'binyanim ba'avir'
An investigation of Aspect Semantics in Modern Hebrew

Master's Thesis

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December 2004

“In all Jerusalem
There is not even one girl
who knows anything about Hebrew”

Eliezer Ben-Yehuda, *Ha-Zevi*, 1888

Preface & Acknowledgements

The motivation for this work arose from a conclusive experiment [50] I conducted to fulfill the completion requirements of the 'Logic and Cognition' course [51] in the winter semester of 2003. This course is taught by Prof. Michiel van Lambalgen and offered by the Philosophy department of the University of Amsterdam (UvA) as part of the 'Master of Logic' program of the 'Institute for Logic Language and Computation' (ILLC).

This course is interdisciplinary in nature, and is concerned with philosophical, logical, cognitive and linguistic aspects of *time*. The focus that semester was on the *acquisition* of *temporal concepts* by children, and in particular on the role that *planning* plays there.

The goals were several: (i) to obtain information about children's use of planning in organizing a narrative, (ii) to investigate how children's use of tenses and aspect is related to the Aktionsart of verbs (and verb phrases) to which the tense is applied, and (iii) to investigate how Hebrew native speakers compensate for the lack of grammatical aspect in Hebrew using other linguistic means.

The assumption underlying the proposed outline (following [3] and others) is that since Modern Hebrew lacks grammatical aspect altogether proficient Hebrew speakers will try compensate using *lexical* means, where the term lexical is used as an umbrella for adverbial modifiers, auxiliary verbs, abundance of subordinate and adjacent clauses, etc.

The result of the investigation indeed showed supporting evidence for increased use of planning components (see also [49] and [52]) in a narrative with age, and identified several ways in which additional lexical material is employed by Hebrew speakers to denote meaningful aspectual distinctions.

However, what I considered most striking about the findings was the systematic occurrences of marked deviations from standardly used verb forms, by shifting to a different morphological template, (in Hebrew, *Binyan*) in the same root. For example, mature speakers used *hithalek̆, hit'opep̆* (walked around, fly around) instead

of the simple verbs *halaǩ, aṕ* (walk, fly) [50, p. 59], and *hit'acev, ne'ecav* (become sad, got sad) instead of *haya acuv* (was sad) [50, p. 72].

Moreover, there seemed to be some correlation between the morphological templates of the verb and aspectual properties of the event it was employed to describe [50, p. 85]. However, the phenomena described using different morphological templates were hard to capture and attempts to generalize introduced too many exceptions.

In April 2004 Prof. Michiel van Lambalgen suggested that I extend this preliminary work to a Master's thesis under his supervision and I willingly engaged with the task, specifically intrigued and disturbed by the 'morphological templates' puzzle. Indeed, the investigation first centered around the lexicon and the study of Hebrew lexical aspect. However, the evidence for purposeful shifting between morphological templates together with meaningful tense alternations [50, p. 82–83] prompted me to the hypothesis that Modern Hebrew does grammaticalize aspect at some level.

This work is an attempt to tackle both the questions of the constituents of Hebrew aspect and the semantics of the morphological templates at once. An investigation of two such fundamental issues requires coverage of a wide range of linguistic, logical, cognitive and computational topics as well as mastery of relevant linguistic forms in Hebrew, notions of general aspect theory, and the logical and computational machinery of the formal semantic framework. The resulting work is thