbs occur with an overt subject (N = 69), about a third occur with other complement types (N = 46), and the rest occur with no arguments (N = 28).

Verb-complements differ in their distribution before and after MLU 2 as follows. Unlike after MLU 2, before MLU 2 more verbs occur with missing arguments, and the distribution of complement types across verbs is more limited. These quantitative differences involve qualitative differences as well: Before MLU 2 most missing arguments are unlicensed (**no** arguments), while beyond MLU 2 most missing arguments are licensed, i.e., occur in *pro-drop* contexts (**null arguments**), as discussed in detail in Chapter 7 (Sections 1.6.4, 1.6.6). As for the distribution of complement types – before MLU 2 there is almost no variation in the realization of [verb + complement] combinations. All occur in SV clusters, suggesting that they are still not productive, and consist mainly of unanalyzed amalgams (see the beginning of this section). Beyond MLU 2, a growing number of verbs occur with more than one complement-type (Subject + PP or verbal complement) which at the same time, there is an increase in the number of times a verb occurs with a specific complement. For example, *bwa1* 'come' occurs most frequently with verbal complements (e.g., *boi nir'e* 'come (let's) see), *yšb1* 'sit (down)' with locatives (e.g., *yoshev al ha-mita* 'sitting on the bed'), and *npl1* 'fall' with dative objects (e.g., *nafal li* 'dropped to = from me' = 'I dropped it'). This implies greater productivity in use of use of [verb-complement] combinations.

Two exceptions (marked in thick borders) are noted in Table 6.4. (1) Before MLU 2, the verb *npl1* 'fall' often occurs with an overt subject, and (2) beyond MLU 2 the verb *bwa1* 'come' occurs with many *Other* complements.[60] Both are due to idiosyncratic use of these verbs by one of the girls. Thus, Smadar uses *npl1* 'fall' with an overt subject nearly all the time, while Lior very often uses *bwa1* 'come' with verbal complements (see examples in Appendix 6.II). This reflects individual

60 It may seem contradictory that below MLU 2 the verb *npl1* 'fall' is often used with an overt subject. But since MLU is calculated over the entire range of a child's utterances at a given period, it could be that although the vast majority of a child's utterances consist of one word, certain utterances are longer.

differences between children in acquisition of VAS, suggesting that initially, VAS acquisition may not be governed by any general universal principle like canonical mapping.

Table 6.5 uses data from Smadar and Lior to show the distribution of argument structure configurations across four transitive verbs (*gmr1* 'finish', *isy1* 'make/do', *ptx1* 'open' and *rcy1* 'want') by MLU.

Table 6.5 Distribution of Argument Structures for Transitive Verbs by MLU

	MLU	Lexeme	Gloss	V	SV	VO	SVO	Other
	<2	*gmr1*	'finish'	11				
		isy1	'make/do'	—	4	5	2	
		ptx1	'open'	7				
		rcy1	'want'	12	1	4		2
Total				**30**	**5**	**9**	**2**	**2**
	=2	*gmr1*	'finish'	10		1	1	2
		isy1	'make/do'	3	1	5	3	
		ptx1	'open'	4		3		
		rcy1	'want'	8	5	17	5	7
Total				**25**	**6**	**26**	**9**	**9**
	>2	*gmr1*	'finish'	10	9	4	1	6
		isy1	'make/do'	6	12	19	39	38
		ptx1	'open'	3	4	7	4	4
		rcy1	'want'	27	35	20	47	148
Total				**46**	**60**	**50**	**91**	**196**

Several findings emerge from Table 6.5. First, the distribution of verb-complements across verbs varies by MLU as follows. Before MLU 2, three of the four verbs (except for *isy1* 'make/do') occur with no arguments, and two occur in SV and VO clusters. Almost no verb occurs with SVO or *Other* complements during this period. At MLU 2, all verbs occur both with no arguments and in VO clusters, and about half the verbs occur in SV, SVO or *Other* complement clusters as well. Beyond MLU 2, all verbs occur in all [verb + argument/complement] configurations. Second, the distribution of total verb occurrences varies by MLU as follows. Before MLU 2 about two thirds of all transitive verbs are bare. The remaining third is divided mainly between SV and VO clusters. At MLU 2, a third of all verbs is bare, another third occurs in VO clusters, and the remaining third is divided between SV, SVO and *Other* verb-argument clusters. Beyond MLU 2, over a third of all verbs occur in SVO clusters, a little less than a quarter occurs in SV clusters, and the remaining 40% are divided

almost evenly between VO clusters and bare verbs.[61] The verb *rcy1* 'want' is an exception, since during this period it occurs with *Other* complements significantly more than all other verbs. Third, as with intransitive verbs, transitive verbs show a gradual decrease in the percentage of bare verbs by MLU (at MLU < 2, 30 = 63%; at MLU = 2, 25 = 30%; at MLU > 2, 46 = 19%). At the same time, there is a cumulative increase in the number of different complement types that accompany each verb – from occasionally one complement-type before MLU 2 to two and occasionally three types at MLU 2 to four complement types beyond MLU 2.

These developmental patterns involve qualitative changes as well. As with intransitive verbs, most occurrences of missing arguments with transitive verbs before MLU 2 are unlicensed, while after MLU 2, most occurrences are morphologically licensed (see Chapter 7, Section 1.6.4). Also, before MLU 2, most [verb + complement] clusters are unanalyzed amalgams, while after MLU 2 children produce most clusters productively.

The following exceptions occur. At MLU 2, the verb *rcy1* 'want' occurs in an exceptionally large number of VO clusters, and beyond MLU 2, it occurs with an exceptionally large number of *Other* complements, e.g., infinitival and sentential complements. The exceptional use of *rcy1* 'want' in VO clusters at MLU 2 is due to Lior's idiosyncratic use of this verb in that configuration. For example, Lior uses *roca* 'want-SG-FM-PR' with *televizya* 'television', *arnavim* 'bunnies', *Dani* 'Dani – a kind of yogurt', *xalav* 'milk', *shoko* 'cocoa', *miklaxat* 'shower', and *et ze* 'ACC it'. The exceptional occurrence of *rcy1* 'want' with *Other* complements is due to extensive use of this verb with verbal complements, e.g., *roca la'asot ra'ash* 'want to make a noise', *loh roca lalexet lishon* '(I) don't want to go to sleep', *roca lilbosh na'alayim* 'want to put-on shoes', *roca lashevet/laredet/lishtot* 'want to-sit-down/ to-get-down/to-drink'.

61 These ratios are calculated for a total of 247 verb occurrences summed for the 4 children (46+60+50+91). This total excludes the exceptionally large number of verb + *Other* complement types due mainly to the use of one verb – *rcy1* 'want', which biases the distribution of complements across all verbs in a particular direction.

The verb *isy1* 'make/do' does not occur alone before MLU 2, and has numerous occurrences in SVO and *Other* clusters beyond MLU 2. The lack of bare occurrences of *isy1* 'make/do' before MLU 2 relates to the way the girls uses this verb. Lior initially uses *isy1* with the subject *at* 'you-2SG-FM' as an unanalyzed amalgam *tusa* 'you+do-SG-FM-PR' (cf. *at osa* 'you do'), while Smadar frequently uses it with onomatopoeic words, e.g., *osa anan* 'go-SG-FM-PR' *anan* = make the sound of a car engine', *osa havhav* 'go-SG-FM-PR woof woof = make the sound of a dog bark'. The extensive use of *isy1* in SVO clusters beyond MLU 2 can be accounted for as follows. Unlike *rcy1* 'want', most uses of *isy1* 'make/do' in the present tense occur with an overt subject – mostly *ani* 'I' in addition to an overt direct object yielding SVO clusters. Also, both girls use this verb in questions far more than other verbs as in *ma Benc ose?* 'What is Benc doing?' *ma at osa?* 'What are you doing?' *ma osa ha-Cipor?* 'What is the bird doing?' *ma Dekel asa im ha-lego?* 'What (did) Dekel do with the Lego?' *ma aba asa?* 'What (did) Daddy do?' *ma Miryam osa?* 'What does Miriam do?' *ma hu asa?* 'What (did) he do?' *ma na'ase itam?* 'What will-we-do with-them?' *ma osim be-ze?* 'What (do people) do with that?'.

Children often use the verb *isy1* as their general verb of making and creating something; so it is not surprising that they use this verb extensively with *Other* complement types, mainly prepositional phrases, which function as instrumentals or benefectives. Instrumental complements include *osim igul* ***im ha-ceva*** '(people) make (a) circle with crayon', *kaxa ani osa* ***ito*** 'that's-how I do with-it'. Benefective complements include expressions like *asinu kvish* ***la-mexonit*** *shelanu* 'we-made (a) road for our car', *ani osa* ***lax*** *masheu* 'I'm-making something for-you', *asiti* ***le-Nican*** *ra'ash* 'I made for Nican (a) noise', and *ani osa migdal gavoa* ***lax*** 'I'm-making (a) high tower for-you'.

A comparison between Tables 6.4 and 6.5 reveals the following. (1) Across MLU values, intransitive verbs occur with overt subjects far more than transitive verbs. (2) As expected, intransitive verbs do not occur in VO or SVO clusters. (3) Transitive verbs occur in these configurations more frequently than in SV clusters across MLU values. Specifically, beyond MLU 2, transitive verbs occur in VO + SVO clusters (combined) twice as much as in SV clusters (57% vs. 24%, respectively).

How can these findings be accounted for? One plausible explanation involves Du Bois's (1985, 1987) discourse-functionalist principle of Preferred Argument Structure (PAS). By this principle, children consistently produce only one core lexical

argument per clause, typically the subject of intransitive predicates (S) or the direct object of transitive predicates (O), but not the subject of transitive predicates (A), since only the S and O but not the A position allow new information to be introduced into discourse. This explanation is supported by the data, particularly by those for the period beyond MLU 2 when children are already engaged in productive use of [verb + argument] structures. It is also consistent with findings for other languages, for example, Clancy 1993 for Korean and Allen and Schroder [in press] for Inuktitut. Additional data from my sample indicate that at the one-argument phase, transitive verbs like *lqx1* 'take', and *sgr1* 'close/switch off' are most often used in VO, than SV in configurations (see below Chapter 7, section 1.6.6, Table 7.3).

Another factor is verb morphology, since whether a particular verb initially occurs with an overt subject or direct object depends in part on its tense/mood. For example, Smadar tends to use verbs in the imperative or in the infinitive with an overt direct-object, and verbs in the present tense mainly with an overt pronominal subject, e.g., *kxi buba* 'take-IMP doll = take (the) doll!' [Smadar, 1;7] versus *ani lokaxat* 'I take-SG-FM-PR = I'm taking' [Smadar, 1;11]. This could indicate that Hebrew-speaking children are aware of the mixed system of their language (*pro-drop* only in 1st and 2nd person only in past and future tense) from very early on as proposed by Elisha 1997 (also Berman 1990).

4. Conclusion

This chapter discussed the early acquisition of VAS (i.e., Phase I). Evidence from child Hebrew suggests that this process first proceeds on a verb-by-verb basis, and with increasing exposure and analysis of data, becomes more general and abstract. The order of VAS realization is cumulative, since children start out by acquiring bare verbs, then proceed to acquire one argument, and only later additional arguments, until they reach the full range of arguments required by the verb. This progression of VAS acquisition is common to all verb types.

VAS is initially unspecified, in the sense that each verb is acquired with empty slots which may or may not be filled in the course of acquisition. The choice of slots to be filled, the order in which they are realized, and their semantic content are determined by input that is initially governed by pragmatic and communicative factors. For example, the verb *give* is initially used without a subject, since children tend to request things of people present in the same place as they are. Similarly, the

verb *fall* tends to be used without an overt subject, since both child and caretaker who are present when the event occurs usually see what falls down and when. The content of each argument seems to depend on the specific verb acquired, so that the direct object of *sing* consists of song names, while the direct object of *give* consists mainly of object names. Later, these factors are reinforced by language particular considerations. For example, a Hebrew-speaking child has to learn that transitivity is expressed by a particular choice of verb-pattern, e.g., *fall* does not require a direct object when it is conjugated in the *qal* (P1) pattern, but it does when conjugated with a causative sense in the *hif'il* (P5) pattern.

In sum, a variety of factors including the type of verb acquired, the specific language of acquisition, pragmatic and communicative factors, and subsequently morphological and syntactic considerations combine to explain how children move into verb-argument acquisition.

Chapter 7: Interactions

A major goal of the acquisition model proposed in this work is to characterize the possible interactions between various linguistic modules (syntactic form and function, morphology, lexical structure, verb semantics, thematic roles, and pragmatics) across development, and to determine their contribution to the process of verb and VAS acquisition. This chapter focuses on two main types of interactions: morphology-syntax and syntax-semantics discussing a particular test case of each. The syntax-morphology interaction focuses on acquisition of null arguments, and the syntax-semantics on the acquisition of thematic roles in child Hebrew. These two phenomena were selected since they are directly relevant to the acquisition of verbs and VAS. Also, since they have been studied crosslinguistically, they allow comparison with typologically different languages to determine whether their contribution to verb and VAS acquisition is local or universal.

A third type of possible interaction – between morphology and semantics – is not considered here. The interaction between inflectional morphology and verb semantics, as realized, for example, in acquisition of viewpoint aspect (speaker's perspective with respect to an event description), is not all that critical to acquisition of VAS. The interaction between certain derivational phenomena (e.g., acquisition of the *binyan* system) and verb semantics (verb *Aktionsarten*), on the other hand, is discussed in some detail in Chapter 5 (Section 1).

1. Morphology-Syntax Interaction[62]

The occurrence of "missing arguments" (subjects and various kinds of objects) is of interest to both general linguistics and language acquisition research, inter alia, as a source of information about the effects of morphology on the acquisition of VAS in languages with rich morphology such as Italian or Hebrew. In generative grammar, for example, the licensing of missing subjects is taken to depend on the existence of a strong morphological system that includes inflectional marking of subject pronouns on the verb. It is thus of interest to examine the relation between command of inflectional morphology and acquisition of VAS and of null versus overt subjects in particular. Another question is whether a strong morphological system has an effect on the occurrence of null-objects in relation to claims about the asymmetry between

62 Parts of this section appear in published form in Uziel-Karl and Berman (2000).

(null) subjects and objects. This section has two aims: to delineate factors which govern subject versus object-omission in Hebrew, and to examine the relative influence of these factors on early as compared with late omissions of arguments. Discussion is confined to simple clause-structure since the period between the one-word stage and acquisition of simple clause-structure is the time when the process of VAS acquisition begins, and so is crucial for tracing the course of this development. Besides, as noted at the outset of this study, confining the study to the period of simple clause structure allows for comparison with other studies on the acquisition of VAS, and of null subjects in particular.

I will argue that in child Hebrew, null subjects are initially motivated mainly by pragmatic factors and that these are subsequently supplemented by morpho-syntactic rules of the grammar. Null-objects, in contrast, are motivated throughout by pragmatic or semantic factors, and are not grammatically licensed. They represent a robust phenomenon, but are far less widespread than null subjects in both child and adult Hebrew.

The rest of this chapter includes a description of missing arguments in child Hebrew (Section 1.1) and their licensing conditions (Section 1.2), a review of previous studies (Section 1.3), a developmentally-motivated account of missing arguments (Section 1.4), my predictions for the licensing of missing arguments in Hebrew (Section 1.5), data analysis (Section 1.6) and conclusions (Section 1.7).

1.1 Missing Arguments in Child Hebrew

For present purposes, the term "**argument**" is confined to only three types of nominals: **Surface Subjects** [SBJ] (nominative, zero-case marked); **Direct Object** [DO] (accusative, marked by the accusative marker *et* if definite, by zero elsewhere), and **Indirect Object** [IO] (dative, marked by the dative prefix *le-* 'to'). In a sentence like *Dan natan et ha-sefer le-Miri* 'Dan give-3SG-PT ACC the book to-DAT Miri' = 'Dan gave the book to Miri', *Dan* is the grammatical subject, *et ha-sefer* 'ACC the book' is the direct object, and *le-Miri* 'to-DAT Miri' is the indirect object. Governed objects, where the verb requires a specific preposition (e.g. Hebrew *ba'at be-* 'kick at = kick', *naga be-* 'touch at = touch', *hirbic le-* 'hit to = hit', *azar le* 'help to = help', *histakel al* 'look on = look at', *hishpia al* 'influence on = affect') are excluded from

this analysis.[63] Also excluded are other postverbal prepositional objects which have adjunct-like properties, e.g., (*yashav)* ***al*** *ha-shulxan* 'sit-3SG-PT on the table', and (*yarad)* ***ba-****madregot* 'go-3SG-PT down the stairs'. This makes it possible to compare my findings with other research, since claims concerning the asymmetry between subject and object ellipsis typically concern only direct objects. Besides, the early stages of acquisition considered here include few predicates that take governed or other oblique objects. Also, for governed objects the choice of a given preposition appears to be lexically idiosyncratic. As a result, it does not reflect a specific semantic or syntactic relation between the verb and its associated NPs (Berman 1978, 1985), making it hard to account for them systematically.[64] Adverbial adjuncts are also excluded from this analysis. As noted in Berman (1982) the latter represent the background to a given event (time of occurrence, duration, cause, or purpose, etc.), and are not logically entailed by it, nor do they entail an event themselves. They thus cannot be construed as arguments of a predicate, nor are they candidates for the syntactic or semantic status of 'object' of any kind.

In the present context, instances of missing arguments are referred to by the term "**ellipsis**".[65] Examples (1) to (3) illustrate Subject, Direct Object, and Indirect Object ellipsis for Hebrew-speaking children at the initial phases of their grammatical development. A zero (∅) indicates an immature instance of ellipsis of the three arguments – SBJ, DO, and ID. The examples in (1) are of subject ellipsis in three of the children, omitting the pronouns *ata* 'you-2SG-MS', *hu* 'he- 3SG-MS', and *ze* 'it', respectively.

63 Hebrew verbs are cited in the morphologically simple form of past tense, 3rd person masculine singular.

64 Berman (1985) notes that Hebrew-speaking children make very few errors in choice of prepositions assigned to specific verbs (unlike L2 learners of Hebrew or children from less educated or nonstandard backgrounds [Ravid 1995]). The input they receive enables children to designate a given preposition as going with a particular verb, even when there is no clear semantic basis to the choice. Children learn the preposition as part of their lexical entry for specific verbs, and this seems to be a successful learning strategy.

65 Hyams (1992) points out that in Italian null subjects are not the consequence of a deletion of or substitution for a lexical pronoun, but that *pro* is inserted directly into a phrase marker at D-structure. In contrast, in Hebrew, the position of *pro* in *pro-drop* contexts (past and future tense, first and second person) can either be filled by a lexical pronoun as in *ani axalti uga* 'I eat-1SG-PT cake' or left empty as in *axalti uga* 'eat-1SG-PT cake' both meaning 'I ate (a) cake'. In this sense, the lexical pronoun in these contexts in Hebrew can be considered elliptical.

Examples of Three Kinds of "Missing Arguments" in Hebrew Child Language

(1) SUBJECT

Child	Age	Context	Child's Utterance
Lior	1;10;19	Hearing her baby brother crying, to her mother:	*shomea? ∅ boxe.* hear-SG-MS ∅ cry-SG-MS 'do you hear? is crying!' cf. ***ata*** *shomea?* ***hu*** *boxe.*[66] 'Do you hear? He is crying'
Hagar	1;9;21	Talking about a picture of a man lying down:	Mother [to Father]: *ata yaxol lesaper la et hasipur, sipur me'od yafe* 'You can to-tell to-her the story, (a) very nice story' Hagar: *po xum, ∅ yashen, ∅ yashen* Here brown-SG-MS ∅ sleep-SG-MS ∅ sleep-SG-MS cf. *po xum,* ***hu*** *yashen,* ***hu*** *yashen.* 'Here's brown, (he's) sleeping, (he's) sleeping'
Leor	1;10;3	Referring to a fan which is not working:	Aunt: *ma kara?* 'What happened?' Leor: ∅ *kakel* ∅ got-broken-3SG-MS = 'broke-down' cf. ***ze*** *hitkalkel* = 'It got-broken'

The examples in (2) illustrate ellipsis of direct object pronouns for three children, omitting *et ze* 'ACC it/this', and *oto* 'ACC him = it'.

(2) DIRECT OBJECT

Child	Age	Context	Child's Utterance
Naama	1;11	Talking about a notebook she is playing with:	*hine ani kishkashti kan. ze shabur. ani shabarti ∅.* here I scribble-1SG-PT here. It broken. I broke ∅. `look I scribbled here. It's broken. I broke.' cf. *hine ani kishkashti kan. ze shavur, ani shavarti* ***et ze***. Here I scribbled here. It broken. I broke ACC it.
Smadar	1;11;18	Talking about the tape-recorder her mother is using:	*tadiki ∅ gam kan.* light-2SG-FM ∅ also here 'Switch it on here too' cf. *tadliki* ***oto*** *gam kan.* 'Light it here too'
Leor	2;2	Telling his aunt about a radio he likes to play with:	Leor: ∅ *mekuka.* ∅ broken Aunt: *naxon,* ***ze*** *mekulkal*. `Right, it's broken'. Leor: *saba holex letaken ∅.* grandpa go-MS to-fix ∅ cf. *Saba holex letaken* ***oto***. 'Grandpa is going to fix'

The examples in (3) below are of indirect object ellipsis for one child, the girl Lior, omitting *li* 'to-me' in two different contexts.

66 cf. = standard adult version.

(3) INDIRECT OBJECT

Child	Age	Context	Child's Utterance
Lior	1;9;1	Holding out her hand to her mother	*tavii ∅ yad.* bring-2SG-FM ∅ hand 'let me hold your hand' cf. *tavii* ***li*** *et ha-yad.* 'Give me (your) hand'
Lior	1;10;11	Talking to her mother, wants to color in:	*tni ∅ daf.* give-2SG-FM ∅ page 'Give a paper'. cf. *tni* ***li*** *daf.* 'Give me some paper'

Examples (1) to (3) listed cases of unlicensed ellipsis that are quite common in child language but prohibited in adult Hebrew.

1.2 Licensing Conditions for Missing Arguments

Across languages, three factors play a role in the licensing of argument ellipsis: permissibility, recoverability, and syntactic function. **Permissibility** is defined by how obligatory it is to either retain or delete a given argument. For example, in impersonal constructions, English and French require generic or expletive surface subjects, where Hebrew generally disallows them (Berman, 1980); or, in coordinated clauses, co-referential subjects may but need not be omitted in English and Hebrew, but they must be in Italian and Spanish and other strongly *pro-drop* languages. **Recoverability** specifies whether the context provides adequate information to ensure that the reference of the missing argument can be reconstructed (Ariel 1991). In such cases, morpho-syntactic cues provide the most reliable source of recoverability, followed by pragmatic cues derived from surrounding discourse, with extralinguistic context the least reliable source of recoverability. **Syntactic function** refers to whether the missing element is a subject, direct object, or indirect object. Here, "subject/object asymmetry" specifies that missing subjects are more readily licensed than missing objects (Hyams 1983, 1986; Hyams & Wexler 1993; Wang, Lillo-Martin, Best & Levitt 1992). The contexts in which subject and object ellipsis are permissible in Hebrew are specified in examples (4) to (6) by type of licensing – grammatical, semantic, or pragmatic with examples from my data.

There are four main contexts for morpho-syntactic licensing of null subjects in simple clauses. These are illustrated in (4) – plural impersonals (4a), root infinitives (4b), imperatives (4c), and *pro-drop* with verbs inflected for number and person (4d).

Examples of Contexts for Null-Subject and Null-Object in Hebrew

(4) MORPHO-SYNTAX

Licensing Context	Grammatical Subject	Grammatical DO[67]
a. Plural Impersonals	∅ *oxlim et ze?* ∅ eat-PL it 'Can one/you eat it?'	—
	∅ *cayrim kax* ∅ draw-PL so 'This is how you/people draw'	—
b. Root Infinitives[68]	*la-redet bevakasha* '(I want) to-get-down please'	—
	loh le-daber! 'Not to-talk = Don't talk!'	
	la-tet lo? to-give to-him? 'Should I give it to him?'	—
c. Imperatives	∅ *tafsik kvar!* ∅ stop-2SG-MS-IMP already = 'Stop it!'	—
	∅ *bo'i hena!* ∅ come-2SG-FM-IMP here = 'Come here!'	
d. *Pro-drop*, 1st & 2nd person Past Tense suffixes, Future prefixes	∅ *asi**ti** pipi* ∅ did-1SG wee wee = 'I peed' ∅ *gamar**nu*** ∅ finished-1PL-PT = 'all done' ∅ ***ni**gmor kvar* ∅ will-finish-1PL already = 'We'll finish soon'	—

The single case I encountered of "semantic licensing" is with direct objects in the context of optional transitive verbs, as illustrated in (5).

(5) SEMANTICS

Licensing Context	Grammatical Subject	Grammatical DO
Optional Transitives	—	*Rni oxel* Ron eat-SG-MS = 'Ron's eating' *hem kor'im* they read-PL-MS = 'They're reading (the paper)'

Finally, I identified three contexts for pragmatic licensing of argument ellipsis: situational (6a), conversational (6b), and textual (6c).

67 In classical and more normative Hebrew, pronominal direct objects were inflectionally incorporated into the verb as in *ahavti-**ha*** '(I) loved+ACC-3SG-FM', cf. Modern Hebrew *ahavti **ota*** '(I) loved her'. Unlike pronominal subjects (e.g., *ani ahavti et ha-ish* 'I loved-1SG ACC the man', ∅ *ahavti et ha-ish* '(I) loved-1SG ACC the man'), these do not co-occur with an overt lexical or pronominal object, e.g., **ahavtia ota/et Rina* '(I) loved loved+ACC-3SG-FM her/ACC Rina'. In Israeli Hebrew, null-objects are not morphologically licensed except in high-register literary texts or formal academic writing. Another context which licenses grammatical null objects, one which lies beyond the scope of this study, is relativization. Direct objects with the accusative marker *et* or with object pronouns incorporating *et* (e.g., *oti* 'me', *otax* 'you-SG-FM', *otam* 'them-PL-MS', *etc.)* can be elided in relative clauses. For example, *ze ha-ish she ani ohevet* ∅ 'this is the man that I love-SG-FM ∅' cf. *ze ha-ish she oto ani ohevet* ∅, 'this is the man that him I love-SG-FM' or *ze ha-ish she ani ohevet oto* 'this is the man that I love-SG-FM him'.

(6) PRAGMATICS

Licensing Context	Grammatical Subject	Grammatical DO
a. Situational Context	—	∅ *ra'ita?* ∅ see-SG-MS-PT = 'Did you see?' [when something fell] ∅ *tiftax Raz* ∅ open-SG-MS-IMP = 'Open, Raz' [someone knocks]
b. Conversational "Adjacency pairs"	A: *ma ata ose sham?* what you-MS-SG do-MS-SG there 'What are you doing there?' B**:** ∅ *bone bayit* ∅ build-MS-SG house 'Making (a) house'	Raz*: ima, Razi roce ta kufsa* Mom R want-SG-MS ACC-the box 'Mom, R wants the box' MOT: *tov, tiftax* ∅. okay open-SG-MS-FI ∅ 'Okay, so open (it)'
	A: *eyx at mevala?* how you-SG-FM spend-SG-FM time 'How (do) you spend your time?' B: ∅ *holexet la-yam* ∅ go-SG-FM to the beach 'Going to the beach'	A: *ma kara la-kadur?* What happened to the ball? B: *zarakti* ∅. threw-1SG ∅ = 'I threw (it)'
c. Extended Discourse [= topic maintenance]	*hayeled ve hakelev hit'oreru. ma* ∅ *ra'u? en cfardea.* ∅ *hitxilu lexapes* ∅ *baxeder,* ∅ *herimu et ha-mita ...* the boy and the dog woke-PL what ∅ saw-PL? no frog ∅. began-PL to search ∅ in the room ∅ lifted-PL ACC the bed 'The boy and the dog woke-up. What (did they) see? There was no frog. (They) began to search, picked up the-bed ...' (from Berman 1990).	

Thus, in Hebrew, **SUBJECT ELLIPSIS** is grammatically licensed by **morpho-syntax** in a range of simple-clause contexts:[69] It is obligatory in subjectless impersonal constructions, with root infinitives used to express irrealis modalities like requests and prohibitions; and like in other languages in imperatives. And it is optional with verbs that are inflected for person, the canonic *pro-drop* contexts in Hebrew, i.e., 1st and 2nd person of past and future tense.[70] Subject ellipsis is also licensed **pragmatically,** by discourse context, most typically (a) by extralinguistic context, where the situation provides for recoverability of the missing element, and

68 The term *root infinitives* refers here to fully articulated main clause infinitives occurring in main clause declaratives (Armon-Lotem 1997, Rizzi 1994, Wexler 1994). Unlike so-called *root infinitives* in English, this type of verb is often well-formed in adult Hebrew to express irrealis modalities like requests, orders, prohibitions, and suggestions as in the examples in (4b). Armon-Lotem (1997) notes that in children's Hebrew, root infinitives also occur in declarative contexts (e.g., *lashir dag* 'sing fish = to sing about a fish') which are considered ungrammatical in the adult language (see, too, Chapter 4, Section 5.1).

69 Subject elision in co-referential coordinate and embedded clauses is an interesting topic, but not relevant to the early stage of acquisition dealt with in this study.

70 The present tense of the modal verb meaning 'want' seems to be a special case, since it always occurs without a subject and marked for gender in Hebrew child speech, often in adult usage too, e.g., ***roca*** *she eten lax od neyar ve ta'asi igul*? '**want-FM** that will-give-1ST you more paper and will-make-2**FM** circle? = (Do you) want me to give you some more paper and you'll make a circle?' said to Hagar, aged 1;9, by her grandmother, just a few utterances after she had asked the child ***at*** *ro'a meshulash?* '(do) **you-FM** see (a) triangle?'.

(b) in "adjacency pairs" like question/answer sequences, where the missing subject, which is the topic, is mentioned in a previous utterance. **OBJECT ELLIPSIS**, in contrast, is not grammatically permissible. It is licensed only by **semantic** constraints in the case of "optional transitives" (like verbs meaning *eat, smoke, write* whose object reference is semantically restricted to referents which are eatable, smokable, or writeable) and by pragmatic contexts similar to those that apply to subject ellipsis.

The examples in (4) to (6) suggest, first, that the "**subject/object asymmetry**" observed in the literature – to the effect that children omit more subjects than objects – can be attributed *a priori* to the conditions which govern ellipsis of these two kinds of arguments in Hebrew (possibly across languages). Second, in simple-clause structures, **ellipsis is licensed** in a range of contexts in Hebrew (perhaps across languages), where it is predictable, and not specific to child language. **Unlicensed ellipsis,** like examples (1) to (3) above, is less predictable, and is characteristic of child language.

1.3 Previous Studies

In recent years, work on missing arguments has focused on subject ellipsis, with various proposals to account for this phenomenon in child language. **Grammaticality accounts** in a generative framework attempt to explain missing subjects in terms of the *pro-drop* parameter (Hyams 1983, 1986, 1992), subsequently extended to include topic-drop in some languages (Hyams & Wexler 1993), or by the early absence of the case filter and/or functional categories (Armon-Lotem 1997, Borer & Wexler 1992, Guilfoyle & Noonan 1992, and Radford 1990). **Processing accounts** attribute subject ellipsis to constraints on the length of utterances, or number of constituents which children can produce (L. Bloom 1970, P. Bloom 1990, Pinker 1984, Valian 1991). **Discourse-based accounts** refer to pragmatic principles such as informativeness (Allen & Schroder [in press], Clancy 1993, Greenfield & Smith, 1976). **Input-based accounts** treat argument ellipsis as initially due to the acquisition of partial verb-argument clusters for individual verbs (Braine 1976, Ninio 1988, Tomasello 1992). Below I review the various accounts of null subjects and objects (Sections 2.3.1 – 2.3.4) as background to my own perspective on null arguments (Section 2.4) and the predictions which follow from it (Section 2.5).

1.3.1 Grammatically-based Accounts

Generative accounts refer to the null-subject phenomenon as *pro-drop*, a parameter within UG that distinguishes languages like Italian and Spanish from languages like English or French. The former are considered *pro-drop* languages since they allow sentences with no overt subjects (example 7 below), while the latter are considered *non-pro-drop* languages since they require an overt subject in all contexts (example 8 below). In *pro-drop* languages, the seemingly empty subject-position is assumed to be occupied by a pronominal, nonanaphoric, empty category, known as *pro*. Being an empty category, *pro* must be both licensed and identified, and this is assumed to be done morphologically (Rizzi 1982, 1986). Licensing is assumed to be performed by Case Theory (i.e., through the assignment of Nominative case), while identification is assumed to be done by the agreement features which appear on the verb (i.e., number, gender, etc.), as in (7).

(7) *axal**ti** tapuax.*
ate-1SG-PT apple
'I ate an apple'

(8) *ate an apple.

Acquisition of the *pro-drop* parameter within the generative framework has yielded several studies. Hyams (1983, 1986) originally proposed that the default universal setting for the *pro-drop* parameter is [+Null], and that as a result, English children start with a *pro-drop* setting for English which allows the empty category *pro* in subject position. With time, these children learn that English is a *non-pro-drop* language, and start using overt subjects. Armon-Lotem (1997), Borer and Wexler (1992), Guilfoyle and Noonan (1992), and Radford (1990) relate subject omission to other aspects of early grammar such as the absence of the Case Filter or of functional categories, or the relaxation of an early requirement that each verbal element have a unique subject.

Based on evidence from Chinese, a language largely lacking in inflectional morphology, Jaeggli and Safir (1989) propose that a *pro-drop* language must be uniform (i.e., **all** of its present tense forms are either inflected or not), while a *non-pro-drop* language must be non-uniform (i.e., not all of its present-tense forms are inflected). Null subjects are permitted in all and only languages with morphologically uniform inflectional paradigms, and the identification of *pro* takes place either through inflection or through discourse factors.

In more recent accounts, in a minimalist framework, Rizzi (1993) suggests that when null subjects are not identified clause-internally under c-command, they are licit only when identified clause-externally in the specifier of the root, i.e., CP. Following a theory of clausal truncation in early grammar, Rizzi (1994) argues that children start with a truncated tree in which IP is the root, which makes root null subjects legitimate in [SPEC IP].

Speas (1994) utilizes the principle of economy to suggest that languages vary over whether affixes are generated in the syntax or in the lexicon. Thus, children have to set a parameter for whether inflection in their language is lexical or syntactic, in order to determine whether their language allows null subjects or not.

Sano and Hyams (1994) propose that the first null-subject stage is a by-product of lack of functional categories in early grammar. They argue that since functional categories are initially underspecified, the node I may be left underspecified, and thus [SPEC IP] can host PRO, since it is not governed. This should account for the use of null subjects by children, crucially differing from the adult use of *pro* in languages like Hebrew or Italian.

Generative accounts distinguish two types of null-objects: null pronominal objects and null variable objects. Null pronominal objects refer to empty categories in object position that are instances of *pro*, i.e., categories which can be recovered from the morphology of a governing element. Null variable objects, on the other hand, refer to empty categories in object position that result from moving a base-generated empty object to an A-bar position. Thus, Huang (1984) and Raposo (1986) argue that in Chinese and Portuguese respectively, the empty category in object position is a variable. In contrast, Rizzi (1986) suggests that in Italian arbitrary null-object is a null pronominal object of the type *pro*, since Italian, unlike English, allows for the licensing of *pro* in verb-governed position, i.e., in Italian both INFL and V can govern *pro*. Cole (1987) uses data from diverse languages to propose a typology of null-object languages: (1) languages that do not permit null pronominal or null variable objects (e.g. English); (2) languages that permit null variable objects but not null pronominal objects (e.g., Mandarin, Portuguese); (3) languages that permit null pronominal objects but not null variable objects (e.g., Imbabura Quechua); and (4) languages that permit both null pronominal and null variable objects (e.g., Korean, Thai).

To account for the fact that English-speaking children tend to omit subjects, Hyams (1991) argues that English-speaking children start out by speaking a Chinese-like language, i.e., a discourse-oriented language. Under this hypothesis, children should have both null subjects and null-objects, and both should be grammatically identified by discourse. However, since English-speaking children do not use null-objects, Hyams proposes that in the early grammar, the inventory of null elements includes *pro* but not variables. Since null-objects are predicted to be variables, null-objects will not be allowed in the early grammar until some later point, when variables mature.

Wang *et al*'s (1992) study of null subjects and null-objects in Chinese- and English-speaking children aged two to four and a half years used an elicited production task to test Hyams's hypothesis. They found evidence against the claim that early English is a discourse-oriented language like Chinese: While the Chinese children systematically used null-objects, the American children did not.

Hirakawa (1993) analyzed the production data of a Japanese child to examine whether a child learning a language which allows null-objects will initially drop only subjects, and null-objects will appear only when the child has developed variables. Hirakawa found that the child used subjects more than objects, and that she used null subjects and null-objects even before she appeared to have acquired variables. Hirakawa thus proposed to treat both null subjects and null-objects in Japanese as *pro*, identified by discourse.

1.3.2 Processing Accounts

Processing accounts attribute subject and object ellipsis to constraints on the length of utterances (e.g., Bloom, Lightbown and Hood 1975) or on the number of constituents that children can produce. According to L. Bloom (1970), certain argument omissions represent reductions of elements present in Deep Structure, due to children's performance limitations. P. Bloom (1990) proposes the "VP length criterion", by which children avoid using subjects when the VP is longer (in transitive verbs) due to constraints on memory span. With age, children are able to recall and so produce longer utterances with both subjects and objects. Pinker (1984) argues that children's processing mechanisms are limited in capacity, and therefore can initially coordinate only a fixed number of lexical items at some stage in the move from communicative intention to actual utterance. Valian (1991) proposes a processing

account for acquisition of null and overt objects by English-speaking children. For her, children do not use a verb unless they know that it subcategorizes for objects. The fact that children provide objects more often for pure transitives than for optional transitive verbs indicates that they recognize the difference between when an object is obligatory or optional. Valian explains the fact that use of optional objects increases between ages 2;1 - 2;5 as due to the relaxation of performance limitations: As children become able to handle longer utterances, there is an increase in use of verbs that require objects.

Hyams and Wexler (1993) point out several problems with processing accounts of null arguments. First, these accounts do not explain the fact that null subjects outnumber null-objects in child language (at least in English). Second, research (Hyams 1983, 1986, Hyams & Wexler 1993) has disproved the claim that there is an upper bound on the length of utterances a child can produce since they found that children produced verb-object and subject-verb-object strings to a similar extent. Third, Newport, Gleitman and Gleitman (1977) show that the beginning of a sentence does not impose a heavier processing load than the end, as argued by certain processing accounts. Other research (e.g., Hyams & Wexler 1993) shows that VP length does not depend on subject type, as claimed for example, by Morrison (1990), who suggests that pronoun subjects are more difficult to process than lexical subjects.

1.3.3 Discourse-based Accounts

Discourse-based accounts explain subject and object ellipsis in terms of principles such as Informativeness, to the effect that children omit from their utterances information that is most easily recoverable from context independent of grammatical structure (Greenfield & Smith 1976). Clancy (1993), and Allen and Schroder (in press) rely on Du Bois's (1985, 1987) discourse-functionalist notion of Preferred Argument Structure (PAS) to account for missing arguments in Korean and Inuktitut child language, respectively. Both studies suggest that children consistently produce only one core lexical argument per clause – typically the subject of intransitive predicates (S) or the direct object of transitive predicates (O), but not the subject of transitive predicates (A). This is because only the S and O but not the A position allow new information to be introduced into discourse. Along similar lines, Brown (1998) reports that in Tzeltal (a VOS language that allows free NP ellipsis), the use of both lexical and pronominal arguments corresponds to PAS. Allen (1997)

reports that in Inuktitut child language, there is a higher percentage of object positions containing arguments with a given informativeness feature than subject positions containing the same feature. Thus, object ellipsis is less frequent than subject ellipsis in Inuktitut.

Hyams and Wexler (1993) propose a combined structuralist plus pragmatic account of null subjects according to which some languages have a principle of topic-drop (Dutch), others have a principle of null-subject (Italian), and still others exhibit a combination of the two (Hebrew). In a topic-drop language, a constituent must be outside the VP to be omitted (Diesing 1988, Kratzer 1989). On the other hand, in a null-subject language, the prerequisite for grammatical omission of a subject is its identification by "rich" Agr.

1.3.4 Input-based Accounts

An input-oriented view of verb-by-verb learning treats argument ellipsis as initially due to the acquisition of partial verb-argument clusters for individual verbs. Along these lines, Braine (1976) argued that children start out learning a small number of positional formulae that map meaning components into positions in the surface structure. Bowerman (1990) argues that the typical mappings between thematic roles and syntactic functions are learned on the basis of linguistic experience with individual verbs and with a particular target language. Likewise, Tomasello's (1992) "Verb Island Hypothesis" assumes that young children learn verbs as individual lexical items, with the morphological and grammatical structures in which they participate linked uniquely to these particular verbs. Clark (1995) notes that in order for children to learn which verbs occur with which configurations of arguments, which kind of arguments belong in each slot, and what meaning is conveyed by each verb-frame or construction, children will start out by associating these properties with individual verbs in their repertoire. For Ninio (1999), children acquire the combinatorial rules of grammar by gradually accumulating the relevant information about the syntactic environment in which a given verb may appear along with the list of terms that can appear in a given environment. On this view, the child's earliest combinations are made up of one fixed element (e.g., a verb) and one variable (e.g., a noun phrase which functions as subject or direct object). For example, Bowerman's (1976) Eve and Braine's (1976) David primarily used the verb *want* with a direct object rather than a subject, while Braine's (1976) Jonathan used verbs such as *bite*

primarily with a subject rather than with a direct object. And along similar lines, Brown (1998) reports that in Tzeltal the acquisition of transitive verbs displays the properties of "verb islands": they occur only in limited constructions, often only with one particular argument (for example, *want* occurs only with the first person A).

These studies converge to reveal three central issues in acquisition of null arguments: differences between child and adult use of null arguments; an asymmetry between null subjects and null-objects; and recourse to different modules as a basis for null arguments in different languages (morpho-syntax, lexicon, discourse). However, all the approaches noted here – grammaticality, processing, discourse-functionalist, and lexicalist verb-by-verb learning – relate to these issues from a single perspective. The analysis I propose differs in aiming to integrate various previously isolated lines of explanation into a single, multi-level account for null arguments. My overall orientation is developmental, and can be identified as lying (somewhere) between Hyams and Tomasello. In this view, children do not start out with strictly structural knowledge, and learning is required for acquisition. On the other hand, what the child eventually acquires includes purely structure-dependent linguistic knowledge (in this case, of VAS).

1.3.5 *Pro-drop* in Hebrew

Hebrew can best be characterized as a typologically "mixed" language with respect to *pro-drop* in that it does not license *pro* in all tense-person configurations (Berman 1990). In simple clauses, *pro* is licensed only in the past and future tenses, not with the present tense; and in past and future tenses only 1st and 2nd person verbs but not 3rd person forms are licensed. Thus, the use of null subjects in Hebrew requires knowledge of the morphological system of the language. Also, unlike strictly *pro-drop* languages like Italian or Spanish, Hebrew allows expletive *it*-like subjects in certain contexts, mainly with propositional complements, e.g., (*ze) loh yafe ledaber kax* 'it (is) not nice to-talk like that'; but it does not allow expletive subjects in existential contexts corresponding to English *there+be*, or French *il y a*. Hebrew-speaking children, then, receive "mixed" and superficially conflicting cues as to where grammatical subjects may, must, or cannot be omitted.

There is extensive generatively motivated literature on the null-subject phenomenon in Hebrew (Borer 1984, 1986, 1989, Shlonsky 1987, 1990 among others). This review is confined to work related directly to acquisition. Armon-Lotem

(1997) proposes that two factors interact in acquisition of null subjects in Hebrew: (1) The setting of the relevant Checking parameters (i.e., identifying the set of features relevant for Tense and Agr in the target language), and (2) the minimalist hypothesis for language acquisition (i.e., argues for a transition from a null-topic to a null-subject model). Specifically, prior to the acquisition of Tense, the lack of subjects in child language can be attributed to a preference for null-topic, whereas after Tense is acquired, *pro* like other pronouns becomes an option, marking a shift to null-subject.

Elisha's (1997) analysis of data from 19 Hebrew-speaking children aged 1;10 - 2;7 focused on the relation between the functional heads TP and AgrP and use of overt and covert subjects in children's Hebrew, using children's initial knowledge of functional categories to determine when and how Hebrew-speaking children acquire the grammatical constraints of their mixed language. According to her *Minimal Competence* model, children are endowed with a minimal structure that consists of universal categories like TP and features like [±finite], and language-specific categories such as AgrP. Children have to learn whether their language is of the agreeing type or not. Elisha concludes that the children in her sample determine whether their language is of the agreeing type as early as the one-word stage. At the combinatorial stage, children with MLU-W below 2 still need to set the strength of Agr to determine which AgrP is projected in different structures. Children with MLU-W above 2 were said to show full competence in the mixed system of Hebrew, with their inconsistencies attributed to performance and pragmatic factors. The results of both Armon-Lotem and Elisha suggest that from very early on, children are attuned to inflectional affixation, specifically to tense and person, in producing sentences both with and without subjects.

1.4 A Proposed Analysis for the Licensing of Argument Ellipsis

In proposing a developmental account for the licensing of argument ellipsis, I argue that the licensing conditions for argument ellipsis, in Hebrew (and possibly in other languages), are set by the interaction of a **universal** Argument Elisibility Hierarchy (AEH) and a **language-specific** weighting of linguistic modules (morpho-syntax, semantics, pragmatics). This account can also be used to explain developmental differences between learners as well as different phases in acquisition of null arguments for any particular learner.

1.4.1 Module-Based Licensing of Arguments

My analysis of ellipsis in Hebrew child language is based on a general model in which language acquisition is viewed as a stepwise process, governed by two distinct developmental criteria: elementary and advanced (as elaborated in Chapter 1, Section 3.4). **Elementary criteria** are necessary to specify that a child has some knowledge of a particular linguistic item or construction, and serve mainly to prevent communication breakdown. **Advanced criteria** are both necessary and sufficient to specify that a child has attained an adultlike level of knowledge, and serve mainly to prevent ungrammaticality.[71] In the case in point, pragmatic factors constitute necessary criteria for ellipsis, and morpho-syntactic properties constitute sufficient criteria for knowledge of ellipsis.

In achieving these two levels of knowledge of ellipsis configurations in Hebrew, children exhibit the following pattern of acquisition. Initially, they reveal behavior characteristic of "null-topic" languages, where ellipsis is guided mainly by (necessary) pragmatic considerations, for example, of pragmatically controlled "free anaphora". Subsequently, they demonstrate knowledge of Hebrew as a "null-subject" language, where ellipsis is licensed by (necessary and sufficient) morpho-syntactic rules, such as *pro-drop*. Eventually, in the most mature phase, children integrate both types of knowledge and can deploy ellipsis to meet appropriate discourse functions across extended texts, such as for purposes of thematic connectivity or to distinguish topic maintenance from topic shift in narrative.

This perspective is in line with other functionally oriented accounts of development, like that of Budwig (1995). She argues that early on, before English-speaking children grasp the morpho-syntactic aspects of pronominalization, they create their own pragmatic and semantic systems, and these change over time. It is also in line with a previous account of null-subject acquisition in Hebrew by Berman (1990), who argues that language typology combines with a confluence of cues to guide children in acquisition of null subjects. These different cues may have a differential impact at different developmental phases. Thus, in the pregrammatical phase, linking speech to the immediate situational context plays a major role. With the onset of structure-dependent production (including grammatical inflections, agreement marking, and case-marking), children become more attentive to the

71 For a specific example refer to Chapter 1, Section 3.4.

particular ways in which pronominal subjects pattern in their native language. Only later will they learn to use the discourse-licensed thematic type of null subjects in constructing cohesive stretches of text.

1.4.2 A Proposed Argument Elisibility Hierarchy

Comrie and Keenan (1979) propose the following Noun Phrase Accessibility Hierarchy (NPAH) to account for the crosslinguistic well-formedness of Relative-Clause (RC) formation.

(9) **Noun Phrase Accessibility Hierarchy (NPAH)**

SUBJECT > DIRECT-OBJECT > INDIRECT-OBJECT > OBLIQUE > GENITIVE > OBJECT-OF-COMPARISON

That is, all languages may relativize the subject, only a subset may relativize both subject and direct object, and only a proper subset of these may relativize indirect object, and so on down the line. According to the strong form of the NPAH constraint, if a language can relativize any position on the NPAH, it can relativize all higher positions. Also, for each position on the hierarchy, there are possible human languages which relativize this position, but no lower positions.

In line with Comrie and Keenan's proposal, I propose the following Argument Elisibility Hierarchy:

(10) **Argument Elisibility Hierarchy (AEH)**[72]

SUBJECT > DIRECT-OBJECT > GOVERNED > INDIRECT-OBJECT > OBLIQUE

This hierarchy implies that if a language allows argument ellipsis, then it allows subject ellipsis, a subset of languages allows both subject and direct object ellipsis, and a proper subset of these allows subject, direct object and governed-object ellipsis, and so on. Both the NPAH and the AEH propose a similar order of arguments that can be relativized or elided in different languages. This similarity can contribute to our understanding of the notions "subject" and "object", and how they function within and across languages.

The order of arguments along the elisibility hierarchy is motivated by three sources of data: (1) Hierarchies of syntactic functions like the ones proposed in Comrie and Keenan's (1979) NPAH, in Greenberg's (1963) Grammatical Relations Hierarchy, which relates to patterns of markedness of grammatical categories, and in Berman's (1982) account of oblique objects in Hebrew; (2) typological studies of the

subject-object asymmetry, e.g., Croft's (1990) and Greenberg's (1963) discussion of subject versus object case marking, word order and agreement features across languages; and (3) research on various aspects of the subject-object asymmetry, e.g., Bybee's (1985) discussion of subject versus object pronominalization, or Gerken's (1990) suggestion that subject position is prosodically weaker than object position.

A primary motivation for proposing this hierarchy concerns learnability (Berwick 1985, Braine 1988, Pinker 1984, Wexler 1981, Wexler & Culicover 1980, Wexler & Manzini 1987), that is, the need to formally state the conditions under which children can successfully acquire a linguistic rule-system within a limited time span – in this case, the conditions under which children acquire the licensing mechanism of null arguments in their language. A universal hierarchy of argument ellipsis makes it easier to explain how children acquire the initial null-argument setting in their target language. Following the initial state of "no arguments", null arguments will emerge according to the hierarchy. Specifically, the AEH predicts that for any particular language, null subjects will be the first to be licensed, later this will be extended to direct and possibly even indirect objects. This hierarchy reflects a typology of languages, which by virtue of the type of argument ellipsis they allow, pattern similarly with respect to a cluster of other linguistic properties, too. Such an elisibility hierarchy also accounts for the subject-object asymmetry both within and between languages.

I propose that the AEH and the licensing modules for null arguments (morpho-syntax, semantics, pragmatics) interact across development. The proposed interaction provides a means for representing and predicting trends of argument ellipsis both within a single language, and crosslinguistically. An example is illustrated in Figure 7.1 below, which shows an interaction between three argument-types (ordered according to the AEH from left to right) and three licensing modules for missing arguments, from necessary to sufficient conditions (from bottom to top) for three types of languages, represented by color-coded dots (white, black, and gray). The white dots represent a topic-drop language like Chinese or Japanese, where both subject and object ellipsis are licensed by discourse; the black dots represent a *pro-drop* language like Italian, where both types of ellipsis are morphologically licensed; and the gray dots represent a "mixed" language like Hebrew, where licensing of null

72 The proposed Elisibility Hierarchy could be extended to account for sentential complement and predicate ellipsis, which lie beyond the scope of this study.

arguments is initially pragmatic, later supplemented by semantic licensing of direct object ellipsis, and by morpho-syntactic licensing of null-subject.

Figure 7.1 Interaction between the AEH and Three Licensing Modules for Three Types of Languages

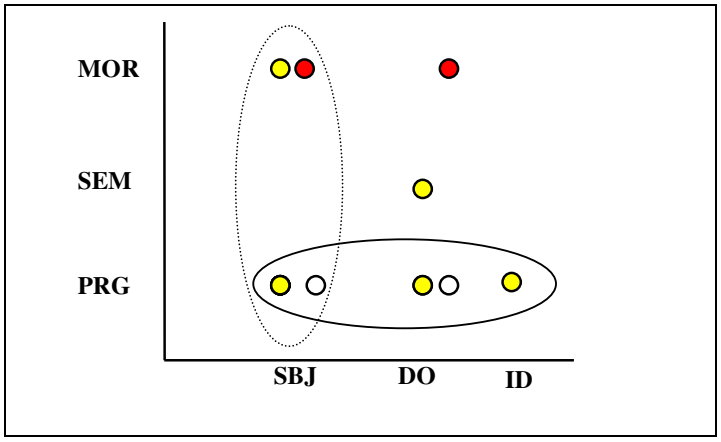


Figure 7.1 shows that in a given language, the selection and relative weight of the various licensing modules for any particular argument may vary as acquisition proceeds. This is illustrated by the distribution of gray dots in the SBJ, DO and ID columns. Also, two languages may exhibit a similar pattern of elisibility (e.g., allow both subject and object ellipsis), but differ in the licensing modules by which each is governed (e.g., morpho-syntactic versus pragmatic). This is illustrated by the distribution of black as compared with white dots in the Figure.

In sum, the distribution of dots across a particular module (e.g., pragmatic versus semantic) or argument-type (e.g., SBJ versus ID columns in Figure 7.1) will reflect both language particular and crosslinguistic trends in the licensing of null arguments.

1.5 Predictions

Below I specify (1) **quantitative** predictions for amount of subject versus object ellipsis and amount of missing versus overt arguments. And (2) **qualitative** predictions for the distribution of licensing modules in argument ellipsis across development and the nature of overt arguments (lexical NPs, pronouns, and expletives).

The amount of ellipsis is predicted to be higher for subject than for direct and indirect object across development, as suggested by the AEH. At the no-argument phase, the amount of subject and direct object ellipsis will be higher than that of overt

arguments. Later on, the amount of overt arguments will increase, while the amount of ellipsis will decrease.

Subject- and object ellipsis are predicted to differ in the licensing conditions that govern them across development. Both types of ellipsis will initially be mainly unlicensed, subsequently replaced by a certain amount of pragmatic licensing which gradually stabilizes, with subject ellipsis finally also extended to morpho-syntactic licensing. That is, from a state of missing subjects in all tense-person configurations (or, possibly, the use of missing subjects at chance level in all tense-person configurations), children will gradually limit their use to canonical *pro-drop* contexts only. Initially, object ellipsis is predicted to be mostly unlicensed, then null-objects will be increasingly pragmatically and semantically licensed, and at the same time, the amount of overt objects will increase.

Initially, most overt subjects and objects will be lexical. With development, subjects and objects will be increasingly realized as pronominal, except for indirect objects, which will initially be realized as rote-learned pronominals, later supplemented by [P + NP] sequences and by a wider range of inflected pronominals.

The acquisition of VAS interacts with the acquisition of licensed ellipsis as follows: Initially, verbs will occur with no overt arguments. At this phase, most cases of argument ellipsis will be unlicensed. Next, verbs will have a single argument – subject, direct object, or indirect object. At this phase, argument ellipsis will be partially unlicensed and to a large extent pragmatically licensed. Finally, at the multi-argument phase, verbs will occur with an increasing number of overt arguments. At this phase, a growing number of missing subjects and direct objects will be morph-syntactically and semantically licensed, respectively.

1.6 Data Analysis

This section analyzes data for five main dimensions. (a) The asymmetry between subject and object ellipsis, (b) the licensing conditions of missing arguments in early versus late omissions, (c) the relation between null and overt arguments, (d) the distribution of overt arguments, and (e) the interaction between acquisition of VAS and the licensing conditions for null arguments.

1.6.1 Methodology

The analysis included all utterances that contained a lexical verb in transcripts of biweekly sessions over a period of six months. It excluded exact imitations of a

caregiver's utterance, frozen formulaic expressions, excerpts from nursery rhymes and songs, and unintelligible utterances as well as utterances with verbs that require governed or other oblique objects or sentential complements (see Section 1.1 for further details). The data were coded as described in Chapter 2, Section 1.4.4.

The data of the present study were supplemented by diary data from my son Raz aged 1;6 – 2 years, and by naturalistic longitudinal data analyzed in previous studies for three other Hebrew-speaking children: Assaf, aged 1;11 to 2;5, Naama, aged 1;7 - 2;6 (Berman 1990), and Sivan, aged 2;2 - 5;6 (Lev 1989). The supplementary data consisted of conversational interactions audio-recorded every three to four weeks. Naama was recorded at home in interaction with her mother, the investigator, and the investigator's little boy. Sivan was recorded at home with one or both of her parents, in interaction with her brother Assaf, aged 13 months younger.

1.6.2 Null Subjects versus Null-Objects

Analysis yielded a total of 2522 "contexts for argument ellipsis" – that is, contexts where SBJ, DO and IO could occur. The contexts for **subject** ellipsis included 4 configurations – SV, SV(O), SVO and SVOI; for **direct object** ellipsis three configurations – SV(O), SVO and SVOI; and for **indirect object** ellipsis only one configuration – SVOI. This means there was some overlap in the count of total contexts. Table 7.1 specifies for each child and argument type, the distribution (in percentages) of the various "contexts for ellipsis" out of the total number of contexts.

Table 7.1 Breakdown of Contexts for Argument Ellipsis by Argument-Type and Child

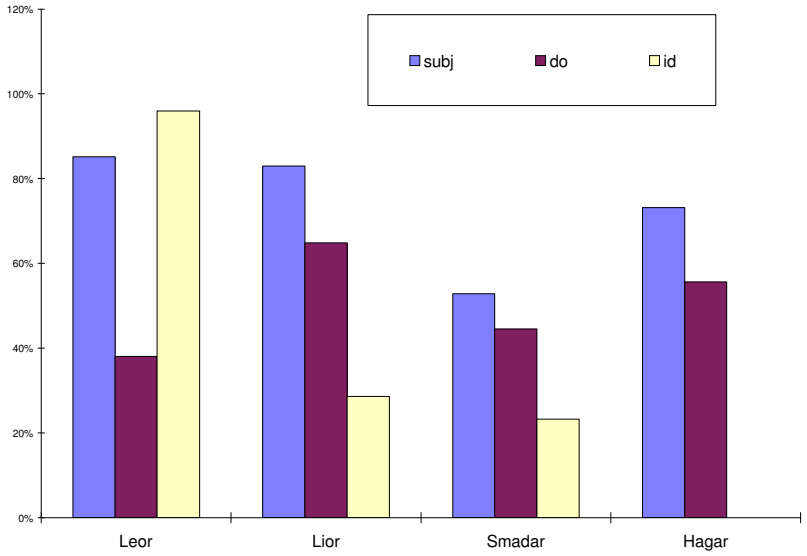
Argument Type	No. of contexts	Lior	No. of contexts	Leor	No. of contexts	Hagar	No. of contexts	Smadar
SBJ	182	63%	377	55%	454	60%	481	61%
DO	91	32%	281	41%	293	39%	256	32%
IO	14	5%	25	4%	12	2%	56	7%
Total	**287**		**683**		**759**		**793**	

Table 7.1 indicates that all four children show remarkably similar patterns in the distribution of contexts for subject, direct object, and indirect object ellipsis. Their speech provides approximately twice as many contexts for subject ellipsis (55%-63%) as for direct object ellipsis, and five to six times more contexts for direct object ellipsis (32% - 41%) than for indirect object ellipsis (2% - 7%).

Figure 7.2 displays the percentage of realized ellipsis in relation to the contexts of ellipsis by type of argument and child. All four children elide Subjects more than direct objects, but they vary in the difference between subject versus object ellipsis.

The difference between subject and object ellipsis ranges between 47% (Leor) and 8% (Smadar), with a mean difference of 23%. In indirect object ellipsis, the behavior of the four children is even more variant: Smadar and Lior elide them only rarely, Leor does so nearly all the time, while Hagar does not elide indirect objects at all.

Figure 7.2 Percentage of Realized Ellipsis in Relation to Potential Contexts for Ellipsis by Type of Argument and Child



How can these discrepancies be accounted for? Methodologically, one might say that the sample is not large enough to reveal acquisitional trends. This may hold for indirect objects, but less so for subjects and direct objects. Distributionally, there are more contexts for subject ellipsis than for object ellipsis, since most verbs in the language require a subject.[73] At the initial period of VAS acquisition, when verbs are still bare and argument structure is not fully acquired, distributional differences between the various types of arguments seem sufficient to account for the asymmetry between subject and object ellipsis. Besides, the licensing conditions for subject ellipsis are more varied than for object ellipsis. In Hebrew, subject- but not object ellipsis is licensed morpho-syntactically as well as pragmatically. The unavailability of grammatical licensing for objects (both direct and indirect) means that these arguments do not have a wide range of contexts for ellipsis to begin with. This asymmetry is most evident at later stages of acquisition, when children begin to realize more instances of subject ellipsis for morpho-syntactic rather than for

73 Hebrew also has numerous intrinsically subjectless constructions, mainly different types of impersonals (Berman 1980). These are not considered here, since they are by default "null-subject" constructions. Children never **add** personal pronouns or expletive subjects in such environments.

pragmatic reasons. Direct and indirect objects might also be heavier on the informativeness scale than subjects, as suggested by the Preferred Argument Structure Hypothesis (Allen 1997, Allen & Schroder [in press], Ariel 1991, Du Bois 1985, 1987), and hence less prone to elision than subjects.

Children appeared to omit indirect objects rather **less** than might be expected. This could be because indirect object usage often seems based on rote learning of [verb + pronoun] clusters as unanalyzed expressions in the initial stage of acquisition (e.g., one-word-stage expressions like *tni li* 'give-IMP to-me = gimme', *tavi li* 'bring-IMP to-me = bring me'). This is supported by the use of dative pronouns with incorrect person marking with certain verbs, while using other verbs like 'give' with the correct object pronoun. For example, *roca lesaper* ***lax*** 'want to tell to-you', *koev* ***lax*** 'hurts to-you = (it) hurts you', *nafal* ***lax*** 'fell-down to-you = (it) dropped to you' (where *you* = *me* in all of these cases), but *tni* ***li*** 'give to-me = give me'.

Two apparent anomalies emerge from the data for the boy, Leor: considerable difference between subject and object ellipsis (47%), and almost invariable indirect object ellipsis (96%). This may be attributed to Leor's marked preference for a few specific verbs. Unlike the other children, he used the verb meaning 'want' no less than 246 times compared to 102, 22 and 18 occurrences in the data of the three girls. This modal type verb occurs mostly with no overt subject in present tense in adult as well as child Hebrew, rather like English *wanna* (see fn. 10). Even though this appears to violate the morpho-syntactic licensing conditions for *pro-drop* in Hebrew, the subject in *want*-utterances is directly recoverable from context. The verb 'want' typically occurs with an overt direct object or infinitival complement. It turns out that during the examined period, Leor used only one single ditransitive verb requiring an indirect object, the Hebrew verb for 'bring'. This verb-specific type of elision of both Indirect object (imperative 'bring!'), and surface subject (present tense 'want') points to the strong impact of individual lexical items in the development of individual children's grammars at a particular point in time.[74] This lends support to the verb-by-verb learning hypothesis noted earlier, but it also points to the problem inherent in sporadic

74 Also, many of these "denuded" verbs like imperative *tavi(i)* 'bring!' or indicative *samti* 'I put-PT', which sound quite bizarre in English, are perfectly acceptable in conversational contexts in Hebrew, even in adult usage. For example, out of 27 occurrences of 'bring-IMP' in the speech addressed to Leor by his caretaker, only two had an overt indirect object. Leor's use of 'bring!' without an overt indirect object thus seems to be strongly affected by input.

sampling procedures of the kind undertaken here, as in many other studies of early grammatical acquisition.

1.6.3 Null versus Overt Arguments

I predicted that the amount of both null subjects and null direct objects would decrease with development, while that of overt subjects and objects would increase gradually. This prediction is tested below.

1.6.3.1 Null versus Overt Subjects

Present tense and 3rd person past tense are two contexts that prohibit morpho-syntactic licensing of null subjects. Analysis of the distribution of null versus overt subjects in these contexts over time can thus reliably plot their development. Figure 7.3 displays the distributional trend (in percentages) of overt subjects in present tense verbs in Hagar's data, between ages 1;8 - 2;11.[75] The line represents the trend of null subjects in relation to the total amount of subjects in the present tense in Hagar's data, while the scattered x's represent the actual distribution of null subjects. The varying size of the x's represents the relative effect of each sampling on the trendline.

Figure 7.3 Distribution (in percentages) of Null Subjects in Present Tense Verbs in Hagar's Data [1;8 – 2;11]

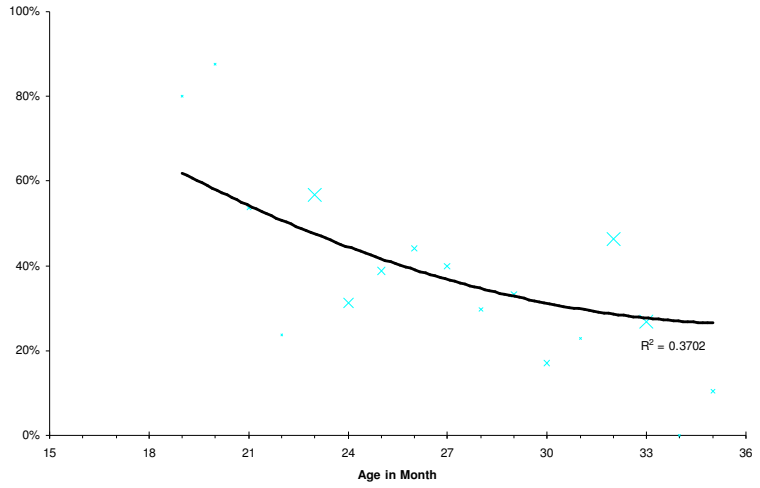


Figure 7.3 shows that the amount of null subjects decreases, and the amount of overt subjects increases with age.

Past tense verbs in the 3rd person do not allow null subjects in simple clauses, unlike verbs in the 1st and 2nd person, which serve as canonical *pro-drop* contexts in

75 In this subsection, detailed data are given for only one child to simplify presentation, since these data can be taken as representative.

Hebrew. The distribution of null and overt subjects in 3rd person past tense verbs over time can also reveal the developmental trend of null and overt subjects. Figure 7.4 shows the distributional trend (in percentages) of null and overt subjects in 3rd person past tense verbs in Hagar's data, between the ages 1;8-2;11. The thin line represents the developmental trend of overt-subjects with 3rd person past tense verbs, while the thick line represents the developmental trend of null-subject, both calculated out of the total contexts of 3rd person past tense verbs in the data.

Figure 7.4 Distribution (in percentages) of Null and Overt Subjects in Past Tense Verbs in Hagar's Data [1;8 – 2;11].

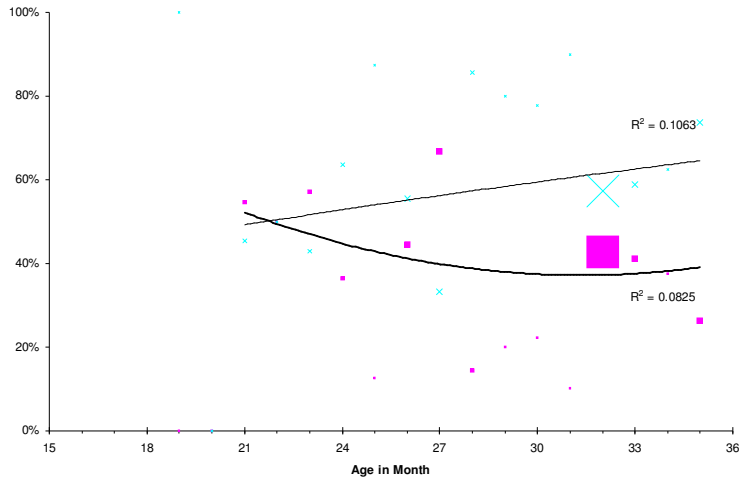


Figure 7.4 reveals that the use of overt subjects in *non-pro-drop* contexts increases along with a decrease in the use of null subjects in these contexts. This finding bears out the prediction specified in Section 2.5.

1.6.3.2 Null versus Overt Direct Objects

Unlike subjects, the relation between null and overt objects over can be examined without reference to morpho-syntactic context. Figure 7.5 displays the percentage of overt versus null direct-objects, calculated out of the total number of occurrences of direct objects in Smadar's data between the ages 1;6 - 2;4. Since the children's overall breakdown of results is so highly similar, I decided to confine detailed figures to one child only. I chose Smadar since, while she is clearly representative of general trends across all the children in my sample, she is precocious in her linguistic development, and demonstrates the clearest transition in MLU levels across time. She was also more talkative than Lior, the only other child for whom systematic longitudinal data is available from as early as 1;5. In the following Figures,

then, data from Smadar is meant to represent developmental patterning of overt and missing arguments in Hebrew child language in general.

In Figure 7.5 the thin line represents the developmental trend of overt direct object, and the thick line represents the developmental trend of null direct object.

Figure 7.5 Distribution (in percentages) of Null and Overt Direct-Objects in Smadar's Data [1;6 – 2;4]

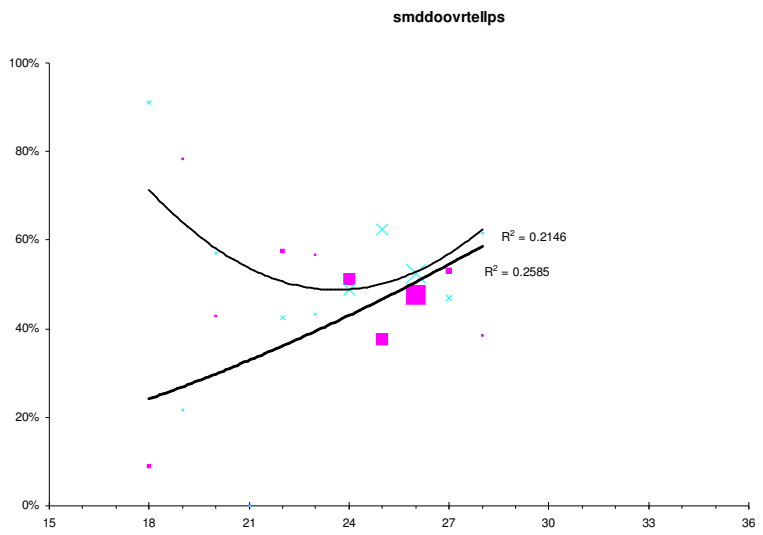


Figure 7.5 shows a decrease with age in null direct-objects, along with a corresponding increase in overt direct-objects. The other children reveal a similar trend.

The distribution of null and overt arguments confirms the prediction that with age there is a decrease in argument-ellipsis along with an increase in overt arguments. This trend is also consistent with the early development of VAS, which is marked by a transition from the no-argument phase to a single argument phase. However, this description is too simplistic. For example, a simple count of the number of overt versus null-objects might be misleading, since the category "null-objects" as such does not distinguish between licensed and unlicensed occurrences. Distinguishing these two types of null-objects is crucial, since the amount of unlicensed null-objects is predicted to show a clear decrease over time irrespective of contextual factors, as a result of the acquisition of VAS. In contrast, the amount of pragmatically licensed null-objects, although expected to increase over time, may in fact show a fluctuating pattern of development (with a number of peaks), since it is determined by contextual factors. Thus, calculating the amount of null-objects for these two types of elements combined might obscure the expected decrease in unlicensed null-objects, as can in

fact be seen by the slight increase in the amount of null direct-objects in figure 7.5. Accordingly, I move on to consider the licensing of null arguments.

1.6.4 Licensing Conditions for Missing Arguments

Figure 7.6 shows the amount of unlicensed ellipsis in Smadar's data by MLU, where "unlicensed" refers to contexts of argument ellipsis that are neither pragmatically or grammatically licensed (e.g., missing arguments in bare verb forms or in root infinitives).

Figure 7.6 Realization of Unlicensed Ellipsis by MLU for Smadar

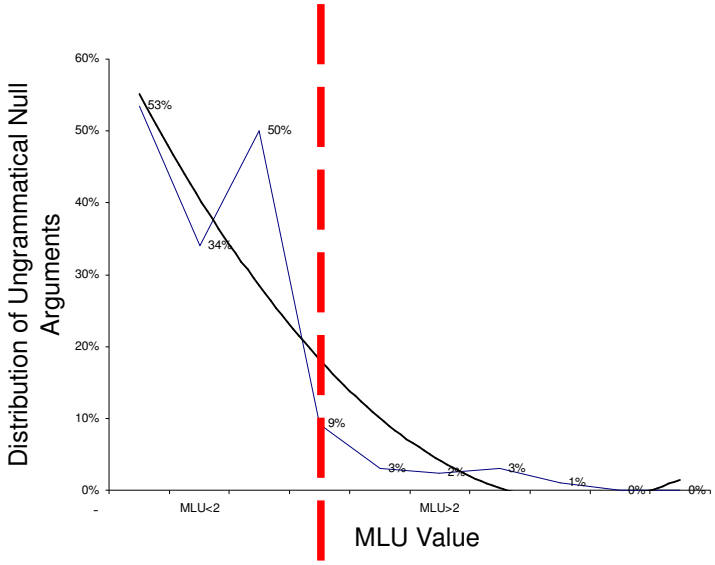


Figure 7.6 shows that below MLU 2, more than half the verbs in Smadar's corpus occur with unlicensed null arguments, but with the increase in MLU value, the amount of unlicensed null arguments decreases. This finding bears out my prediction that initially most null arguments will be unlicensed. It may also serve as evidence for the "boundedness" of the *Training Level* argued for in Chapter 1 (Section 3.1.1), since it suggests that Smadar's use of unlicensed null arguments across development correlates with her MLU scores.

With the decrease in amount of unlicensed ellipsis, there is a gradual rise in both overt arguments and licensed ellipsis (where "licensed" includes morpho-syntactic, semantic, and pragmatic licensing) as illustrated for Smadar in Figures 7.7 and 7.8. The Figures also suggest that the **nature** of licensing changes markedly over time.

Figures 7.7 and 7.8 display the distribution (in percentages) of null subjects (7.7) and null direct-objects (7.8) by licensing conditions out of the total amount of

potential licensing conditions for subject and direct object ellipsis in Smadar's data between the ages 1;6 - 2;4.

Figure 7.7 Distribution (in percentages) of Licensing Conditions for Null Subjects in Smadar's Data [1;6 – 2;4]

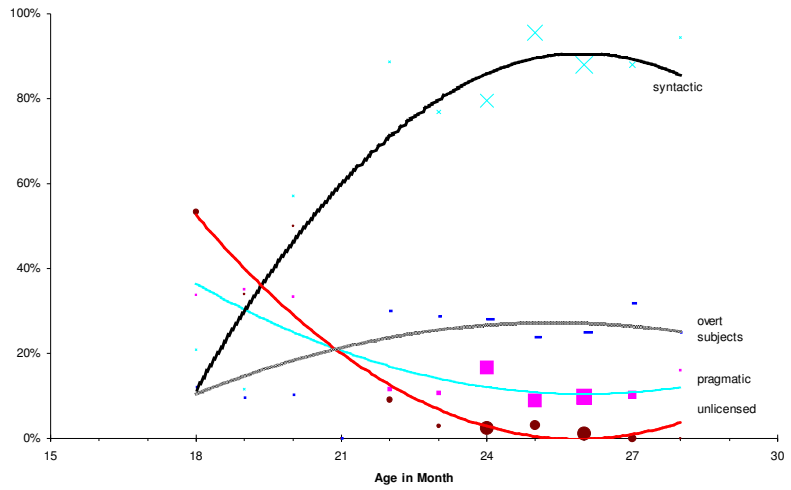
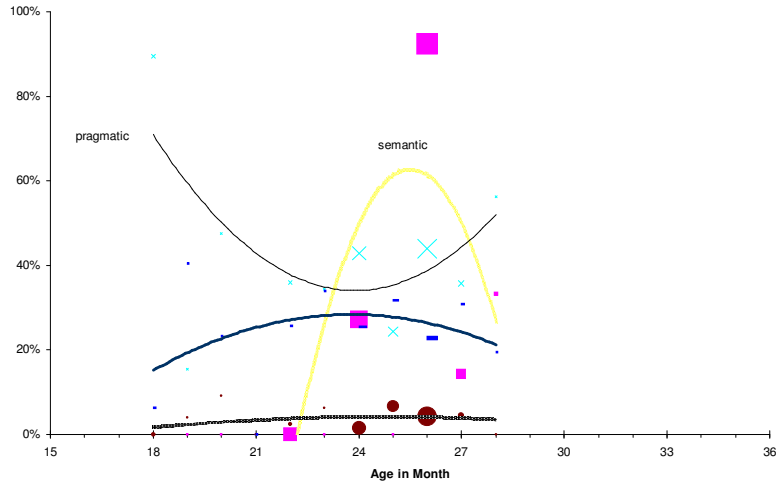


Figure 7.7 shows that the amount of unlicensed as well as pragmatically licensed null subjects decreases with development, while the amount of overt subjects shows an increase up to a point at which it stabilizes, and the amount of grammatically licensed null subjects shows a sharp increase.

Figure 7.8 Distribution (in percentages) of Licensing Conditions for Null Direct Objects in Smadar's Data [1;6 – 2;4]



Comparison of the developmental trends in Figures 7.7 and 7.8 shows, first, that both overt subjects and direct objects increases with development. Second, there is a

decrease in pragmatically licensed null subjects and pragmatically licensed null direct objects. However, pragmatic licensing of null direct objects differs from null subjects in being more prominent to begin with and in showing a slight increase with development. Third, initially the number of unlicensed null subjects is much higher than of unlicensed null-objects, and it decreases more drastically than unlicensed null direct object. These findings suggest that over time, overt arguments replace, at least in part, pragmatically licensed null arguments and unlicensed null arguments. Also, with age, a growing number of null subjects becomes grammatically licensed, while a growing proportion of null-objects becomes semantically and pragmatically licensed.

Initially, children's verb-inventories do not include a large number of optional transitive verbs (like *eat, drink, draw, play, write*), which explains the small number of semantically licensed null-objects. This changes when children begin to use optional transitive verbs more widely without an overt direct object. Subsequently, they make increasing use of overt direct objects, and this again leads to a drop in semantically licensed null direct objects. This developmental pattern is consistent with the acquisition of optional transitive verbs as reported by Valian (1991), who notes that English-speaking children do not seem to use a verb unless they know how it subcategorizes for objects, and so they provide objects much more frequently for pure transitives than for optional transitive verbs, suggesting that they recognize the difference between obligatory and optional object. Valian notes that the use of objects with optional transitives rises between ages 2;1 - 2;5. My data reveal a similar trend, with the use of overt direct objects in optional transitive constructions beginning around age 2;1 and increasing from then on.

1.6.5 The Nature of Overt Arguments

This section discusses the overt arguments used by the four children across development: Overt subjects (1.6.5.1), direct objects (1.6.5.2), and indirect objects (1.6.5.3).

1.6.5.1 The Nature of Overt Subjects

Figure 7.9 displays the distribution (in percentages) of pronominal subjects out of the total contexts for overt subjects by child and age.

Figure 7.9 Proportion (in percentages) of Pronominal Subjects out of the Total Contexts for Overt Subjects by Child and Age

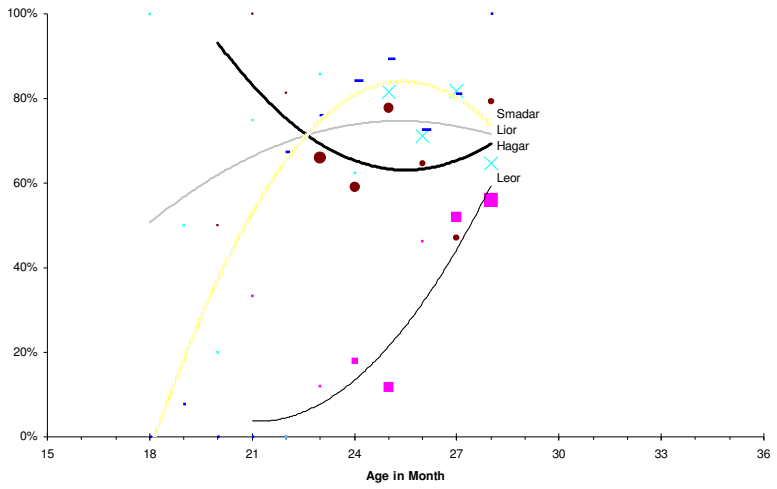


Figure 7.9 shows that for three of the four children (Smadar, Leor and Lior), overt pronominal subjects increase across development, but to differing extents. Smadar and Leor show a sharp increase in pronominal subjects as against Lior's more moderate increase and Hagar's decrease in pronominal subjects, followed by a moderate increase starting at age 2;1. Correspondingly, with age, Smadar and Leor exhibit a sharp decrease in overt lexical subjects, while Lior shows a slight decrease, and Hagar shows a slight increase. These diverse developmental patterns reflect individual differences in the types of arguments that are replaced by overt pronominal subjects. Smadar and Leor use pronouns largely as a trade-off for overt lexical subjects, and so the decrease in lexical subjects with development. In contrast, with Hagar and Lior pronominal subjects seem to replace null subjects, so that the use of overt lexical subjects remains more or less stable across development. Valian and Eisenberg (1996) propose a similar strategy for the way Portuguese-speaking children increase their use of subjects. They point to a trade-off between null and pronominal subjects such that null subjects decrease with development and become expressed as pronouns, while lexical subjects remain relatively stable, arguing that age and verb-use are related to the frequency with which children use pronominal subjects.

1.6.5.1.1 Overt Pronominal Subjects

Several studies on Hebrew-speaking children deal with development of overt pronominal subjects. Maoz's (1986) cross-sectional study found that 1st person pronouns were acquired first, followed by 2nd person pronouns, plural pronouns, and

only then 3rd person pronouns. Berman's (1990) study of acquisition of personal pronouns by four Hebrew speaking children aged 1;7 - 4;6 reports that the two younger children in her sample, Na'ama (1;7 - 2;6) and Assaf (1;11 - 2;5) showed a similar trend. They first acquired 1st person singular pronouns, then 2nd person singular pronouns, and only later 3rd person singular masculine and feminine forms. Armon-Lotem's (1997) longitudinal research on a similar database as the present one supports the finding that Hebrew-speaking children use 1st person pronouns, and then 2nd and 3rd person masculine forms before age two. Plural and feminine pronouns emerge during the first few months of the third year, with plural before feminine. Armon-Lotem notes that the emergence of pronouns correlates with the productive use of mood/tense, and precedes the mastery of the person inflectional paradigm, in line with predictions based on the minimalist program within which her research is conducted.

Table 7.2 displays the distribution of overt pronominal subjects in my sample by child and age. The data displayed in the Table relate to the beginning of productive use of a given form rather than to its first occurrence.[76]

Table 7.2 Order of Occurrence of Overt Pronominal Subjects

Pronoun	Lior	Smadar	Leor	Hagar
ani 'I'	1;11	1;7	1;11	1;9
ata 'you-SG-MS'	1;11	1;11	1;11	1;10
at 'you-SG-FM'	1;11	1;7	2;3	1;10
hu 'he'	2;1	1;10	2;0	1;11
hi 'she'	2;5	1;10	2;3	2;4
anaxnu 'we'	2;8	2;1	2;3	2;4
atem 'you-PL-MS'	2;5	1;11	2;9	—
aten 'you-PL-FM'	—	—	—	—
hem 'they-MS'	2;5	1;11	2;6	2;3
hen 'they-FM'	—	—	—	—

Table 7.2 shows, first, that singular pronouns are used productively before plural pronouns. Second, 1st person singular is the first pronoun to be used productively by all four children. Third, the three girls seem to use *at* 'you-2SG-FM' productively either before, or at the same time, as they start using *ata* 'you-2SG-MS'. Leor, the boy, on the other hand, starts using *ata* before the corresponding feminine form *at*. Fourth, all children demonstrate productive use of *hu* 'he' before the corresponding feminine form *hi* 'she'. Finally, unlike the boy, the three girls show

76 *Productive use* is defined here as five occurrences of a given form in self-initiated utterances, each in the appropriate context, and with a different verb (see, further, Chapter 2, Section 2.1).

productive use of 1st person plural *anaxnu* 'we' later than *atem* 'you-2PL'or *hem* 'they'.

These findings differ from previous studies in the order of acquisition of 3rd person singular pronouns. Berman (1990) claims that 3rd person are acquired after 2nd person pronouns, but my sample suggests that this is so only for feminine *hi* 'she', but not for masculine *hu* 'he' (e.g., compare Leor and Smadar in Table 7.2). Like Armon-Lotem (1997), I found that singular 1st and 2nd person pronouns as well as 3rd person masculine forms are used productively before age two. In contrast to Armon-Lotem, my data suggest that after age two, feminine singular *at* 'you' and *hi* 'she' are used productively before plural pronouns. These disparities may stem from methodological differences such as the relative size of the corpus and sampling intervals, but most problems derive from the principled definition of what constitutes "acquisition" or "usage" (see Chapter 2, Section 2.1). A third possibility is that the general developmental pattern that emerges from the literature (Clark & Sengul 1978, Deutsch & Pechmann 1978), e.g., 1st > 2nd >3rd person, singular > plural, is subject to individual variation (e.g., 2MS > 2FM) that is affected by input to the child. For example, a boy might show productive use of 1st > 2nd > 3rd person pronouns in the singular masculine, but not in the singular feminine form (e.g. Leor), since his caregivers address him using masculine rather than feminine pronouns (see, too, the discussion of gender acquisition in Chapter 4, Section 4.1).

1.6.5.2 The Nature of Overt Direct Objects

Unlike subject pronouns, object pronouns like all non-nominative pronouns in Hebrew are bound forms, in which gender, number and person inflection is affixed to the accusative marker *et*, involving a phonological change of form before a pronoun suffix, e.g., et+1PL = ***ot****anu* 'us', et+2SG-FM = ***ot****ax* 'you', et+3SG-MS = ***oto*** 'him'.

To calculate the distribution of overt pronominal direct objects, the inventory of overt direct objects of Hagar, Leor and Smadar was coded for obligatory contexts for the occurrence of pronouns.[77] Four such contexts were defined, as illustrated below with data from Smadar [age 2;2]: (1) overt direct-objects which referred to the speaker as in Smadar's utterance about herself *anaxnu shom'im oti* 'we hear-1PL-MS-PR me = we hear me'; (2) overt direct-objects which referred to other people who were present in the room, as *in ve az macati otax* 'and then I find-1SG-PT you-2SG-FM

= and then (I) found you' in conversation with her mother; (3) direct-objects which referred to objects present in the room, as in *kxi et ze* 'take-2SG-FM-IMP ACC it = take this', as she handed a flower to her mother; and (4) direct-objects which referred to people or objects previously mentioned in the conversation as in *ve az lakaxti otam* 'and then I take-1SG-PT them-3PL-MS = and then (I) took them' used in telling a story about her bicycle (*ofanayim* 'bicycle' is a plural noun in Hebrew). Figure 7.10 displays the distribution in percentages of overt pronominal direct object out of the potential contexts for pronominal direct objects for the three children, between ages 1;6 - 2;4.

Figure 7.10 Distribution (in percentages) of Overt Direct-Object Pronouns out of Total Contexts for Overt Direct-Objects in Hagar, Smadar and Leor [1;6 – 2;4]

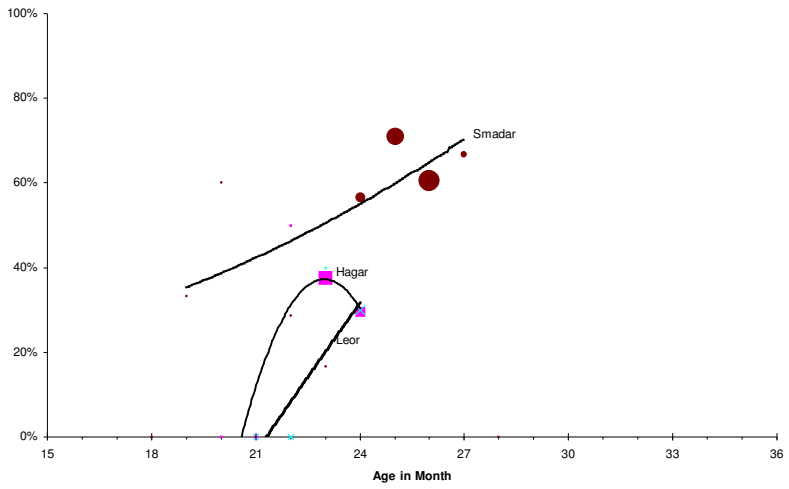


Figure 7.10 points to a gradual increase in the use of pronominal direct objects over time, with a corresponding decrease of overt lexical direct objects. Use of pronominal direct objects shows some individual variation, with Smadar using higher percentages than Hagar and Leor. A comparison between the distribution of overt pronominal subjects (Figure 7.9) and overt pronominal direct objects (Figure 7.10) reveals that both types of pronouns increase over time.

1.6.5.2.1 Overt Direct Object Pronouns

All four children start by using the 1st (*oti* 'me') and 3rd person singular inflected object forms (*ota* 'her', *oto* 'him'). In Hebrew both 'him' and 'her' refer to animate as well as inanimate objects, although inanimates can be replaced by the (more juvenile) analytic form *et ze* 'ACC it/that/this'). These are then supplemented by

77 Lior was not included in this analysis since the number of relevant cases in her data was too small to

the 2nd person accusative pronouns *otax* 'you-2SG-FM' and *otxa* 'you-2SG-MS', and by plural pronouns mostly in the 1st and 3rd person. Comparison with findings for pronominal subjects reveals that in both cases, singular pronouns are acquired before plural and 1st person pronouns are acquired before 2nd and 3rd. The major differences between the two types of pronouns are in order of acquisition of 2nd and 3rd person pronouns, and the relatively late acquisition of plural direct-object pronouns compared with plural subject pronouns.

1.6.5.3 The Nature of Overt Indirect Objects

Several studies have examined the acquisition of oblique pronouns in child Hebrew. These may be suggestive of the acquisition of indirect (dative) objects in the language. Rom and Dgani (1985) conducted an experimental elicitation of case-marked pronouns (e.g., *et* accusative, *al* oblique) on Hebrew-speaking children aged 2 - 5;5. They found five developmental phases: (a) before age 2, children do not use case-marked pronouns productively; (b) around age 2 - 2;5, they use the correct preposition and a nonspecific noun in an analytic free form, e.g. *al ha-yeled* 'on the boy' instead of *al-av* 'on-him'; (c) between 2;6 to 3, they use around half the prepositions correctly, and the correct pronoun in an unacceptable analytic free form, e.g., *al hu* 'on he' (cf. normative *al-av*); (d) by age 3 to 4, children have generally acquired case-marked pronouns, i.e., they fuse the two elements – pronouns and prepositions, although two types of errors persist: regularization of irregular forms (e.g., *al* 'on', **al-o* 'on him' on a par with *sal* 'basket' *sal-o* 'his basket' for normative *al-av*) and use of non-normative forms (e.g., *ot-ex* instead of *ot-ax* 'you-2FM-SG-ACC); (e) By age 4, inflection of the three case-marked pronouns that they studied – the possessive particle *shel* 'of', the direct object marker *et*, and the locative preposition *al* 'on'. These results support the stages of acquisition of inflected prepositions delineated by Berman's (1981, 1985) analysis of spontaneous speech samples, and are consistent with what Johnston and Slobin's (1979) findings for spatial prepositions. Ravid's (1996b) structured elicitation study of Hebrew-speakers, aged 3, 5, 8, 12, 16 compared with adults from different socio-economic backgrounds, reveals that children **use** the [pronoun + preposition] combination productively quite early, but it takes them long to acquire the specific bound form used by adults.

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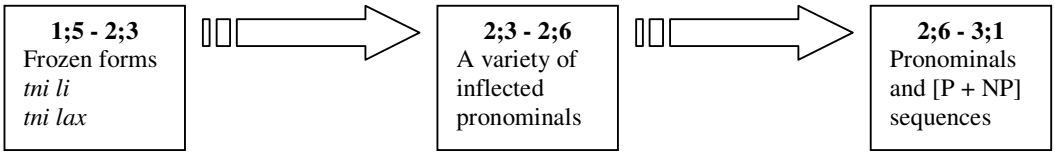
yield any significant results.

As for order of acquisition, Rom and Dgani note that first person pronouns are acquired before second and third person pronouns ($1^{st} > 2^{nd}, 3^{rd}$), suggesting that general crosslinguistic factors operate on the acquisition process in that Hebrew-speaking children like English- (Charney 1980, Waryas 1973) and German-speaking children (Deutsch & Pechmann 1978) acquire the role of the speaker prior to that of the non-speaker. On the other hand, Rom and Dgani found inconsistencies in the relative order of acquisition of 2nd and 3rd person pronouns, compared with that reported in the literature for proximal-nonproximal deictic terms, i.e. $1^{st}, 2^{nd} > 3^{rd}$ person pronouns (Chiat 1981, Clark & Sengul 1978, Deutsch & Pechmann 1978). They attribute this inconsistency to language-specific morphophonological complexity, since in Hebrew, the morphophonological form of 2nd person pronouns is more complex than that of 3rd person pronouns, e.g., *al-ayix* 'on-you' vs. *al-av* 'on-him'.

Development and order of acquisition of pronominal indirect objects is expected to resemble that of oblique objects. In my sample, the girls' data reveal that initially, most occurrences of overt indirect objects are pronominal rather than lexical, e.g., Smadar has 85% pronominal and 15% lexical overt direct objects (N = 94). For the boy, all early occurrences of indirect objects (up to age 2) are null (Leor used a single bitransitive verb – *bwa5* 'bring').

Figure 7.11 describes the development of overt indirect objects in my data.

Figure 7.11 Development of Overt Indirect Objects



The Figure suggests that initially most occurrences of pronominal indirect objects are frozen expressions like *tni li* 'give to-me = gimme' or *tni lax* 'give to-you = give you (when actually referring to self)'. Once the acquisition of person inflection is complete, children start using a variety of inflected pronominals. For example, *tni* ***la*** *xalav* 'give-2SG-FM-IMP to-her milk = give her milk', *ani avi* ***laxem*** *mic* 'I bring-1SG-FUT to-you-PL juice = I'll bring you juice', *titni* ***lo*** *le'exol* 'give-2SG-FM-FI to-him to eat = give him (something) to eat'. These forms are later supplement by [P + NP] sequences as in *titni maka* ***le-Nicanush*** 'give-2SG-FM-FI a spank to Nicanush = give Nicanush a spank'.

The development of overt indirect object pronouns follows the model of Rom and Dgani (1985) in that initially the use of these elements is nonproductive. Also, later on, children use clusters of the preposition *le-* (*le+ha=la* 'to+the') and a nonspecific noun, e.g., *heviu la-dod harbe mocecim* 'brought-PL to-the man many pacifiers = (they) brought the uncle lots of pacifiers' [Smadar 1;11]. My data showed no evidence for a phase in when children used the correct preposition and pronoun in an analytically free form, e.g., *al hu* 'on he = on him' cf. *alav*, *mi at* 'from you-SG-FM' cf. *mimex*. In fact, the three girls showed command of the correct fused forms of the indirect object pronouns even before age 3. According to Berman (p.c.) this interim strategy is documented for only some children, and is very short-lived.

Overall, the number of contexts for indirect objects is much smaller than for subjects or direct objects (see Section 1.6.2), and the number of overt indirect objects is even smaller. This creates a methodological problem for evaluating the order of acquisition of a particular construction.

Besides, the data for pronominal indirect objects in my sample reveal that all four children acquired singular before plural pronouns, and none used the plural 2nd and 3rd person feminine forms, *laxen* and *lahen*. These are replaced by the masculine form, e.g., ***hem*** *crixot kcat likfoc, ve ha-anashim marshim* ***lahem*** [Lior 2;8] 'they-**MS** need-PL-**FM** a little to jump, and the people let them-**MS** = they need to jump a little, and the people let them'. This leveling of gender distinctions in plural pronouns is common in standard adult Hebrew too, across nominative, dative and other cases (Berman & Ravid 1999).

1.6.6 Interaction between the Acquisition of VAS and the Licensing of Null Arguments

To examine the interaction between development of licensing conditions and acquisition of VAS, I analyzed the patterning of four transitive verbs (*sym1* 'put', *lqx1* 'take', *sgr1* 'close, turn off', *isy1* 'make/do') in data from Smadar, who demonstrated the clearest chronological transition in MLU-W levels of the four children. As noted, These verbs are transitive and also have high frequency, both within and across sessions. Table 7.3 shows the distribution of arguments and licensing conditions by verb, age, and MLU-W score for these four verbs. For example, at age 1;6 (MLU-W 2), Smadar used the verb *sym1* 'put' with no arguments. Since most of her verb forms were of the "unclear" type (Chapter 3, Section 1.3.1), it was not clear whether the

missing subject was grammatically licensed (e.g., in imperative or infinitive) or not (e.g., present tense). At age 2;3 (MLU-W 4), she used the same verb with two overt arguments, but now her missing subjects were morpho-syntactically licensed.

In Table 7.3, the number of arguments for each verb at a given age is the number of arguments that occurred in over 50% of the verb (token) occurrences at a given age. A similar criterion applies to the licensing module of a given null-argument at a given age. That is, the "sbj-licensing" cell for a particular age was marked **GR** just in case 50% of the occurrences of null subjects at that age were morpho-syntactically licensed. MLU-W 1, for example, does not conflict with the fact that Smadar uses bare verbs (∅ arguments), since the MLU-W score is calculated for the total number of **words** in an utterance, while "number-of-arguments" is calculated only for words that serve as **arguments** of a particular verb. Certain words are not arguments, and so may add to the MLU-W score without affecting the number-of-arguments score in the Table, e.g. hortative *kxi, ima!* 'take-2SG-FM-IMP Mommy = Mommy take', subjectless *kodem nasim* 'first, put-1PL-FUT = let's put first', or *loh lisgor* 'not to shut-INF = don't shut'. Individual sessions may also have an effect on the results. For example, for the verb *isy1* 'make, do', Smadar uses two arguments over 50% of the time at age 1;11, but with only one argument at age 2;4.

Table 7.3 Interaction between Acquisition of VAS and Licensing of Null Arguments for Four High Frequency Transitive Verbs in Smadar's Usage

Verb	**Age**	**1;5**	**1;6**	**1;7**	**1;8**	**1;9**	**1;10**	**1;11**	**2;0**	**2;1**	**2;2**	**2;3**	**2;4**
	MLU-W	**1**	**2**	**2**	**2**		**2**	**3**	**3**	**4**	**4**	**4**	**4**
sym1 'put'	# of overt arg.		1	0-1				1-2	1-2	1-2	2	2	2
	SBJ licensing		UC	UC, GR				GR, OV	GR, OV	GR, OV	OV	GR	GR
	DO licensing		PR	PR				OV	PR, OV	PR, OV	OV	PR	OV
lqx1 'take'	# of overt arg.		0	1				1	2		1		2
	SBJ licensing		GR	GR				GR	OV		GR		
	DO licensing		PR	OV				OV	OV		OV		
isy1 'do, make'	# of overt arg.			1	1-2		2	2	1-2	1-2	1-2	2	1
	SBJ licensing			UC, PR	PR, OV		OV	OV	OV	OV	OV, GR	OV	GR
	DO licensing			OV	OV		OV	OV	OV, PR	OV	OV, PR	OV	OV

Verb	Age	1;5	1;6	1;7	1;8	1;9	1;10	1;11	2;0	2;1	2;2	2;3	2;4
	MLU-W	1	2	2	2		2	3	3	4	4	4	4
sgr1 'close, turn off'	# of overt arg.		0		0				1		1-2	2	
	SBJ licensing		UC		GR				GR	GR, OV	GR	OV	
	DO licensing		OV		PR				OV	PR, OV	PR, OV	PR, OV	

Table 7.3 shows that numerous null subjects are grammatically licensed very early in acquisition (MLU 1.7). Initially, this is mostly due to the use of imperative or infinitive forms, rather than canonic (past and future tense) *pro-drop* forms. In fact, early instances of canonic *pro-drop* such as *gamarnu* 'finished-1PL' = 'we're done, allgone' and *asiti pipi* 'did-1SG wee wee = I peed' typically occur in formulaic, rote-learned contexts before productive command of person and other inflections, and arise in productive use of canonic *pro-drop* characterizes later phases of morpho-syntactic licensing of null subjects. Second, most cases of direct object ellipsis are pragmatically licensed either by the situational context or by discourse. Third, there is an increase in overt arguments (indicated in Table 7.3 by "OV") with rise in age and MLU-W score (cf. *sym1* 'put' at age 1;6, 2 and 2;2). Finally, the acquisition of VAS and licensing conditions for missing arguments interact as follows: (1) Initially, most verbs are bare, occurring with no overt arguments, and most cases of argument ellipsis are unlicensed (UC). (2) Next, at the one-argument phase, argument ellipsis is partially unlicensed and partially licensed, with licensing either pragmatic (mostly direct objects) or morpho-syntactic (mostly subjects). (3) Finally, at the multi-argument phase, there is a clear rise in number of overt arguments, on the one hand, and a growing number of morpho-syntactically licensed null subjects, on the other.

1.7 Conclusion

Data from Hebrew child language serve to throw light on the conditions that govern subject versus object ellipsis, and on the distinction between early and late omissions. The developmental account of the findings indicates that initially both subject and object ellipsis are initially pragmatically licensed, and that subject, but not object ellipsis, is subsequently supplemented by morpho-syntactic rules. This model is based on the interaction between two hierarchies across development: (1) a universal Argument Eligibility Hierarchy (AEH), following Comrie and Keenan's (1979) Noun Phrase Accessibility Hierarchy and Berman's (1982) account of oblique objects in

Hebrew, and (2) a Licensing Hierarchy involving language-specific weighting of linguistic modules.

The proposed account takes into consideration the transitions in licensing conditions of null arguments across development. It also allows for variation in licensing conditions of different arguments a given language, possibly across languages. And, it makes it possible to consider ellipsis in relation to both specific lexical items and specific classes of verbs, on the one hand, and to individual differences between learners, on the other.

The predictive power of this account lies in the fact that where there is **change** across **development**, arguments higher on the AEH are expected to move from a less restrictive to a more restrictive licensing module – that is, from pragmatic to morpho-syntactic licensing. Second, **individual variation** in acquisition of different arguments can be explained as follows: the higher the argument on the AEH and the more restrictive its licensing conditions, the less susceptible it will be to individual variation. And it reflects patterns of **language change** so that arguments higher on the AEH will be more resistant to change than ones lower on the hierarchy. For example, in Israeli Hebrew, unlike in classical Hebrew, accusative object inflections, e.g., *ahavti-**ha*** '(I) loved+ACC-3SG-FM' cf. Modern Hebrew *ahavti **ota*** '(I) loved her' are no longer inflectionally incorporated into the verb (unlike inflected subjects), except in marked, high-register literary texts or formal academic writing (Cahana-Amitay & Ravid 2000, Ravid 1995).

The current data (sections 1.6.2 – 1.6.4) can be taken to shed light on whether Hebrew child language manifests null-topic or null-subject characteristics. As noted in the literature (Section 1.3), in the early phases of acquisition, a null-topic language should not exhibit an asymmetry between null subjects and null-objects, whereas a null-subject language should exhibit a marked preference for null subjects. My analysis reveals that Hebrew provides more contexts for subject than for object ellipsis to begin with. Yet, in the relevant contexts, the realization ratio of subject to direct-object ellipsis is quite low for the three girls (though it is high for the boy, the oldest of the children). This suggests that children might start out with a model of a null-topic language, one that is characterized by initially identifying null arguments through discourse. This is supported by the large number of pragmatically-licensed null arguments in the Hebrew data in the initial phases of acquisition.

Two factors combine to promote early pragmatic conditioning in Hebrew. It provides the only context for object ellipsis and many permissible contexts for subject ellipsis. And, it emerges at a period when the requisite grammatical systems of inflectional marking of mood/tense and person, number and gender agreement on verbs, and of case on pronouns are not yet mastered. In these circumstances, formal licensing of ellipsis by grammatical rules will emerge later than communicative considerations of recoverability. This proposal takes into account the concurrent operation of the two processes of topic omission and subject omission (Armon-Lotem 1997, Hyams & Wexler 1993). And it also extends this distinction to account for both subject and object ellipsis, by integrating syntactic and semantic factors with communicative intent and discourse motivations in the process of acquisition. This broadening of perspective on the issue of missing arguments makes it possible to take into account both general, shared trends in processes of ellipsis as well as the role of language particular facts, of specific classes of verbs and of individual differences between learners.

With development, there is a clear decrease in both subject- and direct object ellipsis, giving way to overt arguments, on the one hand, and to morpho-syntactically licensed null arguments on the other. This suggests that at some point (around age 1;10 - 2), Hebrew-speaking children realize that their language is a null-subject language, and shift from a null-topic to the null-subject model. Following findings of Armon-Lotem (1997) and my own observations, this shift seems to co-occur with the emergence of pronouns and the productive use of mood/tense.[78] That is, a grammatically motivated command of null subjects is related to development in other, lexico-structural domains, specifically the use of the closed class set of pronouns as lexical items and of inflectional marking of verb tense and person.

Overt subjects increase across development, initially with more verbs in past (3rd person) than in present tense (all persons). This is consistent with the claim for early pragmatic licensing of null arguments. Verbs in the present tense in children's early language typically relate to the here and now, and so more readily allow arguments that are recoverable from the situational context. In contrast, verbs in third person past tense relate to entities that are not present and so require explicit mention of their arguments to be grammatical. For example, the modal verb *roce, roca* 'want-

78 The sample used in the present study is compared with that of Armon-Lotem (1997) in Chapter 2, Section 1.1.

SG-MS/FM' occurs largely without any overt subject in present tense in adult as well as child Hebrew, rather like English *wanna*. This appears to violate the licensing conditions for *pro-drop* in the language, but in fact the subject in 'want'-utterances is straightforwardly recoverable from the extralinguistic context. In contrast, a verb like *raca* 'want-3SG-MS-PT = wanted' or *halxa* 'go-3SG-FM-PT = went' requires an overt subject in lone clauses, since the missing subject in these utterances is not recoverable from the situational context.

With age, children's overt arguments are increasingly realized as pronouns, elements that typically introduce given information. A rise in overt pronouns suggests that apart from the acquisition of formal conditions for the licensing of null arguments, children are in the process of developing their communicative skills for introducing new topics into discourse and distinguishing between new and old or given information.

In early acquisition, pragmatic considerations like new versus old information also determine whether or not an object will be realized. For example, the verb *give* is usually used when child and caretaker interact, with one holding an object that the other wants. Since both child and caretaker can usually see the requested object, the recipient of the object is more likely to constitute new information. In Hebrew, the recipient of a bitransitive verb is marked by the indirect object so that the initial argument used with 'give' is most likely to be the indirect object, e.g., *tni li* 'give-2SG-FM-IMP to-me = gimme' [Lior 1;9]. With *bring*, another bitransitive verb, the object to be transferred is typically out of sight, and will most likely constitute new information. Since the transferred object usually takes the form of a direct object, it will be the first to occur with this verb, e.g., *tavi'i kapit* 'fetch/bring-2SG-FM-IMP teaspoon = bring (a) teaspoon' [Leor 1;11]. In this sense, claims for a verb-by-verb view of early development – with initial verb-argument structures linked to specific lexical items – reinforce my idea of early pragmatic licensing of null arguments.

More research is needed from larger samples in order to explore further the role of parental input in acquisition of argument ellipsis. And, more data is needed, particularly from typologically different languages, to specify the impact of language typology on acquisition of verbs and verb argument structure.

2. Syntax-Semantics Interaction

The interaction between syntax and semantics touches on a core issue of my study, specifically on whether children use an initial correspondence between syntax and semantics to acquire verb argument structure. This section reviews formal approaches to the syntax-semantics interface (2.1), considers mapping systems proposed for linking semantic and syntactic information (2.2), and presents evidence from child Hebrew against an *a priori* correspondence between the two modules, showing that early argument structures are learned on the basis of linguistic experience (2.3).

2.1 Formal Accounts of VAS

Formal accounts of VAS are either "lexical-entry driven" or "predicate-based" (Arad 1998). Lexical-entry driven approaches (e.g., Jackendoff 1983, 1987) propose that lexical entries contain all the information (including thematic and aspectual) required for correctly projecting verb syntax. Predicate-based approaches (e.g., Borer 1994) assume that thematic information is associated with structural positions on the syntactic tree rather than with particular arguments, and that arguments are interpreted where they happen to be generated.

2.1.1 Conceptual Semantics (Jackendoff 1983)

In Jackendoff's (1983) theory of "Conceptual Semantics", language is organized on three autonomous levels of structure: phonological, syntactic, and semantic/conceptual, each described as a set of formation rules which generate the well-formed structures of the level. The innate formation rules for conceptual structure include an inventory of primitive conceptual categories, such as Thing (or object), Event, State, Action, Place, Path, Property, and Amount. Jackendoff (1987) proposes that the meaning of a verb be decomposed into lexical primitives and meta-predicates like CAUSE, GO, BE, STAY, from which its syntactic structure can be derived.

The correspondence of syntactic and semantic/conceptual structures is specified by primary correspondence rules or "projection rules", which determine the relation of syntactic structure to meaning. These include subsidiary principles, partly language-specific, concerning which syntactic category can express which conceptual category. Any lexical item thus represents a small-scale correspondence between well-formed fragments of phonological, syntactic, and conceptual structure, making

the lexicon part of the correspondence rule component. Example (11) illustrates the elementary properties of the mapping between syntactic and conceptual structure.

(11) John entered the room.

Here *enter* is a transitive verb, with the following lexical entry:

(12) enter

[-N, +V]

[___(NP_j)]

[$_{Event}$ GO ([$_{Thing}$]$_i$, [$_{Path}$ TO ([$_{Place}$ IN ([$_{Thing}$]$_j$)])])]

In this view, lexical entries contain structured representations, composed through lexical-conceptual formation rules, which schematically describe the meaning of the predicate. All correspondences of argument positions and syntactic positions are stipulated in the lexical entry of a verb; with regularities presupposed, for example, that agents will appear in subject position.

For Jackendoff, thematic roles appear as positions in a detailed conceptual representation, while individual theta-roles (e.g., Agent, Theme) appear as particular structural positions, with their own conceptual content. The constraints on number and type of thematic roles follow from whatever constraints exist on the range of conceptual functions necessary to express verb meanings. Theta marking, thus, amounts to establishing a correspondence between syntactic and conceptual arguments of a verb, as formalized by coindexing and binding conventions.

In consequence, (a) there is no theta-role of *Subject*, since *Subject* is a syntactic, not a conceptual relation, and syntactic subjects can hold a variety of different theta-roles; (b) not only NPs but propositions receive theta-roles; and (c) there is no default thematic relation, but each NP must correspond to a specific argument position in conceptual structure and therefore must have a specific thematic role.

2.1.2 Structured Argument Structure (Grimshaw 1990)

Grimshaw's (1990) *structured argument structure* account distinguishes two types of innate hierarchies, thematic and aspectual, which together determine the syntactic position of both nominal and verbal arguments.

In Grimshaw's "thematic hierarchy" – AGENT > EXPERIENCER > GOAL/SOURCE/LOCATION > THEME – the lowest argument must be theta-marked first and the highest last. Theta marking proceeds cyclically; first, within the NP and only subsequently in the clause. Such a thematic hierarchy cannot, however, explain all of

subject selection, e.g., "psych" verbs violate the thematic hierarchy, and so Grimshaw proposes an "aspectual hierarchy", based on Dowty's (1979) analysis of event structure. For example, activity verbs are assumed to consist of two sub-events, whereas stative verbs consist of only one. The argument most prominent on the aspectual hierarchy is the one that takes part in the first sub-event, and an argument that takes part only in the first sub-event is more prominent than one which takes part in both. In Grimshaw's structured argument structure, a change of argument structure will automatically follow from addition of a participant, since arguments are projected onto their syntactic positions according to these two hierarchies (thematic and aspectual).

2.1.3 Role and Reference Grammar (RRG)

Van Valin (1990) proposes a structural-functionalist Role and Reference Grammar (RRG), where grammatical structure is understood by reference to its semantic and communicative functions. RRG posits only one level of syntactic representation, which is linked directly to a semantic representation. The RRG notion of (non-relational) clause structure is termed THE LAYERED STRUCTURE OF THE CLAUSE, and is based on two fundamental contrasts: between the predicate and its arguments, and between elements that are and are not arguments of the verb. The clause has three constituents: the **Nucleus** contains the primary constituent units of the clause (predicate, verb), the **Core** contains the nucleus and the arguments of the predicate, and the **Periphery** is an adjunct to the core, includes non-arguments of the predicate, locative, and temporal phrases. The elements in these units may, in principle, occur in any order, if a given language allows this, since the hierarchical structure of the clause is semantically rather than syntactically based. Grammatical categories like aspect, tense and modality are treated as operators modifying different layers of the clause.

A predicate in RRG has a skeletal semantic representation called *a logical structure,* with two basic operators: BECOME and CAUSE. These logical structures provide information for the first step in determining thematic roles for a given predicate on one of two tiers of semantic roles: macro-roles and thematic roles. Macro-roles are a level of semantic roles broader than thematic roles, involving, in a sentence – ACTOR and UNDERGOER. In RRG, a verb that takes both macro-roles in a sentence is transitive, and one that takes only a single macro-role is intransitive. The

macro-roles ACTOR and UNDERGOER function as the interface between thematic and grammatical relations. RRG recognizes a series of six thematic roles: agent, effector, experiencer, locative, theme, patient. Unlike semantic roles, grammatical relations are assumed to be universal. RRG further assumes the existence of two-way linking rules: from semantics to syntax and from syntax to semantics.

2.1.4 Lexical Relational Structure (Hale and Keyser 1992, 1994)

Hale and Keyser (1992, 1994) propose a hierarchical lexical structure for the verb and its arguments, with relations between them regulated by syntactic principles like move-alpha, and Head-Movement Constraint.

Hale and Keyser distinguish between a lexical level – *l-syntax*, which serves as the input for D-structure, and a syntactic level – *s-syntax*. In *l-syntax*, only government and predication relations exist, and at this level the structure of a verb at *l-syntax*, i.e., Lexical Relational Structure (LRS), does not contain a subject, unless the subject originates as an internal argument. Thus, only the projection of internal arguments takes place at *l-syntax*, while the projection of external arguments takes place at *s-syntax*. The position of the s-syntactic subject is a functional projection, so that the appearance of s-syntactic subjects will depend on the development and use of functional projections. Unlike subjects, objects do not depend on these processes, since they are part of the core meaning of a verb.

2.1.5 Aspectual Analysis (Tenny 1994)

Tenny (1994) proposes that aspectual properties are sufficient to mediate between the lexicon and syntax. She distinguishes three aspectual roles – MEASURE, PATH and TERMINUS – all related to the construal of the event denoted by the predicate. A MEASURE is an argument that undergoes a change-of-state or motion, and indicates the progress of the event, and marks the inherent endpoint. A PATH is a defective MEASURE, since it indicates the progress of an event, without an inherent endpoint. A TERMINUS, typically lexicalized as a prepositional phrase (in English), adds an endpoint to the scale provided by the PATH. These aspectual roles determine how arguments will be mapped onto syntax, since an argument's aspectual role determines the place that the argument will occupy in syntax.

The mapping of lexico-semantics to syntax is conducted by the following Linking Rules: a MEASURE must be an internal direct argument; a TERMINUS must be an internal indirect argument; and a PATH is either implicit or an internal argument.

The choice between options in the aspectual role grid is made at the level of Lexical Conceptual Structure, as a separate level of linguistic representation. Thus, a delimited transitive verb must have a MEASURE, and its Linking Rules stipulate that this MEASURE will be the direct internal object. Optional transitives have the aspectual role grid [(MEASURE)], while stative verbs do not have an aspectual role grid at all.

2.1.6 Verb Semantics (Rappaport-Hovav and Levin 1998)

Rappaport-Hovav and Levin (1998) aim to predict the range of argument expressions and meanings that can be associated with a particular verb. The different lexical entries for individual verbs can be generated from general principles that determine the range of possible meanings of a verb. For example, manner and result verbs have different lexical aspectual classification: manner verbs are activities while result verbs are either achievements or accomplishments.

Each verb has two kinds of meaning: A **structural** meaning determines the semantic class to which it belongs and an **idiosyncratic** meaning distinguishes that verb from other members of the same class. Verbs have structured lexical semantic representations from which syntactic structures are projected.

A predicate decomposition consists of two major components, **primitive predicates** and **constants**. Universal grammar provides an inventory of lexical semantic templates consisting of various combinations of primitive predicates, which correspond to a large degree to the generally acknowledged event types. These constitute the basic stock of lexical semantic templates of a language. A verb's meaning consists of an association of a constant with a particular lexical semantic template, for example:

(13) [[x ACT] CAUSE [BECOME [y <STATE>]]]
[[x ACT] CAUSE [BECOME [y <DRY>]]]

The pairing of a constant with an event-structure template constitutes the "event structure" of a verb. The example of <[x ACT] CAUSE [BECOME> is a semantic template (i.e., a combination of primitive predicates), whereas <[y <DRY>]> is a constant (i.e., the idiosyncratic element of meaning). Two types of participants can be distinguished in an event structure – those licensed by virtue of both the event structure template and the constant and those licensed by the constant alone. Much of the variation in verb meaning is attributed to an operation termed *Template*

Augmentation, which allows more complex event structure templates to be built on simpler ones.

Rappaport-Hovav and Levin assume a theory of linking that determines the specific syntactic expression of the participants in the event structure. Linking rules determine the precise syntactic expression of participants based on their function in the lexical semantic representation of a verb.

The accounts reviewed in sections 2.1.1 – 2.1.6 are "lexical-entry driven", since for all alike, the information concerning the interaction between a verb's syntax and semantics is contained in the lexical entry for that verb. Several accounts organize syntactic and semantic/conceptual information on different levels of representations, to propose that verb semantics specifies the projection of VAS through the mediation of a mapping system that links these levels in predictable ways.

2.1.7 Syntactic VAS (Borer 1994)

Unlike "lexical-entry driven" accounts, Borer (1994, 2000) proposes a "predicate-based" account of VAS. A syntactic theory of argument projection takes syntactic structure, rather than the lexical unit, as its starting point, linking syntactic positions to argumental interpretations independently of information contained in specific lexical entries. In this account, VPs are specified for the number and category of arguments they take when they enter syntax. Verb arguments are unordered, so the external argument is not singled out. The semantic interpretation associated with arguments is given by their case-driven placement in syntactically projected aspectual (*aktionsart*) specifiers. Following Tenny (1994), Borer proposes that MEASURE NPs have a landing site above VP, a position (Aspect Phrase Event Measure [AspPem]) that is optionally specified, and is more or less equivalent to Chomsky's 1993 [Spec, AgrOP]. An originator phrase (AspPor) above AspPem is associated with the role of originator, akin to a source or to an agent role. In case AspPem is not specified and does not qualify as a landing site for the object NP, the subject NP will move to AspPor, while the object NP remains in the VP. Thus, in a sentence like *Mary wears glasses*, since *glasses* does not constitute an Event Measure, it remains in VP while *Mary* moves to AspPor, to get interpreted as an agent.

In this "predicate-based" account, it is syntactic information that specifies verb semantics independently of the verb's lexical entry. In this sense, Borer's account involves a "constructionist" view, where meaning is associated with syntactic

configurations, and the lexical content of substantive items serves to modify rather than determine structural properties.

"Lexical-entry driven" accounts can be identified with Semantic Bootstrapping (Grimshaw 1981, Pinker 1984), whereas "predicate-based" accounts can be identified with Syntactic Bootstrapping (Gleitman 1990), as mentioned in Chapter 6, Section 1.1. Both approaches agree that there is an *a priori* relation between the interpretation of arguments and their syntactic position. They differ on whether syntactic position determines argument interpretation or rather the verb determines the nature and syntactic placement of arguments.[79]

A major claim of certain modular accounts is that initially, syntax-semantic correspondence is regulated by "canonical mapping" (e.g., Grimshaw 1981, 1990, Pinker 1984). That is, children are assumed to assign default mapping between thematic roles and syntactic functions to new predicate-arguments sequences to facilitate acquisition. The following sections examine this claim against data from child Hebrew. The consequences of this examination have implications for questions like whether the lexicon drives syntax.

2.2 Thematic Roles, Mapping Systems, and Linking Rules

This section reviews major mapping systems that have been proposed to account for linking semantic/thematic roles and syntactic categories.

2.2.1 Thematic Roles

In the early stages of generative grammar, Gruber (1965), Fillmore (1968) and Jackendoff (1972) attempted to devise a universal typology of the semantic roles played by an argument in relation to its predicate. These roles have come to be known as **thematic roles** or **theta-roles**, a partial listing of which is provided in Table 7.4.

Table 7.4 A Partial List of Thematic-Roles [adapted from Cowper 1992, pp. 48 – 51]

Thematic Role	Description	Example
Agent	(Volitional) initiator, doer of an action	**Dan** broke the vase
Benefective	The one for whose benefit the event took place	Dan bought flowers for **Rina**
Experiencer	The individual who feels or perceives the event	**Dan** likes Rina
Goal	Entity toward which motion takes place	Dan went to **Jerusalem**
Instrument	The object with which an action is performed	Dan cut the meat with **a knife**
Location	The place where something is/occurs	Dan stayed in **Tel Aviv**
Patient	An entity which undergoes an action	Dan hit **Ronny**

79 In contrast, an "integrative" view of VAS acquisition is represented by researchers like Bowerman (1990), Braine (1988), Schlesinger (1988), Slobin (1997), and Tomasello (1992), who argue that children initially acquire VAS for individual verbs, using specific knowledge to form generalizations about both syntax and semantics (see Chapter 6, Section 1.2.2).

Thematic Role	Description	Example
Percept	An entity which is experienced or perceived	**The story** frightened Dan
Recipient	A subtype of goal, with verbs denoting change of possession	Dan gave a book to **Rina**
Source	Entity from which motion takes place	Dan went from **Jerusalem** to Tel Aviv
Theme	with a verb of motion (specifies what moves) or location (the entity whose location is described)	Dan gave **a book** to Rina **Dan** stayed in Tel Aviv

How do the proposed thematic roles map onto particular argument positions to facilitate VAS acquisition? In these earlier accounts, the lexical entry of any predicate included the theta-roles carried by its arguments, represented as a **theta-grid**. For example, *cook* <Agent, Patient>, means that the verb *cook* takes two arguments, one is the doer of the cooking and the other the thing being cooked.

2.2.2 Mapping Systems

More recent studies have proposed a range of mapping systems to account for syntax-semantics correspondences, all alike based on regularities between semantic and syntactic information, that is, on the observation that arguments bearing certain (thematic or other) semantic roles are realized in certain syntactic positions. Such mechanisms may take the form of rules stating correlations between semantic roles and syntactic positions so that mapping serves as a function that takes as its argument certain semantic information about an argument (e.g., agent), and that has as output a certain syntactic position into which this argument is mapped (e.g., subject). Ideally, lexical specifications of arguments and (presumably universal) linking mechanisms should be enough to constrain the association of verbs and syntactic structures: verbs specify some information about the nature of their arguments, and the linking rules map these into syntactic positions.

The strictest mapping system is the "Uniformity of Theta Assignment Hypothesis" (UTAH) proposed by Baker (1988), which states that identical thematic relationships between items are represented by identical structural relationships between these items at the level of D-structure. That is, an argument bearing a particular thematic role will always be mapped into the same syntactic position. Other less strict mapping systems are based on a "thematic hierarchy", which does not require one-to-one mapping between particular theta-roles and particular augments, but only that the relative order in the hierarchy be respected, and that arguments which appear higher in the hierarchy will be realized in syntactically higher positions. Examples of different thematic hierarchies are shown in (14) below:

(14) **Thematic Hierarchies**

Agent > Location/Source/Goal > Theme (Jackendoff 1972)

Agent > Experiencer > Goal/Source/Location > Theme (Grimshaw 1990)

Cause > Experiencer > Goal/Location/Target > Theme (Pesetsky 1995)

Two additional kinds of mapping systems were noted in earlier sections. One is (1) Tenny's (1994) mapping of aspectual roles (MEASURE, TERMINUS, and PATH) to syntactic-functions through a series of linking rules; and (2) Rappaport-Hovav and Levin's (1998) mapping of syntactic expressions to event participants based on the function of each participant in the lexical semantic representation of a verb. In addition, in the Government-Binding framework, Chomsky (1981) proposed the **theta criterion** to ensure that the theta-roles listed in the lexical entry of any predicate will each be assigned a single argument, and that no argument appears without bearing a single theta-role.

In acquisition, Pinker (1984) proposed a linking algorithm of two interrelated hierarchies – of thematic roles, and syntactic functions, such that a particular thematic role is linked to a corresponding syntactic function through "canonical mapping". Children are assumed to assign default mapping between thematic roles and syntactic functions to new predicate-arguments sequences to facilitate acquisition. The proposed hierarchies and examples of linking rules are listed in (15) and (16) below.

(15) **Pinker's Thematic and Syntactic-Function Hierarchies**

AGENT	THEME/PATIENT	LOCATION/GOAL/SOURCE
SUBJECT	DIRECT OBJECT	OBLIQUE OBJECT

(16) **Examples of Linking Rules**

Link the agent to the external argument.

Link the patient to the direct internal argument.

By this mapping scheme, most AGENT roles are initially assigned to the subject, most THEME roles to the direct object, and most LOCATION/GOAL/SOURCE roles to the indirect object, as follows. Children first check whether the predicate they analyze has an agent argument (the first role on the thematic hierarchy). If it does, this role is assigned to the first function on the syntactic hierarchy – Subject, if not, children look for the next available role on the thematic hierarchy and assign it to Subject. Once "Subject" is linked, children move along the thematic hierarchy to the next role associated with the predicate and assign it to the next available syntactic function. The proposed linking rules are assumed to reflect properties of children's innate capacity

for language acquisition. In cases of noncanonical mapping, children have to learn each individual instance by observing how proficient speakers treat the relevant predicate syntactically (Pinker 1984:300).

2.2.3 Drawbacks of the Proposed Mapping Systems

Each of these systems has certain drawbacks. First, there is no exhaustive list of thematic roles, nor is there a clear-cut definition of certain thematic roles (e.g., theme). As a result, some researchers propose to give up Thematic Role Types altogether, as for example, Marantz (1984) who uses individual thematic roles, e.g., the thematic role of the subject of *kill* is the *killer-role.* Dowty (1991), in contrast, proposes to reduce the number of roles to two: Proto-Agent and Proto-Patient. He defines Proto-roles as prototypes with clusters of properties entailed by predicates with respect to their arguments. Each Proto-role has a number of properties, and predicates may entail all or some of these properties with respect to each of their arguments. The closer a given argument is to a Proto-Agent (i.e., has a large number of Proto-Agent properties), the higher its chances of being lexicalized as the subject of a predicate.

A second problem is the variety of different thematic hierarchies (e.g., those of Baker 1997, Bresnan & Kanerva 1989, Fillmore 1968, Givon 1984, Grimshaw 1990, Jackendoff 1972, 1990, Kiparsky 1985, Van Valin 1990). These differ in (1) the set of roles that they include – certain hierarchies include only arguments while others include both arguments and adjuncts). (2) In how fine-grained they consider roles to be, e.g., Dowty's (1991) Proto-Agent versus Van Valin's (1990) agent/effector distinction; and (3) in the precedence relations of the various thematic roles in each hierarchy (Rappaport-Hovav & Levin, 2000). These differences seem to contradict the claim that such hierarchies are universal.

2.3 The Hebrew Data

This section uses data from child Hebrew to the claim that children are initially guided by a "canonical mapping" scheme in the acquisition of VAS.

Table 7.5 shows the distribution (in percentages) of the initial argument structures and thematic roles of the six most frequently used verbs in my sample for ages 1;7 – 1;11 (MLU 1.5 – 2.5), when there is evidence for acquisition of word combinations. Consistent occurrence of self-initiated and correctly ordered sequences

served as a measure for proper mapping. Note that all verbs in Table 7.5 are in the P1 pattern, by far the most common in early acquisition.[80]

Table 7.5 Distribution (in percentages) of Early Argument Configurations

Lexeme	No. of Tokens	Gloss	Initial Argument Configuration	Thematic Role of Overt Argument	Distribution of Preferred Form	Bare Verbs
bwa1	57	'come'	SV	Theme	25	52
npl1	39	'fall-down'	SV	Patient	46	44
hlk1	30	'go'	SV, V PP	Theme, Goal	20, 26	37
rcy1	180	'want'	VO	Theme	47	16
ptx1	43	'open'	VO	Patient	35	60
sym1	54	'put'	VO, VADV	Theme, Locative	22, 44	22
ntn1	16	'give'	VI	Recipient	69	6

The Table shows that children do not use all of their early verbs with the subject as the first overt argument, but certain verbs are used with an overt direct or indirect object, or with an adjunct (e.g., *hlk1, sym1*). Second, for verbs that are used with a subject, this argument is not always an AGENT, but may be a THEME or a PATIENT (see Table 7.6 below). Third, in cases when the direct object occurs as the first overt argument, the mapping between it and the relevant thematic role follows the canonical mapping scheme. The last two facts suggest that the THEME and PATIENT roles map to both subject and direct object, so there is no unique correspondence between a thematic role and a syntactic function as required by the canonical mapping scheme. Even so, children use the verbs in the Table very frequently with the observed argument structure.

Table 7.6 shows the distribution of thematic roles across all overt subjects in the early word combinations of the four children (MLU-W range 1.5 – 2.5). Here, too, consistent occurrence of self-initiated and correctly ordered subject-verb sequences served as a measure for proper mapping.

Table 7.6 Distribution (in percentages) of Thematic Roles across Overt Subjects

Child	Agent	Other
Lior	18	82
Hagar	28	72
Smadar	11	89
Leor	22	78

The data indicate that only 11% - 28% of all relevant utterances had an AGENT subject. Most overt subjects, 72% - 89%, occurred with achievement, i.e., change-of-state, or "unaccusative" type intransitive verbs whose subjects require the THEME role.

80 Berman 1981,1993, Berman & Armon-Lotem 1996, and Chapter 3, Section 1.4 above.

Table 7.7 lists examples from my data of subject-verb sequences with a NON-AGENT subject.

Table 7.7 Examples of Early Subject-Verb Sequences with Non-Agent Subjects

Child	Example	Gloss
Hagar	*Hagar nafal*	Hagar fall-3SG-MS-PT = 'Hagar fell down'
	Abale higia	Daddy arrive-3SG-MS-PT = 'Daddy arrived'
	Yotam yavo	Yotam come-3SG-MS-FUT = 'Yotam will come'
	ze nishpax	it spill-3SG-MS-PT = 'it spilt-INTR'
Smadar	*Gaga halax*	Gaga go-3SG-MS-PT = 'Gaga went (away)'
	kushi omed kaxa	Kushi stand-SG-MS-PR thus = 'Kushi (a puppet) stands like this'
	ha-buba roca moceci	the doll want-SG-FM-PR pacifier-DIM = 'The doll wants a pacifier'
Lior	*ha-pil xole*	the elephant sick-SG-MS-PR = 'The elephant is sick'

Pinker (1984) suggests that acquisition of verbs that adhere to the canonical mapping scheme is easier and so faster, than acquisition of noncanonical verbs, since for canonical mapping the evidence coming from the input about the syntax of the verb's arguments matches the child's innate linking rules. By this reasoning, if children use innate linking rules, they should acquire verbs with prototypical AGENT-PATIENT arguments earlier than verbs with nonprototypical argument structures, i.e., verbs with THEME, or LOCATION/SOURCE/GOAL subjects, transitive stative verbs, verbs denoting events in which the AGENT is static (following Bowerman 1990, p. 1273). This hypothesis was tested with developmental data from Smadar, the most linguistically precocious child in the sample, between ages 1;7 to 2;4. Smadar's verb lexicon was divided into prototypical and nonprototypical AGENT-PATIENT verbs. In line with Bowerman (1990), the prototypical AGENT-PATIENT category included verbs expressing causation of a change-of-state or location, and verbs expressing events in which the AGENT acts on the PATIENT in a "physically obvious way", e.g., push, wash, tickle (p. 1271). All other verbs were classified as nonprototypical AGENT-PATIENT verbs. Among the prototypical AGENT-PATIENT verbs were *nqy3* 'clean', *lbš1* 'wear' *lqx1* 'take', *prq3* 'take apart', *isy1* make/do', *rkv5* 'put together', *sgr1* 'close', *irbb3* 'stir', *šqy5* 'water', *asp1* 'collect', *rwm5* 'pick up', *dgdg3* 'tickle', and *yrd5* 'take off'. Among the nonprototypical verbs were *rcy1* 'want', *mca1* 'find', *xps3* 'look for, search', *qra1* 'read', *rwx5* 'smell', *spr1* 'count', *zkr1* 'remember', *xzq5* 'hold', *šmi1*

'hear', *zmn5* 'invite', and *nkr5* 'know (someone)'(see Appendix 7.1 for a complete listing of examples by prototypicality, age and word order).

Acquisition of prototypical AGENT-PATIENT verbs does not appear to precede acquisition of nonprototypical verbs for Smadar. In fact, the first transitive verb in her data was *rcy1* 'want' which is nonprototypical: *ha-buba* ***roca*** *moceci* 'The doll wants a pacifier' [1;7]. If canonical mapping facilitates acquisition of prototypical AGENT-PATIENT sequences, this suggests either that children may not use canonical mapping in early acquisition or that use of canonical mapping does not, in fact, facilitate acquisition. Besides, more cases of noncanonical word order occur with prototypical AGENT-PATIENT verbs than with other verbs, e.g., *gam Rolf ani* ***lokaxat*** 'too, Rolf I am taking = I'm taking Rolt, too' [1;11], *oti hu* ***medagdeg*** 'me he tickles = he tickles me' [2;0], *axshav et ha-shaon ani* ***orid*** 'Now the watch I will take off = now I will take off the watch' [2;1], and *ha-na'al ha-xadasha, aba* ***na'al*** *ota?* 'The new shoe, daddy put it on? = (did) daddy put on the new shoe? [2;1]. In fact, Smadar's attempts to enforce canonical AGENT-PATIENT mapping on certain intransitive verbs resulted in overextensions like *ani rokedet oto* 'I am dancing him' (cf. required *ani markida oto* 'I'm making him dance', *aba herim oti ve* ***ala*** *oti* 'Daddy picked me up and rised me (up)' (cf. required *aba herim oti ve he'ela oti* 'Daddy picked me up and raised me up', and *Miryam overet et kol ha-dapim* 'Miryam crosses all the pages' (cf. required *Miriam ma'avira et kod ha-dapim* 'Miriam turns-over all the pages'. This suggests that even when there is evidence for use of canonical mapping, it alone may not be enough to direct children into acquisition of VAS in their language.

Hebrew allows relatively free ordering of dative objects, as illustrated by examples (17) and (18). In (17) the direct object precedes the indirect object while in (18) the order is reversed. The choice of a particular order depends on what is taken as background as opposed to new or more dominant information (Erteschick-Shir 1979, Hopper & Thompson 1980).

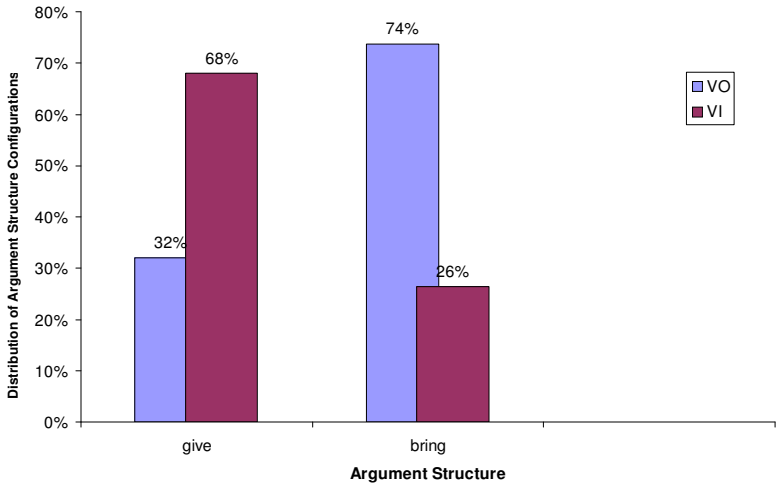
(17) *ima natna* ***[et ha-buba] [le-Ruti]***
Mommy give-3SG-FM-PT ACC the-doll to-Ruti
Mommy gave the doll to Ruti

(18) *ima natna* ***[le-Ruti] [et ha-buba]***
Mommy give-3SG-FM-PT to-Ruti ACC the-doll
Mommy gave Ruti the doll

The two bitransitive verbs *ntn1* 'give' and *bwa5* 'bring' at the single argument phase (MLU-W range 1;5 – 2;5) were initially acquired with a different first argument,

as shown in Figure 7.12 for Hagar.[81] Dark bars represent the percentage of [verb + indirect-object] sequences (VI), and the light bars of [verb + direct-object] sequences (VO), the two left bars relate to production of *give*, while the two right bars to the production of *bring*.

Figure 7.12 Distribution of Argument Structure Configurations in the Acquisition of Two Verbs



Although the two verbs have the same argument structure (SBJ, DO, IO), *bring* is initially acquired with an overt direct object, e.g., *tavii sefer* 'bring-2SG-FM-IMP (a) book', while *give* is initially acquired with an indirect object, e.g., *tni li* 'gimme'. This pattern matches parental input of the two verbs (see, Section 1.7 of this chapter for details). If we assume that "canonical mapping" is used to acquire the argument structure of these two verbs, the following problems arise. Children may associate both direct and indirect objects with the THEME role, since both argument-types occur immediately after the verb in a position that is linked to this thematic role by the canonical mapping scheme. Alternatively, children my associate the same syntactic position with two different thematic roles, i.e., THEME and GOAL in violation of the canonical mapping scheme. One could argue that children first identify the arguments of these two verbs by observing which NPs they subcategorize for in adult speech, and then apply innate linking rules to map these arguments to the corresponding syntactic positions. But this is circular, since it means that children use canonical mapping to assign syntactic functions to arguments of a particular verb, and at the same time, that children must refer to the verb's syntactic structure in order to identify its arguments (see, too, Bowerman 1990, p. 1259).

81 For purposes of illustration, I use data from Hagar alone, since she used these two orders more than the other three children, but they all showed the same pattern in use of these two verbs.

2.4 Conclusion

The data fail to reveal a one-to-one correspondence between thematic roles and syntactic functions in early acquisition. And there does not appear to be any advantage to using prototypical AGENT-PATIENT verbs over nonprototypical ones. In fact, the bulk of children's early verbs do not adhere to the thematic hierarchy for the canonical mapping scheme (AGENT – SUBJECT, THEME – DIRECT OBJECT). Yet these verbs are acquired early, and with no errors, as is also shown by evidence from English (Bowerman 1990). This means children must figure out the noncanonical mapping for each verb by observing how adult speakers use it, which in turn means that, a canonical-mapping scheme, or an *a priori* set of linking rules will have no advantage over a verb-by-verb strategy for acquiring VAS.

Bowerman (1996c) challenges the hypothesis that verbs with similar meanings are often similar in their syntax and so share the set of syntactic frames they can appear in. She notes that the verb *donate* is semantically and syntactically similar to verbs like *give* and *send,* but cannot appear in the double object construction, e.g., *John gave /sent/ donated all his books to the library* vs. *John gave /sent/ *donated the library all his books*. Similarly, in the Hebrew sample, when two verbs have a similar meaning and a similar transitivity value (e.g., *give* and *bring*), children initially do not generalize from the argument structure of one verb to that of the other. Initial choice of arguments appears to be determined by input, and by pragmatic factors like new versus old information, suggesting that children need to learn certain verb-argument configurations in isolation. If so, then using a supposedly innate set of linking rules will not facilitate acquisition.

As discussed in Chapter 5 (Section 3.1) verb syntax and semantics do not fully overlap across languages. Comparative data from English and Chechen-Ingush (Bowerman 1990, and Nichols 1984 cited there), likewise, show that a universal linking mechanism cannot account in the same way for acquisition of predicate-argument relations in different languages. If different languages require different canonical mapping schemes, then canonical mapping may not be universal.

In consequence, acquisition of predicate-argument relations in the present context is assumed to be data-based and cumulative (see Chapter 6, Sections 3.2, 4). Initially, children acquire experience with individual verbs; then each verb is used with different noun phrases in a particular syntactic position such as direct object

position; later, children add more complement types to each verb; and eventually, they generalize particular structures to entire classes of verbs. In this account, children do not use an *a priori* linking mechanism, but gradually develop a mapping mechanism as acquisition of VAS proceeds. That is, they first use verb-particular mapping along the lines of Marantz (1984), and then gradually extend and generalize this mapping scheme toward the end of Phase I (see Chapter 1, Sections 3.1.2 – 3.1.3 for details). Once this mapping mechanism is established, new verbs that enter children's vocabulary can be mapped onto one of the previously constructed mapping patterns.

Chapter 8: Summary and Conclusions

1. Introduction

The focus of this study has been verb and VAS acquisition. Two main reasons motivated the choice of this topic: the importance of VERB as a lexical category and the relatively little research on verb and VAS acquisition to date. Also, the study of verbs is especially relevant to Hebrew, where much information is morphologically encoded inside the verb – tense/mood and subject-predicate agreement (person, number, gender) as well as valence relations (transitivity, voice, causativity, etc.).

My main goal was to provide a "single vendor" (Pinker 1984) **developmental** account of early verb and VAS acquisition, based on longitudinal data from child Hebrew. To this end, I proposed a three-phase **developmental** model that includes an initial *Data-Driven Phase* (Phase I), an intermediate phase of *Top-down Application of Rules* (Phase II), and a final *Integrative Phase* (Phase III). The present study focused on Phase I and its sub-periods: the *Training Level*, *Bottom-up Construction of Generalizations*, and *from Generalizations to Rules*.

The proposed model has a developmentalist orientation, and emphasizes an initial bottom-up development. Verb and VAS acquisition are characterized as dynamic processes that advance to a point of mastery through constant organization and reorganization of knowledge – from partial, item-based knowledge to fully proficient command of the target language. Acquisition is described as multi-tiered, in the sense that it is shaped by a wide range of factors whose relative contribution vary across development, and the child is viewed as an active participant in the process, engaged in constant selection and processing of cues from the input.

The study addressed two main methodological problems: the problem of "representativeness" concerns how genuinely my sample represents actual language acquisition and use and the problem of relating theory to data and vice versa, that is, what constitutes evidence for a given claim, and for the proposed model. Concerning the problem of representativeness, I consider my database sufficiently varied to prevent context bias, and samples frequent enough to allow detection of developmental trends (see Chapter 2, Section 1.1 for details). To handle the second problem, the model I devised aims to combine relevant elements of current theories of acquisition with a carefully established basis of genuine language data.

The major findings that emerged from my study can be summed up as follows. **1. Early Lexical Development**: the proportion of verb-like items and verb-containing utterances in the early lexicon of Hebrew-speaking children is initially relatively small. Children first acquire verbs in their "basic" form (i.e., with no overt arguments), most frequently in *binyan qal* (P1) or "stripped" in terms of verb pattern and inflections, with almost no alternation of a particular root in more than one verb-pattern. With development, children increase the number of verbs in their lexicon, and move from unclear, "stemlike" forms to tensed verb forms. The early verb lexicon is affected by a combination of universal, language particular, and situational factors, consistent with a more general view of language acquisition as triggered by multiple linguistic and extralinguistic cues (Berman 1993a, Hirsh-Pasek & Golinkoff 1996, Maratsos & Chalkley 1981, Shatz 1987).

2. Morphological Development: Verb-inflection develops in steps (Berman 1986a, 1988a), from an initial state of no productivity to an eventual state of mastery. Initially, most verbs are acquired without inflectional marking. Next, each verb is used in a particular inflectional configuration (e.g., *gmr1* 'finish' is mostly used as *gamarnu* in the plural, 1st person, past tense, with unspecified gender, while *ntn1* 'give' is mostly used as *tni* with feminine gender, in the singular, 2nd person, imperative). Next, a particular inflectional category is extended to different verb forms within a particular lexeme (e.g. with *izr1* 'help', masculine is extended to both 2nd person imperative and 2nd person future-imperative). At the same time, different inflectional markings are extended to verb forms that are mutually exclusive within a particular lexeme (e.g., *npl1* 'fall down' occurs as both 3rd person masculine past and 2nd person feminine past). Finally, all forms occur in similar contexts with all verb lexemes (e.g., *bwa1* 'come' occurs in both 2nd person masculine imperative and in 2nd person feminine imperative, and *yšn1* 'sleep' occurs in both singular masculine present and singular feminine present). The attested development characterizes each inflectional category independently of the others (gender, number, person, and tense), and the inflectional system as a whole.

3. Semantic Development: My data suggest that at first children rely on broad subclasses (e.g., MODALITY, MOTION, TRANSFER, CHANGE-OF-STATE, and CAUSALITY) of the four major semantic classes as a kind of mediator between quite general and highly specific knowledge of verb meaning and verb-usage. This is supported by the fact that each subclass is initially encoded by a large number of occurrences of a

particular verb in the data. Also, most early verb tokens belong to the "class-specific" category, i.e., instantiate characteristics of a particular class, e.g., *le'exol* 'to eat' vs. the specific verbs *lil'os* 'to chew', *lenashnesh* 'to nibble' (Chapter 5, Section 2.1). Exposure to these verbs in repeated contexts allows children to associate them with their prototypical meanings, and at the same time to identify this prototypical meaning in other relevant verbs in the input. With an increase in verb vocabulary, children are also able to systematically associate a particular semantic subclass with the corresponding verb patterns in Hebrew.

General-purpose verbs are used by children to move from isolating, syntactic paraphrases to morphologically incorporated representation of arguments, e.g., *ose miklaxat* → *mitkaleax* 'takes a shower → showers'. Across development, these verbs are partially replaced by semantically more specific and lexically/morphologically less transparent options. This points to a developmental trend toward a semantically more specified lexicon, and to children's gradual internalization of the typological properties of this language**.**

4. Verb Argument Structure: I argue that VAS is initially unspecified, in the sense that each verb is acquired with empty slots which may or may not be filled in the course of acquisition. The choice of slots to be filled, the order in which they are filled, and their semantic content are initially determined by input, as guided primarily by communicative factors. For example, the verb *give* is initially used without a subject, since the child tends to request things of people present in the room. Similarly, the verb *fall* tends to be used without an overt subject, since the child and caretaker usually see what has fallen down. Later these are reinforced by language particular morphological and syntactic considerations. For example, a Hebrew-speaking child has to learn that transitivity is expressed by a particular choice of verb-pattern, e.g., *fall* cannot take a direct object when it is conjugated in the *qal* (P1) pattern, but it must when conjugated in the *hif'il* (P5) pattern, and conversly.

The order of VAS acquisition is data-based and cumulative in the sense that children first acquire individual verbs with no overt arguments. Next, each verb is used with a single argument (e.g., subject or direct object) in repeated contexts. Then, more complement types are used with each verb, and subsequently, particular structures are generalized to whole classes of verbs.

5. Interactions: In early acquisition, no one-to-one correspondence was found between thematic roles and syntactic functions, and there was no advantage to using prototypical AGENT-PATIENT verbs over nonprototypical ones. Early verbs which do not adhere to the canonical mapping scheme (AGENT – SUBJECT, THEME – DIRECT OBJECT) were acquired early and without error (see, too, Bowerman 1990). This suggests that children initially figure out noncanonical mappings for each verb from the input, as revealed, for example, by the differential use of *give* and *bring* (see, too, Marantz 1984). In this case, a set of universal linking rules has no advantage over a verb-by-verb strategy for VAS acquisition. From this point on, children develop a mapping mechanism, which they gradually extend and generalize toward the end of Phase I. Once this mapping mechanism is established, new verbs that enter their lexicon are fit into one of the already formed mapping patterns, as suggested by children's overextension errors.

Licensing of argument ellipsis develops as follows. Initially, the bulk of children's missing arguments are either unlicensed or pragmatically licensed. With development, a growing number of missing arguments (subjects) is morpho-syntactically licensed, i.e., occur in *pro-drop* contexts. This suggests that at some point (between 1;10 - 2), Hebrew-speaking children realize that their language is a null-subject language, and shift from the null-topic to the null-subject model. This shift evidently co-occurs with the emergence of pronouns and productive use of mood/tense (see, too, Armon-Lotem 1997).

6. Extralinguistic factors: Throughout this study, pragmatic and communicative factors were shown to play an important role in various aspects of verb and VAS acquisition. In the early make-up of children's verb lexicon, in the realization of particular arguments, in licensing argument ellipsis, in early choice of a particular verb/tense pairing to mark viewpoint, and in accounting for individual differences in verb and VAS acquisition.

The assumption that pragmatics plays a role in verb and VAS acquisition may seem to contradict the view adopted here for early "verb-by-verb" acquisition. This is because pragmatic constraints are assumed to apply across-the-board, while a verb-by-verb approach emphasizes the acquisition of individual lexical items. In fact, these two assumptions do not contradict, but rather complement each other, as follows. The term *pragmatics* refers here both to communicative and situational factors and to principles such as Du Bois's (1985, 1987) Preferred Argument Structure (PAS). These

two senses of the term should be distinguished, to accommodate the "verb-by-verb" approach. At the initial period of acquisition, children use verbs in particular morpho-phonological forms, and with argument structure configurations linked to specific lexical items to fulfill their communicative needs. Only during the period of early word combinations do pragmatic principles like PAS come to govern the acquisition process, but by then verbs are no longer acquired on an item-by-item basis (see, too, Chapter 3, Section 2).

In sum, a variety of factors including the particular verb acquired, the specific language of acquisition, pragmatic and communicative factors and, subsequently, morphological and syntactic considerations combine to explain how children move into verb-argument acquisition. This follows naturally from one of the assumptions underlying my approach, that since children need to acquire a complex array of different types of knowledge on various levels, they will use bits of whatever they know about linguistic form and language use to learn more.

2. Further Directions

The present study covered a range of issues relating to verb and VAS acquisition, yet several topics need to be more fully explored. The following sections outline some thoughts and preliminary proposals for future research in three areas: The role of input in verb and VAS acquisition (2.1), an explicit measure of linguistic development that could yield a "profile of verb and VAS use" (2.2), and an experimental design for studying verb and VAS acquisition (2.3).

2.1 The Role of Input in Verb Acquisition

The role and impact of input on language acquisition is a focus of major controversy, from nativist claims of highly impoverished stimulus and no negative evidence (Berwick 1985, Chomsky 1986) to emergentist and distributional accounts that are entirely data-driven (Hopper 1998, Thompson & Hopper 1997). The effects of input are discussed in the present study in relation to a range of topics as follows: approaches to cognitive development, accounts of language acquisition, and the proposed model of verb and VAS acquisition (Chapter 1, Sections 2.1, 2.2, and 3 and Chapter 6, Sections 1 and 2); acquisition of initial verb form and saliency of particular verb patterns (Chapter 3, Sections 1.3, 1.4); early acquisition of verb morphology

(gender, person) and use of root infinitives (Chapter 4, Sections 4.1, 4.3 and 5.2); individual differences in distribution of semantic classes, and the early make-up of children's verb-vocabulary (Chapter 5, Section 2.2); initial argument realization (Chapter 6, Section 3) as an alternative to canonical mapping (Chapter 7, Section 3.3); and in accounting for individual differences in verb and VAS acquisition (Chapter 1, Section 3.5 and Chapter 8, Section 2.1). From these analyses, language input, and parental input, particularly, emerge as important factors in the early acquisition of verb and VAS. This is supported by evidence on the effects of input on verb and VAS early acquisition in other languages (e.g., De Villiers 1985, Naigles & Hoff-Ginsberg 1993 – English, Choi & Gopnik 1995 – English and Korean, Kempen, Gillis & Wijnen 1997 – Dutch, Wilkins 1998 – Arrernte).

Input promotes verb and VAS acquisition in several ways. First, it exposes children to a large range of verbs in the early phases of acquisition, and provides them with relevant and varied contexts for using verbs. Second, and perhaps more importantly, it focuses their attention on particular verb inflections, verb/meaning correspondences and argument structure configurations either directly through reinforcement and pragmatic directions (Clark & Grossman 1998), or indirectly through frequency, saliency of use, and nonverbal communication. This is supported by other studies on the means by which parental input reinforces acquisition of diverse linguistic phenomena (e.g., Brown, Cazden & Bellugi 1969, Ervin-Tripp & Mitchell-Kernan 1977, Goldfield 1998, Greenfield & Smith 1976, Nelson 1973, Shatz 1982, Snow 1972).

But input is not the only factor that affects verb acquisition, and it is often not sufficiently or appropriately structured to control the course of language development (Shatz 1982). The following interaction between Hagar [2;3;12] and her mother provides an anecdotal illustration to show that input is not always effective, and that in fact, its influence lessens with development as noted by Ochs Keenan (1977), and De Villiers (1985).

(1) Hagar: ***tni*** *li.*
give-2SG-**FM**-IMP to-me = 'give-FM me'
Mother: *ma ze?*
'What's that?'
Mother: *eyx kor'im le-ze?*
'What's it called?'
Hagar: *day day,* ***ten*** *li.*
stop-it, stop-it, give-2SG-**MS**-IMP to-me = 'Stop it, stop it, *give-MS me!'
Mother: *cnonit.*
'(a) small radish'

Mother: *tagidi eyx kor'im.*
tell (me) how call = 'what's it called?'
Hagar: ***ten*** *li!*
give-2SG-**MS**-IMP to-me = '*give-MS me'
Mother: *kxi, ve tagidi li,* ***tni*** *li, loh* ***ten*** *li, ela,* ***tni*** *li.*
take-2SG-FM-IMP (it), and tell-2SG-FM-IMP to-me, give-2SG-**FM**-IMP to-me, not give-2SG-**MS**-IMP to-me, but give-2SG-**FM**-IMP to-me
'Take, and tell me, give-FM me, not give-MS me, but give-FM me!'
Hagar: ***tni*** *li.*
give-2SG-**FM**-IMP to-me = 'give-FM me'
Mother: *kxi.*
'take'
Mother: *ve xuc mi-ze, eyx ze yaxol lihyot she at loh yoda'at ma ze cnonit?*
'And besides, how can it be that you don't know what (a) small radish is'
Hagar: ***ten*** *li laxtox ota ba-calaxat ha-zot.*
give-2SG-**MS**-IMP to-me to cut it on this plate = 'let (= *give-MS) me cut it on this plate'

In this interchange, Hagar uses the verb 'give' in the masculine form to refer to her mother. Her mother corrects her by providing both positive and negative evidence for use of the feminine, saying explicitly 'say to me give-FM [*tni*] me, not give-MS [*ten*] me, but give-FM [*tni*] me'. Right after her mother's remark, Hagar uses the verb 'give' in the correct feminine form, but soon after, she goes back to the inappropriate masculine form.

Given such evidence, I propose that verb and VAS acquisition is not only affected by the quality and quantity of the input, but mainly by the way input is processed by the child. This idea draws on a distinction made by Corder (1967) and others (e.g., Elbers 1995, 1997, Wijnen 2000), between language **input** – all utterances a child can perceive – and language **intake** – the child's selection from the input. Across development, input need not change in any relevant way, while intake does, since the factors that determine it vary as acquisition proceeds. For example, Wijnen (2000) proposes that in early acquisition, intake is determined by factors like distributional and prosodic features and frequency, while in subsequent phases, it is also affected by what the child has acquired so far.

Similarly, the Hebrew data suggest that children first hear and presumably store a range of verbs from the input, each in a specific morphological form. This form is initially determined by its frequency in the input, and by the communicative function of each verb. Children, then, rote-learn certain [verb + complement] combinations as relating to individual verbs. The restricted use of verbs and [verb + complement] combinations from the available input suggests that children take in data selectively. During this early period, children engage in distributional analyses to help them come up with approximations of argument structures for particular verbs. This is marked by

the formulaic use of certain [V + X] combinations in repeated contexts (Brent 1994, Bates & MacWhinney 1987, 1989, Maratsos & Chalkley 1981, Wijnen 2000, and see above Chapter 1, Section 3.1.2, and Chapter 6, Sections 2.2, and 3.1.2). These limited-scope formulae pave the way for generalized, more abstract argument structure representations termed here meta-argument structures. From that point on, knowledge becomes increasingly top-down and constructionist, so that children associate new verbs that enter their lexicon with meta-argument structures from their established repertoire.

This account is supported by the occurrence of overextensions, which show that children's intake is affected by what they have already acquired. This view of input/intake fits in well with a broader view of language acquisition advanced in this study, where mastery is seen as achieved through constant organization and reorganization of knowledge. In this view, attained knowledge determines intake, which, in turn, results in a new level of knowledge, and so on until mature knolwdge is achieved (Berman 1986a, 1998a, Karmiloff-Smith 1986, 1992, 1994). Children thus participate actively in the process of acquisition by using bits of whatever they know about linguistic form and language use to learn more (Berman 1993a, Hirsh-Pasek and Golinkoff 1996, Maratsos & Chalkley 1981, Shatz 1987).

The role of input-intake in early acquisition needs further investigation to explore its applicability to other domains of grammatical development and to data from other languages. Another area which requires further study concerns the effects of specific strategies like imitation or repetition on acquisition of VAS in Hebrew and other languages (cf. Ervin-Tripp 1964, Kemp & Dale 1973, Bloom, Hood & Lightbown 1974, Ochs Keenan 1977).

2.2 Profile of Verb and VAS Use as a Measure of Linguistic Development

I argued earlier that Mean Length of Utterance (MLU) and Morpheme Per Utterance (MPU) cannot serve as reliable and comprehensive measures of early grammatical development (Chapter 2, Sections 2.2.2, 2.2.3). In this section I propose my own *Profile of Verb and VAS Use* as a measure of linguistic development, based on the assumption that a multi-tiered evaluation of children's knowledge of **verbs** can serve as a reliable predictor of their linguistic development as a whole. This is motivated by the fact that verbs play a central role in various aspects of linguistic structure, in language form-function relations, and in processes of language

acquisition and development, (Chapter 1, Section 1). The rest of this section provides a preliminary, rough draft, description of the proposed profile and how it might be applied as a measure of linguistic development. I first describe qualitatively what it means for a child to know a verb (Section 2.2.1), and then outline a way to quantify these requirements in order to measure children's linguistic development based on their use of verbs and VAS (Section 2.2.2). A more detailed account would require in-depth analysis of additional data from Hebrew and other languages as well as piloting and statistical analyses, which are beyond the scope of the present study.

2.2.1 Measuring Verb Knowledge

What does it means for a child to know a verb? To show complete knowledge of a verb (and subsequently whole classes of verbs), the child's performance should comply with all of the following (unordered) criteria:

(Lexical) Distribution and usage

The child should use the verb **independently**. That is, usage should be self-initiated, and not merely the result of a repetition or imitation of a caretaker's utterance. The verb should not be used solely as part of a nursery rhyme, a frozen or a formulaic expression.

Verb form usage should be **consistent** and not sporadic. That is, it should be used in *repeated similar contexts* so that it is clearly comprehensible to an adult listener/interactor other than the primary caretaker. In addition, usage should persist over time (i.e., a period of one year).

Pragmatics and discourse appropriateness

The verb should be used in an **appropriate pragmatic context** and with the appropriate **illocutionary force**.

Semantics

The relevant form should function as **a predicate**, in the sense of a linguistic form (verb or adjective) that describes **a situation** (an activity, event or state).

The child should provide evidence of understanding the **meaning** of the word, either by linguistic context (e.g., in answers to questions), or in relation to the extralinguistic context of usage.

The semantic **selectional restrictions** should be observed (e.g., the selectional restrictions of the verb *give* are <+ *animate Subject*> <+ *animate Indirect Object*>; thus, the child must not use an inanimate noun in subject position if s/he wishes to form a grammatical sentence (See Appendix 8.I for a short discussion).

Morpho-syntax

In terms of **subcategorization frames**, the verb should be used with a full range of syntactic arguments, in different syntactic categories (e.g., not only pronouns) and with 3 - 5 alternating lexical items.[82]

The verb should be used in the correct morphological form. It must:

a. Show correct marking of grammatical tense or mood.
b. Meet the agreement requirements in **gender, number and person** (in that order).
c. Be constructed in the *binyan* that matches **its argument structure** requirements, e.g., in transitivity and voice.

2.2.2 Profile of Verb and VAS Use

To measure children's linguistic development by their production knowledge of verbs and VAS, I propose a multi-tiered profile of verb and VAS use. The proposed profile is constructed on the basis of an evaluation sheet that consists of six parts: lexical distribution (I), pragmatic appropriateness (II), morphology (III), syntax (IV), semantics (V), and discourse (VI) (see Appendix 8.II for a detailed example). Each part consists of items that relate to a particular aspect of verb and VAS development. In the evaluation sheet, each item may receive a score between 0 – 2 (0 = no occurrences, 1 = used below 50%, and 2 = used above 50%). Scoring should be based on a careful quantitative analysis of recordings/transcripts of naturalistic speech samples for at least one month, starting at the single-unit period. For this, researchers can use the methodological tools provided by CHILDES (i.e., CLAN, coding categories), and specified in Chapter 2 (Section 1.2). On this sheet *use* = correct occurrence of a particular form in less than 50% of total relevant contexts, while *productivity* and *acquisition* (as defined in Chapter 2, Section 2.1) = occurrence of that form in over 50% of total relevant contexts. The individual scores of all items on the evaluation sheet are added to a total. The total raw score of a particular child at a given point in time, i.e., his or her "profile of verb and VAS use" determines the child's overall status of linguistic development. This score can then be compared to the child's own scores on earlier periods of development, or to raw scores of other children in the same language community.

82 The number of alternations was determined following Bloom (1991). The motivation for giving a range of possibilities and not simply deciding on 3 or 5 alternations stems from the fact that verb classes vary in the number of alternating lexical arguments they allow. Thus, 3 applies to verbs with a restricted range of lexical arguments (even in adult usage), *eat*, *smoke*, *sing,* and 5 applies to verbs with a more open-ended range of lexical arguments (e.g., *see, buy*).

The proposed "profile of verb and VAS use" evaluates development of several items (Appendix 8.II) as follows.

Relational terms (e.g., *more*, *all*, *other*, *here/there)* precede the use of verbs in languages like English and Hebrew (Braine 1976, Clark 1993, Tomasello 1992, and see Chapter 3, Section 1.1). Extensive use of such terms would suggest that children are at an early phase in their linguistic development. Also, with time, the number of verbs increases in relation to other lexical items, pointing to a gradual progress in children's linguistic development.

Communicative skills like using a verb in the appropriate context and with the appropriate illocutionary force are necessary for early acquisition (Chapter 1, Section 3.4, Chapter 8, Section 2.2.1, and see, for example, Ninio & Snow 1988). These preliminary skills contrast with the discourse-based skills measured in Part VI, which are expected to occur only in later phases of acquisition (see Chapter 7, Section 1.4.1, Chapter 3, Section 2). Thus, evaluating the appropriate application of early communicative skills is relevant for measuring linguistic development.

Acquisition of verb **morphology** involves a number of different measures like the use of nonfinite forms – the more infinitives a child has, the less advanced his linguistic development (Chapter 4, Section 5.2). The acquisition of verb inflections by consistently correct marking of inflectional affixes indicates that the child has advanced beyond the initial phase of acquisition. This measure is particularly effective in languages with rich inflectional systems like Hebrew (e.g., Berman & Armon-Lotem 1996, Kaplan 1983, Ravid 1995). Subject-verb agreement marks an even higher level of proficiency, since it involves matching of inflections across syntactic categories. This part allows the researcher to evaluate the development of each inflectional category in isolation, as well as morphological development as a whole.

Acquisition of **verb argument structure** is important since it goes beyond individual lexical items, to measure the child's ability to combine words. If children use overt arguments in over 50% of the relevant contexts, this indicates that they are beyond the one-word stage. As for the nature of overt argument(s), the following criteria are relevant: Whether only a particular argument is realized, whether the realized argument occurs only with a specific verb, and whether it is compatible with the verb's subcategorization frames (Chapter 6, Section 3, Chapter 7, Sections 1.6.3, 1.6.5). A positive answer on the first two criteria and a negative answer on the third

would indicate that the child is still in the early phases of acquisition. Licensing of missing arguments is evaluated in two ways: Whether or not missing arguments are licensed, and what linguistic module constitutes the licenser. The more licensed arguments there are, and the more of these are morpho-syntactically licensed, the more advanced the child (Chapter 7, Section 1.6.4). Valency changes can also indicate the child's linguistic status. For example, lack of verb-pattern alternations in the early vocabulary of Hebrew-speaking children suggests that they are still at an initial phase of acquisition.

Semantic development is evaluated by marking aspectual distinctions, (over/under)extension of meaning, and compliance with selectional restrictions. Marking of aspect before tense was noted to occur in early phases of acquisition (e.g., Aksu 1978, Antinucci & Miller 1976, Bronckart & Sinclair 1973, Ferreiro 1971 versus Weist 1986). Likewise, semantic restrictedness (e.g., use of *gmr1* 'finish, end' only in the sense of 'enough' in Hebrew), overextension (e.g., use of *lbš1* 'wear clothes' for wearing clothes, shoes, glasses, a hat, etc.) and noncompliance with the verb's selectional restrictions are characteristic of early acquisition.

The child's "profile of verb and VAS use" can be standardized to allow comparison between speakers of different languages. A schematic diagram of such standardization procedure is displayed in Figure 8.1.

Figure 8.1 Standardization of "Profile of Verb and VAS Use"

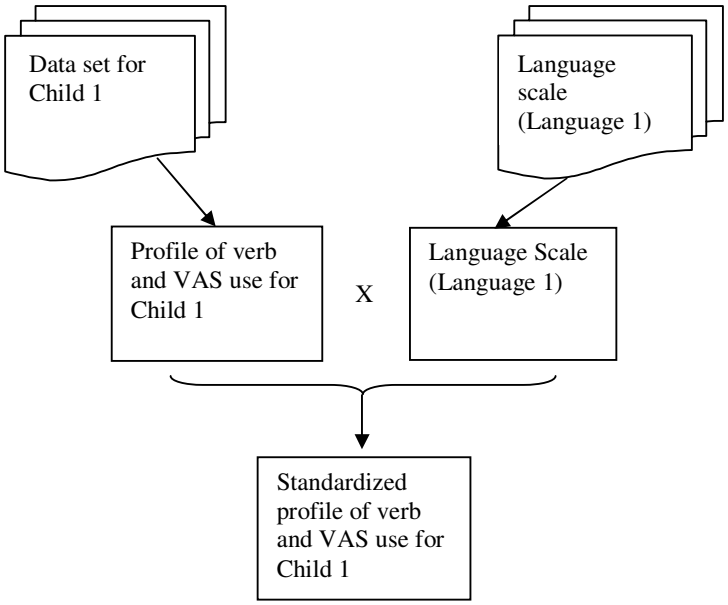


Figure 8.1 indicates that the standardization procedure requires an additional scale – a "language scale", which would be devised independently for each language, and so would need to be filled only once for each language. This contrasts with the "profile of verb and VAS use" which must be filled anew for each child, and/or verb, and/or multiple sampling of any particular child. The "language scale" uses weights between 0 (irrelevant to the language examined) to 1 (most relevant to the language examined) for each item in the "profile of verb and VAS use". The weightings of different items for any particular language must be determined independently on the basis of cross-linguistic and typological research like Berman and Slobin (1994), Comrie (1981), Greenberg (1963), and Slobin (1985), rather than on the basis of production data from one child or another. To compute a child's "standardized profile of verb and VAS use", the weighting of each criterion in the "language scale" is multiplied by the corresponding raw score in the child's "profile of verb and VAS use". The following hypothetical example illustrates this procedure.

Table 8.1 Example of "Profile" Score Standardization

Profile of Verb Use		**Language Scale**	**Standardized Profile**	**Profile of Verb Use**	**Language Scale**	**Standardized Profile**
Subject-verb agreement	**Child 1**	**Language 1**	**Standardized Profile 1**	**Child 2**	**Language 2**	**Standarndized Profile 2**
gender	1	0.33	0.33	1	0.5	0.5
number	1	0.33	0.33	1	0.5	0.5
person	1	0.33	0.33	0	0	0
			1			**1**

Table 8.1 lists data from two hypothetical children (Child 1, Child 2) who speak different languages (Language 1, Language 2, respectively). The performance of each child on subject-verb agreement is recorded under "profile of verb use". Child 1 shows partial use of subject-verb agreement in all inflectional categories, while Child 2 shows partial use of subject-verb agreement in gender and number and no agreement for person. The weighted scores on the "language scale" of Language 1 indicate that this language requires subject-verb agreement in gender, number and person, while the scores of Language 2 indicate that it requires subject-verb agreement only in gender and number but not in person. To obtain a child's respective "standardized profile of verb and VAS use", the "profile" scores for each child are multiplied by the weighted scores in his/her respective "language scale". In the example, both children scored 1. This score is comparable. It suggests that both children are in the process of acquiring subject-verb agreement, but have not yet

acquired it. In a similar way, all scores on the "profile of verb and VAS use" can be standardized to allow cross-linguistic comparison. Such comparison can reveal general developmental trends, which are independent of the characteristics of any particular language.

As noted, the proposed "profile of verb and VAS acquisition" is only a "rough draft" of a more elaborate profile that should be devised to measure children's linguistic development. Yet even as it stands, the proposed "profile" has several important advantages. First, it is a **composite** measure, and so combines multiple factors involved in the acquisition of verbs (and possibly, other language systems, too). Unlike MLU, it allows one to consider the relative contribution of each factor in isolation both for a single verb and across verbs in a given corpus, so that developmental patterns common to all children in a given sample can be identified. As such, it reflects more genuinely the process of language acquisition than existing unidimensional measures.

Second, it allows one to measure particular aspects of acquisition for individual children, and to draw an individual profile for each learner based on the relative weight of the factors that affect acquisition, as well as to evaluate a child's overall linguistic development at a given point in time. Alternatively, it can serve to detect individual differences between learners, and to identify differences for any particular child in the acquisition of individual verbs, or verb classes.

Third, the proposed measure can be adapted to any **type of language** using the standardization procedure to assign different quantitative values to various factors by their prominence in a certain target language. For example, occurrence of a large number of verbs in the early lexicon of a particular child may suggest either that the child is linguistically advanced or that his/her language is a verb-biased language. Multiplying his/her score on the "profile of verb and VAS use" by the relevant weight of "verb distribution" on the relevant "language scale" will reveal which of the alternatives applies. The obtained score can then be correlated with the child's score on other items to determine and validate his or her linguistic status.

A fourth advantage of this measure is that **the units of analysis** are clearly defined, as are the criteria for productivity of use (as detailed in Chapter 2, Section 2.1). Further, the measure can be used to identify **developmental trends** for as long as verb acquisition continues in any individual. Finally, the proposed profile provides a measure of **overall linguistic sophistication**. By this measure, children's linguistic

abilities are more developed and hence, more sophisticated, as they show greater command of the linguistic systems involved in verb acquisition, and as the number of acquired systems increases.

A possible drawback concerns the amount of preparation needed for applying the proposed profile. Although automating the "language scales" and the various calculation procedures will reduce some of the workload, there is still a need for interruption by researchers familiar with the language and the data to be analyzed.

Detailed research is required to complete the item list on the "profile" evaluation sheet and to devise the "language scales". To this end, typological criteria like ergative/accusative, basic word order, relative freedom of word order, subject or topic prominence, verb-framed/verb-satellite, and degree and type of inflectional morphology must be incorporated into the proposed evaluation sheet. And pilot studies are required to establish the reliability of this measure against other available measures, such as MLU or CDI.

2.3 Future Research of Verb and VAS Acquisition

The present study cited evidence from different languages to support its claims for verb and VAS acquisition. Yet, additional crosslinguistic evidence is needed to substantiate the generality of the VAS acquisition model (Chapter 6, Section 2), the account of argument ellipsis (Chapter 7, Section 1.4), and the "standardized profile of verb and VAS use" proposed above. This study was based on analysis of naturalistic longitudinal speech samples of four Hebrew-speaking children. Despite its overall high quality it does not allow for testing particular hypotheses, because it is based on samples of spontaneous speech. These data need to be supplemented by structured experiments along the lines of Alroy (1992), Braine *et al*. (1990), Ragnarsdottir, Simonsen, and Plunkett (1999).

Below, I sketch a preliminary proposal for such an experiment to test the specific hypothesis that parental input has differential effects at different phases of verb and VAS acquisition. In the early phases of acquisition (MLU < 2), the child mainly rote-learns certain patterns in the input. These serve as a basis for constructing more abstract patterns of verb-argument structures that the child later (MLU > 2) uses with new verbs that enter his or her lexicon.

To test this hypothesis, subjects at the one-word phase would be selected through screening by a standard measure like the CDI. They would first meet the

experimenter for one or two play sessions to get acquainted, and to become familiar with the laboratory where subsequent sessions would take place. During the test period, each child would meet the experimenter for a first round of sessions at the one-word period (MLU < 2), and then for a second round of sessions beyond MLU 2.

Each round of sessions would consist of two parts. **Evaluation** – the child's linguistic age and verb inventory are assessed using the CDI questionnaire and an interview with the child's parents. **Testing** – the child is tested by the experimenter in the laboratory (sessions should be video recorded to allow careful analysis of data).

During the first test period (MLU <2), the experimenter would expose the child to a novel transitive verb in a natural conversational setting using a particular argument structure more than others. The experimenter would first introduce the verb to the child using puppets or picture cards, and then verify that the child understood the verb by asking a question like 'What does puppet A do to puppet B?', or by asking for a demonstration as in 'Show me how puppet A does X to puppet B'. Then the experimenter would use the verb in a variety of contexts and syntactic constructions (questions, answers to questions, indicative sentences, negative sentences, in partial and in full argument structure configurations). The experimenter would choose one construction in which to use the verb significantly more than others. Throughout the session, the child's production of the verb would be examined by providing suitable contexts, e.g. asking questions. Later on, the recorded session would be analyzed for use of the verb, and the child's performance would be compared to adult input for number of occurrences, preferred morphological form, and argument structure configuration.

The following results are expected: Children would use the verb with no arguments despite its use in the input, but in the morphological form that was most salient in the adult speech. They might use the verb in the particular argument configuration that was most frequent in adult speech in a frozen form (e.g., no subject-verb agreement).

During the second test session (MLU > 2), the experimenter would introduce a second verb with a similar argument structure. The experimenter would again introduce the verb once, and would then try to elicit child production. The experimenter would be instructed not to use the second verb in a particular preferred argument configuration, but rather to create as many contexts as possible for the child to use it. This session, too, would be video recorded for ease of analysis. Child

production on the second verb would be compared to adult input for the first and second verbs, and compared to the child's own production of the first verb.

Under the assumption that the child analyzes input to generate a more abstract pattern of argument structures, the following results are expected. Beyond MLU 2, the child would produce most occurrences of the first and second verb in the pattern that was most frequently used by the adult for the first verb. This time, however, the verb would not be used in a frozen form, but rather in a variety of morphological forms, and with the correct subject-verb agreement. This would indicate that he or she has indeed analyzed the input, and did not simply imitate adult performance when using the second verb.

To control the amount and content of input to the child, the child's parents would be requested not to use the novel verbs beyond the test sessions. To verify that the child has generated a particular argument structure configuration based on the input, the experimenter would use distracter utterances during each session. These utterances would include verbs with different argument structures than the tested verb, and would be used significantly less frequently than that verb. Child production of these distracter verbs would then be compared to their use in the input, and to the child's use of the tested verb.

This experimental procedure is, as noted, a "rough draft" of a possible design to test a particular aspect of verb and VAS acquisition, its results should be supplemented by advanced statistical analyses, and by application of formalized procedures like structured computer simulations.

3. A Final Note

The present study discussed a wide range of issues related to verb and VAS acquisition, but certain issues still remain to be explored. These include acquisition of modal predicates and detailed error analysis. The acquisition of modal predicates is of interest to researchers in language acquisition for several reasons. Cognitively, use of modal predicates indicates that children have the ability to relate to internal states; typologically, languages differ with respect to the existence of a special morpho-syntactic category of modals, as well as in the ways modalic distinctions are expressed in them; and syntactically, the study of modal predicates can shed light on the acquisition of VAS, since modal predicates (verbs and adjectives) are used as a means for expanding the VP, and some modals are used in impersonal constructions

that entail null subjects in languages like Hebrew and Spanish. A second area that needs further analysis is a detailed study of children's errors, in particular over- and underexsentions, and violations of normative word order, agreement, and causative formation, as a source of insight into how children process particular systems (e.g., Berman 1985, Bowerman 1996c, Pinker 1989). Analysis of the mechanisms that children use to overcome such errors can also be revealing of how children acquire verbs and VAS.

In conclusion, altough much remains to be done, I believe that the present account makes a significant contribution to current acquisition research. Its central purpose has been to exemplify an optimal research program by means of a broad-scale, in-depth study of a selected database as a basis for proposing a comprehensive account of verb and VAS acquisition. Also, the study focused on acquisition of verbs and VAS in Hebrew, which to date has lacked such an account of VAS acquisition. In addition, it has considered key methodological issues relevant to verb and VAS acquisition, to research in child language, and to language development across languages and across linguistic domains.

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Appendices

Chapter 2: Research Methodology

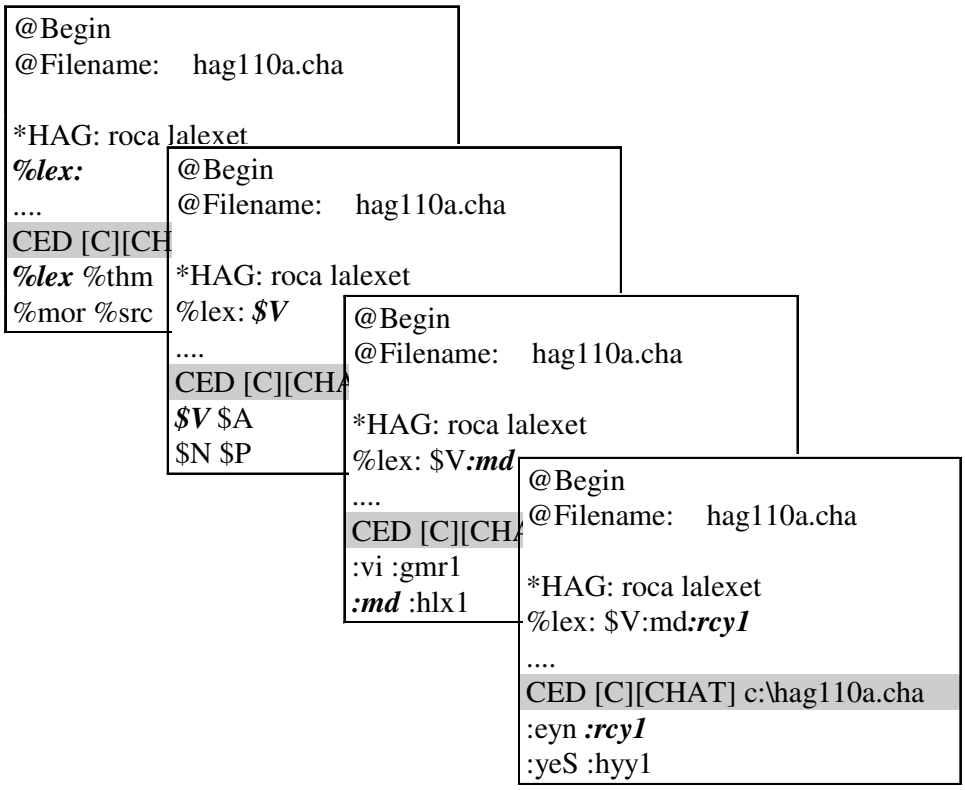
Appendix 2.I: A Semi-Automatic Coding Procedure

A step-by-step semi-automatic procedure was developed for coding the data (illustrated in diagram (i)). For this purpose, a coding file was created with a predetermined list of coding categories organized hierarchically from the most general (i.e., a list of dependent tiers) to the most specific (e.g., a specific lexeme on the lexical tier or a specific tense on the morphological tier). Once a transcript is selected for coding, it is opened within CED. The coding file is then opened within CED in Coder mode [C], splitting the screen in two (i.e., transcript, "codelist"), thus allowing the coder to proceed with the coding procedure while looking at the relevant main tier in the transcript.

In order to initiate the coding procedure, the coder must position the cursor on the line immediately following the relevant main tier, and then click the mouse on the codelist. This action results in a presentation of the first codelist, i.e., the list of dependent tiers. In order to select a dependent tier, the coder marks a single dependent tier by dragging the mouse over it, and then pressing ENTER (see step 1 in diagram (i)). This copies the dependent tier symbol into the line immediately following the relevant main tier, and opens the next list of codes in the codelist hierarchy (e.g., the list of lexical categories in diagram (i)). The same series of actions is repeated until coding of the utterance is completed within the selected dependent tier, resulting each time in adding a selected code to the right of a previously selected one (e.g., until the relevant lexeme is selected in diagram (i)). The coding process is recursive, and can be repeated in full (i.e., for a new dependent tier) or in part (i.e., within a dependent tier, as in the case of *lalexet* 'to go' in the main tier below) an infinite number of times.

Once the coding procedure is completed, the CHECK program within CED is operated to ensure that there are no formatting errors in the code lines (a sort of quality assurance). Then the coded transcript is saved, and can serve as input for further processing by a variety of CLAN programs within CHILDES.

Diagram (i): A Step-by-Step Description of a Semi-Automatic Coding Procedure



Key

Symbol	Tier	Explanation
HAG	main	*Hagar* - the speaker's name
%lex	dependent	the lexical tier
$V	dependent	Verb
$N	dependent	Noun
$P	dependent	Preposition
$A	dependent	Adjective
:vi	dependent	infinitival verb
:md	dependent	modal
:gmr1	dependent	the consonantal root *g-m-r* in *binyan qal* [=1]
:hlx1	dependent	the consonantal root *h-l-x* in *binyan qal* [=1]
:eyn	dependent	
:yeš	dependent	
:rcy1	dependent	the consonantal root *r-c-y* in *binyan qal* [=1]
:hyy1	dependent	the consonantal root *h-y-y* in *binyan qal* [=1]

Appendix 2.II: Semantic Categorization

Broad Semantic Category	Semantic Class	Semantic Subclass	Example	Gloss
ACTIVITY (act)				
	Apparel		*lavash, naal, sam (kova)*	'wear', 'wear (shoes)', 'put on (a hat)'
	Causative		*he'exil, hipil*	'feed', 'drop, make fall'
	Creation		*ciyer, nigen*	'draw', 'play (music)'
	Durative		*nax, gar, nish'ar*	'rest', 'live, reside', 'stay, remain'
	Emission (of)	light	*zarax*	'shine (of sun)'
		sound	*shar, ca'ak*	'sing', 'shout'
		substance	*shafax, yarak*	'spill', 'spit'
	Generic		*asa*	'make/do'
	Ingesting		*axal, bala, shata*	'eat', 'swallow', 'drink'
	Perceptual		*histakel, hikshiv*	'look', 'listen'
	Record		*hiklit, cilem*	'record', 'photograph'
	Communication		*diber, siper*	'speak', 'tell'
	Construction		*bana*	'build'
	Contact	generic	*naga*	'touch'
		violent	*hirbic, sarat, akac*	'hit', 'scratch', 'sting'
	Interaction	cognitive (enablement)	*hirsha, hiskim, natan*	'allow', 'agree', 'give=let'
		negative	*hifri'a, hicik*	'disturb', 'bother'
		social	*hizmin, biker*	'invite', 'visit'
	Motion	deictic	*ba*	'come'
		directed	*ala, yaca, azav*	'go up', 'go out', 'leave'
		generic	*halax, zaz*	'go', 'move'
		manner	*kafac, rac, dahar*	'jump', 'run', 'gallop'
		telic	*higia, ba*	'arrive', 'come (to a place)'
CHANGE OF STATE (sch)			*nafal, hivri, hitkarer*	'fall', 'get well', 'get cold'
	Generic		*kara*	'happen'
	Grooming		*hitraxec, histarek, xafaf*	'wash', 'comb', 'shampoo'
	Reflexive		*hitkaleax, hitgaleax*	'shower (oneself)', 'shave (oneself)'
CAUSE CHANGE OF STATE (kcs)				
	Change of location		*heziz, horid, kerev*	'move', 'bring down', 'bring closer'
	Apart	break	*shavar, haras, pocec*	'break', 'ruin', 'blow, explode'
		removal	*horid, kilef*	'take off', 'peel'
		separation	*perek, xatax, gazar*	'take apart', 'cut', 'cut (paper)'
	Together	closure	*sagar, na'al, satam*	'close', 'lock', 'clog'
		combining	*asaf, ceref*	'collect', 'join'
	Transfer	location	*he'evir, shamar*	'transfer', 'pass'
		possession	*lakax, kibel*	'take', 'get'

Broad Semantic Category	Semantic Class	Semantic Subclass	Example	Gloss
STATE (stt)	**Affective**		*ka'as, hicta'er, paxad*	'be angry', 'be sorry', 'be afraid'
	Cognitive		*hevin, hexlit, zaxar*	'understand', 'decide', 'remember'
	Physical		*dalak, ka'av*	'burn', 'hurt'
	Equational		*haya*	'be'
	Evaluative		*naxon, maspik, kashe li*	'right', 'enough', 'difficult'
	Existential	deictic	*hine*	'voici, here's'
		negative	*eyn*	'be+NEG'
		generic	*yeš*	'be'
		occurrence	*haya, nimca*	'be', 'be found, se trouver'
	Holding		*hexzik, shamar*	'hold', 'keep'
	Modal		*raca, yaxol, xayav, carix*	'want', 'be able to', 'have to','need'
	Possessive		*haya+DAT*	'have'
	Perception		*ra'a, hirgish*	'see', 'feel'
		change	*tafas, maca*	'grasp', 'find'
	Posture		*amad, shaxav, yashav*	'stand (up)', 'lie (down)', 'sit (down)'
	Predicational		*haya*	'be'
OTHER (otr)	**Aspect**	achievement	*hicliax*	'manage'
		completive	*gamar*	'finish', 'end'
		inceptive	*hitxil*	'start'
		lative	*halax*	'go (to do something)'
	Mood	hortative	*bo*	'come=let's'

Appendix 2.III: Dromi and Berman's Rules For Calculating MPU in Hebrew

[Quoted from Dromi & Berman (1982, pp. 410 - 414)]

"Below we describe and try to motivate the procedures we adopted for calculating MPU in Hebrew, according to different word classes.

(1) Nouns and adjectives

Hebrew nouns and adjectives are inflected for plural number by means of the suffixes *-im* or *-ot* for masculine and feminine words respectively - e.g. *dod/dodim* 'uncle/s' and *doda/dodot* 'aunt/s', *gadol/gdolim* and *gdola/gdolot* 'big'; some nouns have a dual ending *-ayim* which is not productive today (Grosu 1969). As noted, all nouns are either masculine or feminine in gender, while adjectives agree with their head nouns in both number and gender. The rules we adopted for this system are as follows:

(1*a*) Count as one morpheme all inanimate nouns in the singular - e.g. masculine *sefer* 'book' or feminine *maxberet* 'notebook'.

(1*b*) Count as two morphemes animate nouns and all adjectives in the feminine, on condition that there is evidence in the sample that the child makes a distinction between the masculine and feminine forms of the same lexical item - e.g. *par* 'bull' vs. *para* 'cow', r*ofe* 'male doctor' vs. *rofa* 'lady doctor'.

(1*c*) Count as two morphemes all nouns and adjectives that appear in plural form, except in the cases noted in (1*d*) below.

(1*d*) Count as one morpheme all plural forms which: (i) have no singular counterpart in the language (e.g. *mayim* 'water', *misparayirm* 'scissors'); or (ii) are clearly unanalyzed or 'rote' forms (MacWhinney 1975, 1978) on semantic, input, or contextual grounds - e.g. *madregot* 'stairs', *garbayim* 'socks'. If words in the latter group do occur in both singular and plural in the same sample, consider the plural as an additional morpheme.

(1*e*) Count as one morpheme all clearly formulaic or unsegmented expressions (Peters 1980), e.g. compound nouns, proper nouns, or ritualistic formulas such as: *yomule'det* 'birthday' from *yom huledet* ('day-of birth', *kfar Vitkin* - a place-name meaning 'village-of *Vitkin*', or *axakax* 'then, afterwards' from *axar kax* 'after thus'.

(2) Verbs

As noted, all verbs in Hebrew are constructed out of a consonantal root which is then shaped into a word by association with one of the set of seven verb patterns termed *binyan* constructions. Within a single *binyan*, each verb is marked for MOOD (imperative, infinitive, or finite) TENSE (present, past, or future) and NUMBER, GENDER and PERSON. In attempting to calculate morphemic units for this complex and often synthetic system, such questions as the following arise: (i) Within each root+pattern combination, is there a 'basic' form or stem which is modified by inflectional affixes to generate all other forms, and if so, how is this identified? (ii) Is there justification for treating affixes as having a cumulative value in terms of the sum of independent meanings or grammatical distinctions which they mark? and (iii) Is the relationship between the same verb-root in different *binyan* patterns productive, and how should this be manifested, if at all, in a count of morphemes? For instance, is *raxac* '(he) washed + transitive' more basic than the verb *higraxec* '(he) washed + reflexive' both from the root *r-x-c*, and if so, should the latter be assigned more points? Similarly, is the causative verb for the root *a-x-l* in *ma'axil* 'is feeding' a derived form of more basic *oxel* 'is eating'?

Again, our answers to these questions, as reflected in the 'rules' outlined below, were motivated primarily by developmental criteria, overriding strictly formal considerations of underlying structure.

(2*a*) Count as one morpheme all infinitives and imperatives; and count as one morpheme tensed forms that occur in 3rd masculine singular, irrespective of whether they are in present, past, or future tense. Imperatives and infinitives are considered 'basic' because they emerge very early in the child's speech output (Berman 1978b, Kaplan in prep.), whereas the 3rd masculine singular is unmarked in Hebrew, as in many languages (Bybee 1979), with respect to other categories; compare, for Past Tense, 3masc. sg. *gamar* 'finished' with 1st sg. *gamar-ti*, 3fem. sg. *gamra*, 2masc. pl. *gamartem* and, for Present Tense, masc. sg. *gomer* 'finishes' with fem. sg. masc. p1. *gomr-im*.

(For historical reasons, Present Tense verbs distinguish only number and gender, whereas Past and Future verbs also indicate person).

(2*b*) Add one additional point to any change in the tensed forms with respect to number, gender, or person, in cases where this change is manifested on the surface as a change in vowel infixes and/or in the addition of a suffix or prefix. DO NOT, however, give an additional point when a girl uses a verb in the feminine singular to refer to her own (1st person) actions. Thus:

(i) *yigmor* 'he will finish' (Future, 3masc. sg.) basic = 1 point

(ii) *gomer* 'finish(es)1 am/is finishing' (Present, masc. sg.) = 1 point

(iii) *gomeret* - as for (ii), but feminine = 2 points; if used by a girl to her own activity = basic = 1 point.

No additional points are thus given for use of the same verb in different tenses. Firstly, there is no clear morphological evidence to indicate that present-tense forms in Hebrew are simpler than future or past tense or vice versa. Secondly, the subject in Berman's (1978b) case-study started to produce her initial verbs in imperatives and infinitives, and only some weeks later to produce finite forms, with present, past and future occurring more or less concurrently; and this is supported by findings of Kaplan (in prep.) for several dozen children. There is, moreover, evidence from Hebrew as well as other languages (Antinucci & Miller 1976, Bloom, Lifter & Hafitz 1980) that children's early use of tense tends to be tied to specific verb types or contexts or action, so that punctive, end-state verbs like *nafal* 'fell' or *nishbar* 'broke, Intransitive' tend to emerge initially in past-tense forms, whereas a process verb such as *boxe* 'cries, is crying' or a stative like *roce* 'want' shows up first in present tense.

The decision to count all changes in the verb system as one additional point is based on the fact that in most cases these changes take the surface form of one (often vocalic infixal) additional morpheme, in view of the large number of portmanteau morphs in Hebrew as noted earlier. This conservative procedure was also necessary, in our view, in order to avoid unrealistically inflated values in the morpheme per utterance count, as discussed above.

(2*c*) Do not assign additional points for use of a given verb root according to the different binyan verb patterns. The reason for this rule is our claim that at early stages of production - up until around age three - children rarely use the same root in more than one binyan pattern. Moreover, even when they do so, they do not as yet appreciate the relationship between the two words (e.g. *raxac* 'wash+transitive'/*hitraxec* 'wash+reflexive', *nishbar* 'break+intransitive '/*shavur* 'break+perfective', *yaca* 'go out'/*hoc*i 'takeout') as being connected in any systematic way. This analysis is supported by observational and experimental data reported in Berman (1982), and is consistent with Bowerman's (1974, 1977, 1978) arguments concerning the reorganization of the lexicon as occurring subsequent to the early stages of language acquisition, as well as with Karmiloff-Smith's (1979) explanation of children's gradually developing ability to treat language as 'a formal problem-space'. In other words, at the point where morpheme counts are most generally considered valid for evaluating language development, many children's morphological construals - in our case, in the area of derivational morphology at all events - are still at the immature stage of 'amalgams', where words are treated as unanalyzed routines, even though they may be perceived by adults or older children as semantically and/or formally complex configurations.

(3) *Function words*

Function words in Hebrew may be characterized in much the same way as for any non-root-based language. All functors are construed out of at least one vowel and one or more consonants, some behaving as free morphemes (e.g. *ze* 'it, this, that', *shel* 'of', *im* 'with') and others as bound (e.g. *ha-* 'the', *ve-* 'and'). The only class that is rich in inflections are pronouns, which take a free form only when used as surface subjects, in all other environments being fused with suffixal prepositions - e.g. *aI+hu* 'on +he' = *alav* 'on him', *shel+ana'xnu* 'of + we' = *shelanu* 'our(s)' (see Berman 1978a, 1982, Dromi 1979).

(3*a*) Count all pronouns in the nominative as one morpheme; disregard gender, person, or number, i.e. *ani* 'I', *anaxnu* 'we', *hi* 'she', *hem* 'they' each receives one point.

(3*b*) Count all inflected pronouns as two morphemes - as in the examples given above of 'on him', ‘our', or in *bishvil+ani* = *bishvili* 'for me'. This rule does not apply to pronouns which are inflected with prefixal prepositions, specifically *le-* 'to' and *be-* 'in, at', which are never pronounced in isolation, so that their minimal free form is when fused with a pronoun. Thus *li* 'to-me', *bo* 'in it' count as only one morpheme.

(3*c*) Count as one morpheme all prepositions, whether monomorphemic or not; i.e. *al* 'on', *mi-* 'from' as well as *al yad* 'beside, next to' literally 'at hand-of' or *mipney* 'because-of' literally 'from-face-of' all count as one morpheme.

(3*d*) Count as one morpheme the following functors: demonstratives, time adverbs, floating operators (e.g. *afilu* 'even', *rak* 'only'), question words, numerals, and quantifiers (e.g. *harbe* 'much, many') and also clearly frozen or formulaic expressions (e.g. *ma ze* 'what's that?').

(3*e*) Count as one morpheme the following functors which are prefixed to the next word in Hebrew: the definite article *ha-* 'the', the conjunction marker *ve-* 'and', and the subordinator *she-* 'that'.

(4) Miscellaneous

(4*a*) Only fully transcribed utterances are to be used to calculate MPU values by means of the above rules.

(4*b*) Repetitions of the same word are counted only once, except where a modifier is produced two or more times for emphasis - e.g. *tinok katan katan* 'baby small small = 'a very tiny baby' counts as three morphemes; this is because in general Hebrew-speaking pre-schoolers use repetition of adjectives and adverbs consistently and productively in place of intensifying elements such as *me'od* 'very' (Berman, to appear).

(4*c*) Meaningful vocalizations such as onomatopoeic sounds and common ritualized articulations are counted as one morpheme, even when they are repeated - e.g. *bum bum bum* said in the context of hitting, or *haw haw* 'woof woof' to refer to a dog, count as one morpheme.

(4d) Fillers and exclamations - e.g. *nu* 'well, then, *er'* or *oyi op* 'upsidaisy!' are not counted unless they convey some recognizable semantic content.

(4e) Diminutive forms - e.g. the suffix *-on* in *dubon* 'teddy-bear, babybear' or *-i* in *xatuli* 'kitty-cat', cf. *pil* 'elephant *'pilon/piloni* - are given an extra point when they appear to be used productively in the sample, when the suffix is added to more than one lexical item, or the free forms appear elsewhere in the sample. For example, when a child says *hiney shafan* 'here's (a) rabbit' and then *hiney shafani* when pointing to a smaller rabbit, he is given 2 points for the first utterance and 3 points for the second. This crediting of diminutives, which departs from Brown's (1973) procedure for English, is motivated by the wide range of different diminutivizing devices in Modern Hebrew (Berman to appear) as well as by very early evidence of their being used productively by Hebrew-speaking children."

Appendix 2.IV: File Formats for MPU Calculation

Original file in CHAT format - .cha

@Begin
@Filename: hag107b.cha
@Coding: CHILDES 2.1
@Age of HAG: 1;7.2
@Sex of HAG: female
@Date: 6-JUN-1988.
@Situation: At home with family. Hagar is ill.
@Participants: HAG Hagar Child, MOT Inbal Mother, GRA Grandmother
@Utterances: HAG: 14
ADU: 10

*GRA: *ma ze?*
*HAG: *ma ze?*
*HAG: *ma ze?*
*HAG: *nadned.*
*HAG: *igati nadned.*
%sit: Hagar wants to go swinging, but plays indoors with her grandmother.
*HAG: *od pam* [: pa'am] [*].
*HAG: *nadned.*
*HAG: *le-gag le-gag.*
*MOT: *Hagari, loh yoc'im la-gag, axshav mesaxkim kan.*
*GRA: *Hagar, at xola.*
*GRA: *at yoda'at she at xola Hagari?*
*HAG: *ava* [: aval] [*] *le-gag.*
*HAG: *gag.*
*GRA: *mi ze?*
*HAG: *ladow le-gag.*
*HAG: *le-e-gag.*
*MOT: *ima loh holexet la-gag.*
*HAG: *gag gag!*
%par: Hagar is crying and shouting.
*MOT: *Hagari.*
*GRA: *at roca sipur?*
*GRA: *boi tavi'i li sipur ve ani asaper lax.*
%par: Hagar is crying loudly.
*HAG: *le-gag!*
*MOT: *loh mesaxkim axshav ba-gag.*
*HAG: *le-gag.*
%par: Hagar is crying.
@End

Database file (Dictionary) - .cnt

@Begin
@Filename: hag107b.cnt
@Comments: This is a list of morphemes and their MPU values
An unspecified value means that the value is 1
Context dependence is marked by “?”
A morpheme consists of one or more repeated identical words, potentially followed by the target form in [:]. Examples:

```
*WRD:  rakevet              1
*WRD:  rakevet
*WRD:  ha-rakavot                   3
*WRD:  akeyet [: rakevet] 1
*WRD:  od od od             1
*WRD: oto                   ?
```

For convenience, the file is in standard CLAN format, with a single 'speaker', named WRD.
@Participants: WRD

```
ava
e         0
gag
gag gag
igati     2
ladow     2
le
ma
od
pam
ze
```

File mapped with morpheme values - .chm

@Begin
@Filename: hag107b.chm
@Coding: CHILDES 2.1
@Age of HAG: 1;7.2
@Sex of HAG: female
@Date: 6-JUN-1988.
@Situation: At home with family. Hagar is ill.
@Participants: HAG Hagar Child, MOT Inbal Mother, GRA Grandmother
@Utterances: HAG: 14
ADU: 10

*GRA: *ma ze?*
*HAG: *ma ze?*
%num: 1 1
*HAG: *ma ze?*
%num: 1 1
*HAG: *nadned.*
%num: 1
*HAG: *igati nadned.*
%num: 2 1
%sit: Hagar wants to go swinging, but plays indoors with her grandmother.
*HAG: *od pam* [: pa'am] [*].
%num: 1 1
*HAG: *nadned.*
%num: 1
*HAG: *le-gag le-gag.*
%num: 1 1 1 1
*MOT: *Hagari, loh yoc'im la-gag, axshav mesaxkim kan.*
*GRA: *Hagar, at xola.*
*GRA: *at yoda'at she at xola Hagari?*
*HAG: *ava* [: aval] [*] *le-gag.*
%num: 1 1 1
*HAG: *gag.*
%num: 1
*GRA: *mi ze?*
*HAG: *ladow le-gag.*
%num: 2 1 1
*HAG: *le-e-gag.*
%num: 1 0 1
*MOT: *ima loh holexet la-gag.*
*HAG: *gag gag!*
%num: 1
%par: Hagar is crying and shouting.
*MOT: *Hagari.*
*GRA: *at roca sipur?*
*GRA: *boi tavi'i li sipur ve ani asaper lax.*
%par: Hagar is crying loudly.
*HAG: *le-gag!*
%num: 1 1
*MOT: *loh mesaxkim axshav ba-gag.*
*HAG: *le-gag.*
%num: 1 1
%par: *Hagar is crying.*
@End

MPU calculation

MPU calculation				
Total of morpheme values		# of utts for Hagar		MPU value
30	:	14	=	2.142

@Begin
@Filename: hag107b.chm
@Coding: CHILDES 2.1
@Age of HAG: 1;7.2
@Sex of HAG: female
@Date: 6-JUN-1988
@Situation: At home with family. Hagar is ill.
@Participants: HAG Hagar Child, MOT Inbal Mother, GRA Grandmother
@Utterances: HAG: 14
ADU: 10

Subtotals	
	*GRA: *ma ze?*
	*HAG: *ma ze?*
2	%num: 1 1
	*HAG: *ma ze?*
2	%num: 1 1
	*HAG: *nadned.*
2	%num: 1
	*HAG: *igati nadned.*
3	%num: 2 1
	%sit: Hagar wants to go swinging, but plays indoors with her grandmother.
	*HAG: *od pam* [: pa'am] [*].
2	%num: 1 1
	*HAG: *nadned.*
1	%num: 1
	*HAG: *le-gag le-gag.*
4	%num: 1 1 1 1
	*MOT: *Hagari, loh yoc'im la-gag, axshav mesaxkim kan.*
	*GRA: *Hagar, at xola.*
	*GRA: *at yoda'at she at xola Hagari?*
	*HAG: *ava* [: aval] [*] *le-gag.*
3	%num: 1 1 1
	*HAG: *gag.*
1	%num: 1
	*GRA: *mi ze?*
	*HAG: *ladow le-gag.*
4	%num: 2 1 1
	*HAG: *le-e-gag.*
2	%num: 1 0 1
	*MOT: *ima loh holexet la-gag.*
	*HAG: *gag gag!*
1	%num: 1
	%par: Hagar is crying and shouting.
	*MOT: *Hagari.*
	*GRA: *at roca sipur?*
	*GRA: *boi tavi'i li sipur ve ani asaper lax.*
	%par: Hagar is crying loudly.
	*HAG: *le-gag!*
2	%num: 1 1
	*MOT: *loh mesaxkim axshav ba-gag.*
	*HAG: *le-gag.*
2	%num: 1 1
	%par: Hagar is crying
Total 30	@End

Chapter 3: The Verb Lexicon

Appendix 3.I: Developmental Measures

Table 1 MLU Scores

Age	Lior	Smadar	Leor	Hagar
1;4	—	1.566	—	—
1;5	1.148	1.367	—	—
1;6	1.143	1.934	—	—
1;7	1.387	2.064	—	2.178
1;8	1.554	1.655	—	2.407
1;9	1.489	—	2.328	2.429
1;10	1.594	2.906	2.525	2.169

Table 2 MLT Scores (Words over Utterances)

Age	Lior	Smadar	Leor	Hagar
1;4	—	1.566	—	—
1;5	1.148	1.367	—	—
1;6	1.145	1.933	—	—
1;7	1.388	2.072	—	2.178
1;8	1.565	1.671	—	2.398
1;9	1.549	—	2.371	2.428
1;10	1.722	3.00	2.592	2.187

Table 3 Type-Token Ratio (First 100 Utterances)

Age	Lior	Smadar	Leor	Hagar
1;4	—	0.211	—	—
1;5	0.634	0.238	—	—
1;6	0.593	0.335	—	—
1;7	0.525	0.368	—	0.345
1;8	0.560	0.327	—	0.486
1;9	0.575	—	0.245	0.380
1;10	0.510	0.338	0.312	0.335

Table 4 Proportion of Verb-Containing Utterances in Lior and Smadar's Data

a. Lior

Age	MLU	Total No. of Utts	No. of Utts containing a verb	Ratio
1;4	—	—	—	—
1;5	1.15	81	6	7%
1;6	1.14	363	35	10%
1;7	1.38	248	19	8%
1;8	1.56	165	36	22%
1;9	1.48	376	59	16%
1;10	1.6	288	35	12%
1;11	2.08	247	50	20%
2;0	2.16	245	56	22%
2;1	2.0	588	129	22%
2;2	2.22	330	84	25%
2;3	2.8	416	165	40%
2;5	2.33	355	107	30%
2;5	3.08	272	124	46%

b. Smadar

Age	MLU	Total No. of Utts	No. of Utts containing a verb	Ratio
1;4	1.56	113	0	0%
1;5	1.37	139	0	0%
1;6	1.93	562	105	19%
1;7	2.06	345	72	21%
1;8	1.65	171	45	26%
1;10	2.9	212	107	50%
1;11	3.36	229	97	42%
2;0	3.05	563	284	50%

Appendix 3.II: Verbs Per Utterance

	Hagar			Lior			Smadar			Leor		
Age	**Total Utts**	**Total Tokens**	**V-U Ratio**	**Total Utts**	**Total Tokens**	**V-U Ratio**	**Total Utts**	**Total Tokens**	**V-U Ratio**	**Total Utts**	**Total Tokens**	**V-U Ratio**
1;5				81	6	**7%**	139	0	**0%**			
1;6				366	40	**11%**	564	97	**17%**			
1;7	176	27	**15%**	255	20	**8%**	349	67	**19%**			
1;8	182	34	**19%**	168	39	**23%**	173	32	**18%**			
1;9	615	79	**13%**	416	67	**16%**				244	136	**56%**
1;10	195	59	**30%**	303	33	**11%**	216	117	**54%**	183	132	**72%**
1;11	699	237	**34%**	248	53	**21%**	239	118	**49%**	248	154	**62%**
2;0	342	148	**43%**	248	58	**23%**	577	325	**56%**	776	343	**44%**
2;1	312	106	**34%**	610	138	**23%**	549	301	**55%**	492	242	**49%**
2;2	359	120	**33%**	344	106	**31%**	503	387	**77%**	154	71	**46%**
2;3	247	121	**49%**	423	235	**56%**	286	213	**74%**	585	300	**51%**
2;4	268	82	**31%**	366	111	**30%**	67	50	**75%**	961	461	**48%**
25	266	80	**30%**	282	162	**57%**				281	173	**62%**
2;6	325	119	**37%**	445	173	**39%**				440	193	**44%**
2;7	232	77	**33%**	486	239	**49%**				560	354	**63%**
2;8	562	417	**74%**	414	190	**46%**				754	389	**52%**
2;9	715	272	**38%**	91	8	**9%**				313	175	**56%**
2;10	62	28	**45%**							497	214	**43%**
2;11	176	93	**53%**							489	294	**60%**
3;0				62	28	**45%**				306	114	**37%**
3;1				294	221	**75%**						
3;2												
3;3	527	264	**50%**									

Appendix 3.III: Early Verb Forms in Smadar's Data [1;6 - 1;8]

Verb Form	Gloss	Possible Readings
shev	'sit down'	***shev***-2SG-MS-IMP *yo**shev***-SG-MS-PR *ye**shev***-3SG-MS-FUT *te**shev***-2SG-MS-FUT *te**shev***-3SG-FM-FUT *ne**shev***-1PL-FUT
sim	'put'	*la**sim*-**-INF ***sim***- 2SG-MS-IMP ya**sim**-3SG-MS-FUT ta**sim**-2SG-MS-FUT ta**sim**-3SG-FM-FUT na**sim**-1PL-FUT
he	'cry'	*bo**xe***-SG-MS-PR
ci	'take out'	*leho**ci*-**-INF *mo**ci***-SG-MS-PR *yo**ci***-3SG-MS-FUT *to**ci***-2SG-MS-FUT *to**ci***-3SG-FM-FUT *no**ci***-1PL-FUT
ken	'fix'	*leta**ken*-**-INF *meta**ken***-SG-MS-PR *yeta**ken***-3SG-MS-FUT *teta**ken***-2SG-MS-FUT *teta**ken***-3SG-FM-FUT *neta**ken***-1PL-FUT
iyax	'manage'	*lehac**liax*-**-INF *mac**liax***-SG-MS-PR *yac**liax***-3SG-MS-FUT *tac**liax***-2SG-MS-FUT *tac**liax***-3SG-MS-FUT *nac**liax***-1PL-FUT
hala/lala	'fall down'	***nafla***-3SG-FM-PT
go(r)	'turn off, close'	*lis**gor*-**-INF *es**gor***-1SG-FUT *yis**gor***-3SG-MS-FUT *tis**gor***-2SG-MS-FUT *tis**gor***-3SG-FM-FUT *nis**gor***-1PL-FUT
pes	'look for'	*lexa**pes***-INF *xa**pes***-2SG-MS-IMP *yexa**pes***-3SG-MS-IMP *texa**pes***-2SG-MS-IMP *texa**pes***-3SG-FM-IMP *mexa**pes***-SG-MS-PR *xi**pes***-3SG-MS-PT *nexa**pes***-1PL-FUT
se	'do'	*a**se***-2SG-MS-IMP *o**se***-SG-MS-PR *ya'a**se***-3SG-MS-FUT *ta'a**se***-2SG-MS-FUT *ta'a**se***-3SG-FM-FUT *na'a**se***-1PL-FUT

Verb Form	Gloss	Possible Readings
kax	'take'	***kax***-2SG-MS-IMP *la**kax***-3SG-MS-PT *yi**kax***-3SG-MS-FUT *ti**kax***-2SG-MS-FUT *ti**kax***-3SG-FM-FUT *ni**kax***-1PL-FUT
de	'tidy up'	*lesa**der*-**-INF *mesa**der***-SG-MS-PR *mesa**deret***-SG-FM-PR *yesa**der***-3SG-MS-FUT *tesa**der***-2SG-MS-FUT *tesa**der***-3SG-FM-FUT *si**der***-3SG-MS-PT *nesa**der***-1PL-FUT
ce	'want'	*ro**ce***-SG-MS-PR *yir**ce***-3SG-MS-FUT *tir**ce***-2SG-MS-FUT *tir**ce***-3SG-FM-FUT *nir**ce***-1PL-FUT
ka	'hold'	*maxzi**ka***-SG-FM-PR
vi	'bring'	*leha**vi*-**-INF *me**vi***-SG-MS-PR *ya**vi***-3SG-MS-FUT *ta**vi***-2SG-MS-FUT *ta**vi***-3SG-FM-FUT *na**vi***-1PL-FUT
pof	'wash'	*lish**tof*-**-INF *sh**tof***-2SG-MS-IMP *yish**tof***-3SG-MS-FUT *tish**tof***-2SG-MS-FUT *tish**tof***-3SG-FM-FUT *esh**tof***-1SG-FUT *nish**tof***-1PL-FUT

Appendix 3.IV: Distribution (in percentages) of Verb Tokens by Verb-Pattern

a. Lior

Age	*qal*	*nif'al*	*pi'el*	*hitpa'el*	*hif'il*	Total No.
1;5	100	0	0	0	0	4
1;6	89	0	11	0	0	9
1;7	100	0	0	0	0	9
1;8	80	0	7	7	7	15
1;9	87	0	13	0	0	23
1;10	76	0	24	0	0	17
1;11	72	0	16	8	4	25
2;0	71	5	24	0	0	21
2;1	59	2	16	11	11	44
2;2	73	2	10	7	7	41
2;3	65	3	19	6	6	63
2;4	67	2	19	8	4	48
2;5	56	6	13	13	12	52
2;6	66	2	14	9	9	65
2;7	68	0	15	12	5	65
2;8	64	4	18	9	4	67
2;9	85	4	12	0	0	26
3;0	55	5	16	13	11	76
3;1	74	2	11	7	7	61

b. Smadar

Age	*qal*	*nif'al*	*pi'el*	*hitpa'el*	*hif'il*	Total No.
1;6	67	0	17	0	17	12
1;7	73	0	7	0	20	15
1;8	73	0	13	0	13	15
1;10	55	0	24	6	15	33
1;11	57	4	22	4	14	51
2;0	61	6	18	1	14	79
2;1	47	5	20	7	20	74
2;2	52	3	19	6	20	89
2;3	56	3	16	4	21	75
2;4	59	7	19	0	15	27

c. Hagar

Age	*qal*	*nif'al*	*pi'el*	*hitpa'el*	*hif'il*	Total No.
1;7	57	0	21	7	14	14
1;8	100	0	0	0	0	13
1;9	79	4	7	4	7	28
1;10	83	0	17	0	0	18
1;11	68	2	19	4	8	53
2;0	79	2	9	6	4	47
2;1	67	0	21	3	9	33
2;2	66	0	20	10	4	50
2;3	67	2	10	6	15	48
2;4	62	3	12	3	21	34
2;5	80	0	9	3	9	35
2;6	63	5	19	2	12	43
2;7	75	0	16	0	9	32
2;8	64	4	11	4	16	91
2;9	68	3	13	1	15	71
2;10	73	7	0	0	20	15
2;11	62	5	14	5	14	37
3;3	63	2	8	3	24	62

d. Leor

Age	*qal*	*nif'al*	*pi'el*	*hitpa'el*	*hif'il*	Total No.
1;9	50	5	10	5	30	20
1;10	90	0	5	5	0	20
1;11	70	3	8	5	14	37
2;0	69	2	16	2	10	49
2;1	59	5	15	5	16	61
2;2	67	0	17	0	17	18
2;3	66	5	14	4	11	56
2;4	62	7	17	2	12	94
2;5	60	2	16	5	16	43
2;6	65	4	17	6	9	54
2;7	68	5	12	4	12	77
2;8	58	8	15	3	15	86
2;9	62	10	10	2	17	52
2;10	47	11	16	9	17	76
2;11	59	7	12	7	15	85
3;0	51	5	10	8	26	39

Chapter 4: Verb Morphology

Appendix 4.I: Gender

Table 1 lists for the three girls (combined) and the boy, the distribution (in percentages) of feminine, masculine and unspecified forms (i.e., verbs in the 1st person) out of the total number of verb tokens by age. Forms for which gender is irrelevant (for example, unclear forms, and infinitivals) are not included.

Table 1 Percentage of Masculine versus Feminine Verbs by Age

	Girls			Boy		
Age	**MS**	**FM**	**US**	**MS**	**FM**	**US**
1;6	25	15	4			
1;7	36	11	4			
1;8	16	17	7			
1;9	36	27	3	63	7	18
1;10	21	36	14	77	1	8
1;11	42	22	9	65	5	6
2;0	18	44	16	73	5	9
2;1	22	39	25	67	5	2
2;2	28	38	24	66	4	0
2;3	30	34	15	43	9	25
2;4	33	40	16	52	15	12
2;5	43	31	14	39	25	4
2;6	33	40	13	52	28	10
2;7	22	51	11	34	32	25
2;8	45	23	22	42	20	21
2;9	25	37	25	46	23	20
2;10	39	14	39	45	28	20
2;11	26	45	15	51	26	19
3;0	7	57	11	32	32	24
3;1	33	30	24			

Table 2 displays the distribution (in percentages) of masculine, feminine and unspecified forms for each child by age.

Table 2 Distribution (in percentages) of Gender by Child and Age

	Hagar			Lior			Smadar			Leor		
Age	**MS**	**FM**	**US**	**MS**	**FM**	**US**	**MS**	**FM**	**US**	**MS**	**FM**	**US**
1;5				33	17	33						
1;6				55	8	13	12	19	0			
1;7	19	7	11	40	20	0	42	10	1			
1;8	6	29	9	31	10	0	9	13	13			
1;9	56	20	4	12	34	1				63	7	18
1;10	32	37	12	21	42	9	15	34	17	77	1	8
1;11	48	22	3	23	21	8	40	23	24	65	5	6
2;0	26	33	11	26	43	3	12	49	20	73	5	9
2;1	32	40	4	26	46	4	16	35	42	67	5	2
2;2	43	36	11	36	34	16	22	39	30	66	4	0
2;3	31	36	12	37	32	6	21	36	27	43	9	25
2;4	37	38	16	36	40	13	22	44	24	52	15	12
2;5	26	50	15	51	22	14				39	25	4
2;6	28	44	16	37	37	11				52	28	10
2;7	19	52	17	23	51	10				34	32	25
2;8	50	18	22	34	33	22				42	20	21
2;9	24	37	25	50	25	25				46	23	20
2;10	39	14	39							45	28	20
2;11	26	45	15							51	26	19
3;0				7	57	11				32	32	24
3;1				33	30	24						
3;2												
3;3	52	12	13									

Appendix 4.II: Distribution [in percentages] of Tense by Age

a. Smadar

Age	Total No.	UC	INF	IMP	PRES	PAST	FI	FUT
1;6	97	69	0	19	0	12	0	0
1;7	67	36	12	18	30	6	0	0
1;8	32	59	6	9	13	13	0	0
1;9								
1;10	117	30	4	3	32	25	3	3
1;11	118	4	9	5	37	26	5	13
2;0	325	5	14	1	39	14	8	18
2;1	301	0	7	0	26	37	10	21
2;2	387	0	9	2	37	36	9	8
2;3	213	0	17	1	27	31	5	18
2;4	50	0	10	0	40	34	4	12

b. Lior

Age	Total No.	UC	INF	IMP	PRES	PAST	FI	FUT
1;5	6	0	17	50	0	33	0	0
1;6	40	23	3	23	25	20	8	0
1;7	20	25	10	20	10	25	5	0
1;8	39	3	56	10	15	15	0	0
1;9	67	34	18	12	22	9	4	0
1;10	33	9	18	24	21	24	3	0
1;11	53	9	32	8	23	25	2	2
2;0	58	19	12	7	41	14	7	3
2;1	138	8	14	5	49	13	9	2
2;2	106	1	13	8	47	25	1	4
2;3	235	1	23	10	34	11	13	8
2;4	111	3	9	4	41	22	16	6
2;5	162	2	11	5	35	27	7	13
2;6	173	0	15	9	39	11	14	12
2;7	239	0	17	2	41	14	19	7
2;8	190	0	11	5	26	22	12	25
2;9	8	0	0	0	38	50	0	13
2;10								
2;11								
3;0	28	0	25	0	18	14	39	4
3;1	221	1	7	1	34	32	10	14

c. Leor

Age	Total No.	UC	INF	IMP	PRES	PAST	FI	FUT
1;9	136	10	1	21	32	12	15	7
1;10	132	3	11	24	42	8	5	6
1;11	154	6	19	16	43	5	4	8
2;0	343	2	10	7	29	16	33	3
2;1	242	7	18	3	38	11	17	6
2;2	71	7	23	6	35	3	17	10
2;3	300	4	19	10	17	17	9	24
2;4	461	3	18	5	36	15	16	7
2;5	173	2	29	5	24	13	21	5
2;6	193	1	9	6	42	15	17	9
2;7	354	1	9	14	23	13	23	17
2;8	389	0	17	8	34	21	8	11
2;9	175	1	11	13	28	24	11	13
2;10	214	0	7	3	34	26	10	19
2;11	294	0	4	3	48	25	10	10
3;0	114	2	11	8	25	17	18	20

d. Hagar

Age	Total No.	UC	INF	IMP	PRES	PAST	FI	FUT
1;7	27	19	44	4	19	7	0	7
1;8	34	12	44	12	24	6	0	3
1;9	79	1	19	16	35	18	3	8
1;10	59	3	19	24	37	12	2	3
1;11	237	12	15	20	41	7	2	3
2;0	148	1	28	4	45	14	2	6
2;1	106	4	21	4	51	9	5	7
2;2	120	0	11	18	38	18	7	8
2;3	121	0	21	7	41	21	6	3
2;4	82	0	10	11	34	22	20	4
2;5	80	1	8	9	53	11	9	10
2;6	119	4	8	16	39	15	5	13
2;7	77	1	10	10	29	21	17	12
2;8	417	0	9	3	23	52	3	10
2;9	272	0	13	6	37	19	7	18
2;10	28	0	7	0	18	61	4	11
2;11	93	0	13	1	32	28	12	14
3;3	264	0	3	11	27	33	11	15

Chapter 5: Verb Semantics

Appendix 5.I: "Light Verbs" in the Early Speech of Hagar, Leor, Lior and Smadar[83]

Lexeme	Gloss[84]	N	Hagar	Leor	Lior	Smadar
akl1	'eat'	20	16		2	2
bky1	'cry'	20	7		9	4
bwa1	'come'	71	27	18	11	15
bwa5	'bring'	32		30	1	1
brx1	'run away'	2		2		
ciq1	'shout'	4	4			
clx5	'manage'	17				17
cyr3	'draw'	8				
dpdp3	'page'	4		4		
eyn	'be+NEG'	13	6			7
glx4	'shave'	6	2	4		
gmr1	'finish+TR'	26	13	5	8	
gmr2	'allgone' = 'finished'	3		3		
hlk1	'go, walk'	31	15	4		12
hpk1	'turn over'	2				2
hyy1	'be'	2		2		
ily1	'go up'	13	2	11		
imd1	'stand (up)'	10	3	7		
isy1	'make, do'	24	17	3	4	
izr1	'help'	8	4		4	
kab1	'hurt'	19	16		3	
kis1	'be angry'	3	3			
kns5	'put in'	5	1	2		2
lbš4	'get dressed'	2	2			
lbš5	'dress+TR'	13		13		
lklk4	'make dirty'	4				4
lqx1	'take'	84	9	62	1	12
npl1	'fall down'	24	7	2	4	11
npl5	'drop'	4			4	
nsi1	'go (by vehicle)'	9	4	5		
ntn1	'give'	35	7	20	2	6
nwm1	'go to sleep'	10		1	9	
ptx1	'open'	69	5	48	9	7
qlp3	'peel'	7	7			
qpc1	'jump'	33	1	29	3	
qra1	'read'	36	2	34		
qry1	'happen'	6	1	5		
qwm1	'get up'	29		28	1	
ray1	'see'	10	1	9		
rbc5	'beat'	3	3			
rcy1	'want'	308	30	278		
rwc1	'run'	8	8			
rxc1	'wash'	4	4			

83 In the Table, dark gray marks general-purpose verbs; light gray marks prototypical verbs, and white marks specific/idiosyncratic verbs.

84 Verbs are translated as [verb + particle] combinations even though they are monolexemic in Hebrew (as in French or Spanish), e.g., *brx1* 'run away = escape', because this form is closer to colloquial (and hence children's) speech.

Lexeme	Gloss[84]	N	Hagar	Leor	Lior	Smadar
rwm5	‘pick up’	13		13		
sgr1	‘close’	66		49		17
škb1	‘lie down’	9	2			7
špk1	‘spill+TR’	5	5			
špk2	‘get spilt’	2	2			
spr3	‘tell’	11	10			1
šty1	‘drink’	3	3			
sym1	‘put’	100	12	50		38
šyr1	‘sing’	25	25			
Tps3	‘climb’	5	2		3	
xps3	‘look for’	11				11
xzr5	‘return’	2		2		
yca5	‘take out’	24		20		4
yeš	‘be-Existential’	47	6	12		29
yrd1	‘get down’	19	2	16	1	
yrd5	‘take down’	12	1	11		
yšb1	‘sit (down)’	35	7	24	1	3
yšn1	‘sleep’	26	24			2
zrq1	‘throw’	5	4		1	
zwz1	‘move’	5		4	1	

Chapter 6: Verb Argument Structure

Appendix 6.I: Examples of [Verb + Complement] Configurations for *bwa1* 'come', *rcy1* 'want' and *ntn1* 'give' in the Data of Four Children

Lexeme	Utterance	Gloss
bwa1 'come'	***boi*** *nir'e* [Smadar]	come-2SG-FM-IMP see-1PL-FUT = 'Come let's see!'
	bo *nexapes et safti* [Leor]	come-2SG-MS-IMP look for-1PL-FUT ACC grandma = 'Come, let's look for grandma!'
	ima shxena ***ba'a*** *lesaxek itxa baxuc* [Lior]	Mother neighbor come-3SG-FM-PT to-play with-you-2SG-MS outside = 'Mother neighbor came to-play with you outside'
	boi [Smadar]	come-2SG-FM-IMP = 'Come!'
	bo *maher maher* [Smadar]	come-2SG-MS-IMP quick quick = 'Come quick, quick!'
	bo *la-yam* [Hagar]	come-2SG-MS -IMP to-the-sea = 'come to the sea'
	mi ***ba****?* [Hagar]	who came-3SG-MS = 'Who came?'
	aba ***ba*** [Smadar]	daddy came-3SG-MS = 'Daddy came'
	Lea ***tavo*** *eleynu* [Smadar]	Lea will come-3SG-FM-FUT to-us = 'Lea will come to us'
	hine Benc ***ba*** *le-Arik* [Smadar]	here Benc come-3SG-MS-PR to-Arik = 'Here's Benc coming to Arik'
	hu ***ba*** *im peca* [Leor]	he came-3SG-MS with wound = 'He came with (a) wound'
rcy1 'want'	***roca****?* [Hagar]	want-SG-FM-PR = 'want?'
	loh ***roca*** [Smadar]	not want-SG-FM-PR = 'don't want'
	roca *od* [Hagar]	want-SG-FM-PR more = 'want more'
	roca *kaxol* [Hagar]	want-SG-FM-PR blue-SG-MS = 'want blue'
	ani ***roca*** [Smadar]	I want-SG-FM-PR = 'I want'
	roca *sakin* [Smadar]	want-SG-FM-PR knife = 'want (a) knife'
	ani ***roca*** *po* [Lior]	I want-SG-FM-PR here = 'I want here'
	roca *la^bayit sheli* [Hagar]	want-SG-FM-PR to-the-home my-1SG = 'want to my home'
	roce *be^kos yafa* [Lior]	want-SG-MS-PR in glass pretty-SG-FM = 'wants in (a) pretty glass'
	im ketchop ani ***roca*** [Smadar]	with ketchup I want-SG-FM-PR = 'I want (it) with Ketchup'
	ani ***roca*** *gam be^ze* [Smadar]	I want-SG-FM-PR also in this = 'I want also in-this (one)'
	hu ***roce*** *la-agala* [Lior]	he want-SG-MS-PR to-the-stroller = 'He wants to-the-stroller'
	ma hu ***roce*** [Lior]	what he want-SG-MS-PR = 'What he wants?'
	ani ***roca*** *kafe* [Hagar]	I want-SG-FM-PR coffee = 'I want coffee'
	ani ***roca*** *lir'ot* [Smadar]	I want-SG-FM-PR to-see = 'I want to-see'
	roca *she ani elbash otam* [Smadar]	want-SG-FM-PR that I wear-1SG-FUT them-3PL-MS = 'Want that I'll wear them'
ntn1 'give'	***tni*** *et ze* [Lior]	give-2SG-FM-IMP ACC this = 'Give this!'
	tni *li* [Lior]	give-2SG-FM-IMP to-me = 'Give me!'
	titni *li maka* [Lior]	give-2SG-FM-FI to-me spank = 'Give me (a) spank'
	titni *li lesaxek ba-bacek* [Lior]	give-2SG-FM-FI to-me to-play with-the-dough = 'Give me to-play with-the-dough'

Appendix 6.II: Examples from Lior and Smadar for the Use of *npl1* 'fall down' [MLU <2] and *bwa1* 'come' [MLU > 2]

1. *npl1* 'fall down' [MLU <2]

Smadar 1;6	Lior 1;6
Smadar: *oy, sefer* ***nafal*** (1). '(a) book fell down'	Lior: ***nafal*** (1). 'fell down'
Smadar: *Pigi* ***nafla*** (1). 'Piggy fell down'	Lior 1;7
Smadar: *Gonzo* ***nafal*** (5). 'Gonzo fell down'	Lior: ***nafal*** *ze* (1). 'fell down'
Smadar: ***nafal*** (2). 'fell down'	Lior: ***nafal*** *ze* (1). 'it fell down'
Smadar 1;7	Lior 1;8
Smadar: ***nafal*** *moceci* (1). '(the) pacifier fell down'	Lior: *mil* ***nafal*** (1). '(the) coat fell down'
Smadar: *oy,* ***nafal*** *ze* (1). 'it fell down'	Lior: ***nafal*** *la* (1). 'fell down from her'
Smadar: *ken,* ***nafal*** *domino shama* (1). 'Yes, dominoes fell down there'	Lior: ***nafal*** (4). 'fell down'
Smadar: *oy, domino* ***nafal*** (1). 'dominoes fell down'	Lior: *loh ze* ***pol*** (1). 'this will not fall down'
Smadar: *oy,* ***nafal*** (1). 'fell down'	Lior 1;9
Smadar: *xxx* ***nafal*** *Kushi* (1). 'Kushi fell down'	Lior: *xxx kol,* ***nafal*** (1). 'everything fell down'
Smadar 1;8	Lior: ***yipol*** (1). 'will fall down'
Smadar: ***nafal*** *mixse!* (2) '(the) lid fell down'	Lior: ***nafalt*** (1). '(you) fell down'

2. *bwa1* 'come' [MLU > 2]

Smadar 1;10

Smadar: *hine Benc **ba** le-Arik!*
'There, Benc came to Arik'

Smadar: ***bati**!*
'(I) came'

Smadar 1;11

Smadar: ***bo** hena, coek Benc.*
'Come here, Benc shouts'

Smadar: *…ani **ba**.*
'I'm coming-MS'

Smadar: *ani **ba'a** lehavi le-ima et ha-seara.*
'I'm coming to bring Mommy the hair'

Smadar 2;0

Smadar: *ani **ba**.*
'I'm coming-MS'

Smadar: *ani **ba'a** !* (4)
'I'm coming-FM'

Smadar 2;2

Smadar: *nir'e, **boi** she nir'e.*
'Let's see, come so we can see'

Smadar: ***boi** nir'e.*
'Come (let's) see'

Smadar: ***boi** nir'e et ha-kelev.*
'Come (let's) see the dog'

Smadar 2;3

Smadar: *oy ima, **boi** tir'i et Donald Dak.*
Mommy, come see Donald Duck'

Smadar: *ani **ba'a**!*
'I'm coming-FM'

Smadar: *loh, roca ledaber kshe ima **tavo**.*
'No, (I) want to speak when Mommy comes'

Smadar: ***bau** gam shney barnashim im xulcot pasim.*
'Two guys with striped shirts came, too'

Smadar: *aval pa'am she Lea **tavo** eleynu ani elex ita le-gan Chizik.*
'But once when Lea comes to us I will go with her to Chizik garden'

Smadar: *loh, kshe hi **tavo**.*
'No, when she comes'

Lior 2;2

Lior: ***yavo**.*
'(He) will come'

Lior: *texef ima **tavo**, tov?*
'Soon Mommy will come, okay?'

Lior: *loh **ba**, xxx **ba**.*
'didn't come, xxx came'

Lior: *mi ze **ba**?*
'Who came?'

Lior 2;3

Lior: ***bo** takum rega.*
'come get up a moment'

Lior: ***bo** telex la-kit.*[85]
'come on go to the kit'

Lior: ***bo** teshev al ha-kit.*
'come sit on the kit'

Lior: ***bo** teshev al ha-shulxan.*
'come sit on the table'

Lior: ***bo** teshev al ha-xxx, yihiye lexa xam.*
'come sit on the xxx, you'll be warm'

Lior: ***bo** teshev leyadi.*
'come sit next to me'

Lior: ***bo** nesaxek.*
'come (let's) play'

Lior: *hine aba shel ha-kelev, hu **ba**, hine.*
'there the dog's father, he came, there'

Lior 2;4

Lior: ***bo** tir'e eyx ani osa migdal.*
'come see how I make a tower'

Lior 2;5

Lior: *ve hi **ba'a** maher maher, ve hi raca.*
'and she came quickly, and she ran'

Lior: *hine ha-shfena [: shfana or shxena] **ba'a** xxx.*
'there the neighbor came'

Lior: ***bo, bo** le-ima shxena, **bo**.*
'come, come to mother neighbor, come'

Lior: *ima shxena **ba'a** lesaxek itxa baxuc, **bo**.*
'Mother neighbor came to play with you outside, come'

Lior 2;6

Lior: *mi **ba**?*
'who came?'

Lior 2;7

Lior: *aba **bo** tece.*
'Daddy come on (come) out'

85 A nonexistent but possible word in Hebrew, analogous to, say, *kib* in English.

	Lior 2;8 Lior: ***boi*** *nevaker maxar et ima shela.* 'come (let's) visit her mother tomorrow' Lior: *ma na'ase* ***boi*** *nelex.* 'what shall we do come (let's) go' Lior: ***boi*** *nagid le-Aviva she xxx ha-magevet shel Har'el.* 'come (let's) tell Aviva that the towel is Harel's' Lior: *loh tare li tar'e li loh* ***yavo*** *eleynu.* 'no show me show me (he) won't come to us' Lior: *kol ha-ishim* ***yavou*** *eleynu.* 'all the people will come to us' Lior: *ha-ishim* ***yavou*** *eleynu la-luna+park.* 'the people will come to us to the amusement park' Lior: *kulam* ***bau***. 'everybody came' Lior: *aval ha-anashim loh* ***bau*** *gam Edna.* 'but the people didn't come, neither (did) Edna' Lior: *she Edna* ***tavo***. 'that Edna will come' Lior 2;9 Lior: *aval Edna loh* ***ba'a***. 'but Edna didn't come'

Chapter 7: Interactions

Appendix 7.I: Development of Prototypical and Non prototypical Agent-Patient Verbs

	Prototypical Agent-Patient Verbs		**Nonprototypical Agent-Patient Verbs**	
Age	**SVO**	**Other**	**SVO**	**Other**
1;7			*ha-buba* ***roca*** *moceci* 'The doll wants a pacifier'	
1;8	*yeladim* ***asu*** *bayit* '(The) kids made = built a house'			
1;10	*aba* ***yenake*** *et ha-shatiax* 'Daddy will clean the carpet'		*ani loh* ***mocet*** *et ha-Benc* 'I cannot find Benc'	
1;11	*aba ve ima* ***hisiu*** *et kol ha-mocecim* 'Mom and Dad drove all the pacifiers'	*gam Rolf ani* ***lokaxat*** 'too, Rolf I am taking = I'm taking Rolf, too'	*hem loh* ***mac'u*** *et ha-mocec shel ha-yeled* 'They didn't find the kid's pacifier' *misheu* ***xipes*** *et aba* 'Someone looked/was looking for Daddy'	
2;0	*hayom ani* ***lavashti*** *et zoti* 'Today I wore this one' *ani* ***eftax*** *et ha-aronot* 'I will open the closets' *ani* ***lokaxat*** *shteyhem* 'I'm taking both (of them)' *ani* ***mefareket*** *et ze* 'I'm taking this apart' *ani* ***osa*** *rekevet/knisa* 'I'm making = building (a) train/ (the) entrance'	*oti hu* ***medagdeg*** 'me he tickles = He tickles me'	*hi* ***koret*** *sefer* 'She's reading (a) book'	

	Prototypical Agent-Patient Verbs		**Nonprototypical Agent-Patient Verbs**	
Age	**SVO**	**Other**	**SVO**	**Other**
2;1	*ani **arkiv** et ha-harkava* 'I'll put together the puzzle' *ani **afarek** et ha-shaon* 'I'll take apart the watch' *axshav ani **esgor** et ze* 'Now I will close this' *aba **asa** pipi* Daddy did wee wee'	*axshav et ha-shaon ani **orid*** 'Now the watch I will take off = now I will take off the watch' *ha-na'al ha-xadasha, aba **na'al** ota?* 'The new shoe, daddy put it on? = (did) daddy put on the new shoe?'	*masheu **okef** oti* 'Something passes me by = overtakes me' *ani **merixa** et ha-rei sheli* 'I smell my mirror' *ani **espor** otam* 'I will count them' *anaxnu **kaninu** mic xadash* 'We bought new juice' *ani **roca** et ha-harkava* 'I want the puzzle' *ani **mexapeset** et ha-praxim* 'I'm looking for the flowers' *hem **zoxrim** et ze* 'They remember this' *aba **hexzik** oti* 'Daddy held me' *ani **espor** kama xalakim* 'I will count how many parts'	*et ze ani **maclixa*** 'This I manage = I can do this'
2;2	*ani **hisketi** et ha-acicim* 'I watered the plants' *axshav ani **aarbev** et ha-ciyur* 'Now I will mix the drawing' *ani **mearbevet** oto* 'I am mixing it' *ani **e'esof** otam* 'I will collect them' *aba **herim** oti* 'Daddy picked me up' *ani **e'ese** et ha-hit'amlut* 'I will do the exercises'		*ani **roca** otam/et ze* 'I want them/this' *anaxnu **shom'im** oti* 'We hear me' *Miri loh **hizmina** et ha-smartuti* 'Miri didn't invite the rug doll' *Mel **mexapes** et ha-smartuti shelo* 'Mel is looking for his rug doll' *aba **hisi'a** oti* 'Daddy drove me'	*od harkava ani **roca*** 'Another puzzle I want = I want another puzzle'

	Prototypical Agent-Patient Verbs		**Nonprototypical Agent-Patient Verbs**	
Age	**SVO**	**Other**	**SVO**	**Other**
2;3	*ani* ***esgor*** *et ze* 'I will close this' *ani gam* ***mashita*** *oto* 'I am sailing him' *ani* ***aglish*** *et ha-yarok ha-ze* 'I will slide this green (one)'		*ani* ***macati*** *xaruz exad* 'I found a bead' *Kruvi gam* ***hikir*** *et Oskar* 'Kruvi knew Oskar, too' *ani* ***roca*** *tapu'ax adama ve pire* 'I want potatoes and mashed potatoes'	
2;4	*ani* ***ekax*** *et ha-tik* 'I'll take the bag'		*ani* ***mexapeset*** *et Gadi* ***nixnas*** *le-refet* 'I'm looking for *Gadi entered the barn*' *ani* ***ershom*** *ambatya kazot cehuba cehuba* 'I will draw a yellow yellow bath tub like this'	

Chapter 8: Conclusions

Appendix 8.I: Categories for Measuring Verb Knowledge

The major categories used for measuring knowledge of verbs and VAS are described below.

Predicate: An element that designates a property or a relation. Belongs to the syntactic category of VP, AP or, sometimes, even NP (e.g., Dan is **a teacher**). It is not a syntactic argument, but rather has arguments to which it assigns thematic-roles. Verbs functioning as predicates may describe an activity (e.g., *sit, stand, eat*), an event (e.g., *fall down, open, break*) or a state (e.g., *love, think, want*).

Subcategorization frames: A subcategorization frame refers to the syntactic categories in the context of the verb. That is, to the constituent structure in which the verb occurs. The subcategorization frame of a verb like *give* has the following form: **give**: [+ __ NP PP]. This formulation means that the verb *give* must be followed by two arguments whose syntactic categories are NP and PP.

Subcategorial restrictions limit the phrasal categories that can serve as sisters to a node. Thus, the verb can in general impose subcategorial restrictions on the nodes that occur with it directly under the VP node, but not on the internal structure of those sister nodes. Such restrictions do not extend to the subject NP.

Selectional restrictions: A verb may place semantic restrictions on the noun which occurs as its Subject, Direct Object or on the preposition in any PP within V'. These selectional restrictions specify the semantic properties required of elements in the context of the verb. For example, the selectional restrictions of the verb *give* are <+ *animate Subject*> <+ *animate Indirect Object*>.

Selectional restrictions in this form have largely been eliminated from the syntactic component of the grammar in recent years, as they can be made to follow from the thematic role which a verb assigns to its arguments, or they can be incorporated into the meaning of the verb itself. For example, from the fact that *give* assigns its subject the thematic role of agent, it follows that the subject is animate, for only animate beings are capable of volition or intention, as normally characterize agents.

Pragmatic context: The term *pragmatic context* refers to the discourse situation, or context of communication in which the child has an opportunity to be exposed to and to learn a new word. Tomasello (1992) lists the following pragmatic contexts for the acquisition of verbs by his daughter Travis:
(a) A parent's comment on the child's activity or state; (b) a parental comment on a state or activity of another person or object; (c) a parent's question to the child about his intentions or desires; (d) A parent's request of something of the child or of another person. Here, "parent" will be extended to include any caretaker who interacts with the child on a regular basis (e.g., siblings, grandparents, caretaker at a daycare center), with a fifth context added - exposure to the media (television, VCR, audio cassettes, etc.).

Appendix 8.II: Evaluation Sheet of Children's Early Linguistic Development

Module	Measure	No	Below 50%	Above 50%
Lexical distribution	Relational terms	0	1	2
	Other lexical items	0	1	
	Verbs	0	1	2
SUBTOTAL				
Pragmatics	Appropriate context	0	1	2
	Appropriate illocutionary force	0	1	2
SUBTOTAL				
Morphology	Infinitival forms	0	1	2
	Marking of –	0	1	2
	Case	0	1	2
	Aspect	0	1	2
	Gender	0	1	2
	Number	0	1	2
	Person	0	1	2
	Tense/mood	0	1	2
	Subject-verb agreement	0	1	2
	Gender	0	1	2
	Number	0	1	2
	Person	0	1	2
SUBTOTAL				
Syntax	Overt arguments	0	1	2
	A particular argument occurs only with a specific verb	0	1	2
	A particular argument occurs with different verbs	0	1	2
	More than one argument occurs with transitive or bi-transitive verbs	0	1	2
	Arguments are compatible with the verb's subcategorization frames	0	1	2
	Licensing of null arguments –	0	1	2
	Pragmatic	0	1	2
	Semantic	0	1	2
	Morpho-syntactic	0	1	2
	Causative marking by –	0	1	2
	different verb	0	1	2
	auxiliary verb	0	1	2
	verb-pattern alternation	0	1	2
	affixation	0	1	2
SUBTOTAL				
Semantics	Aspectual distinctions	0	1	2
	Verb use limited to a single meaning	0	1	2
	Verb used with a range of meanings available for it	0	1	2
	Verb meaning is overextended	0	1	2
	Arguments comply with the verb's selectional restrictions	0	1	2
SUBTOTAL				

Module	Measure	No	Below 50%	Above 50%
Discourse (extended texts)	Null arguments used for purposes of topic maintenance/ discourse connectivity	0	1	2
SUBTOTAL				

TOTAL – "Profile of verb and VAS use"	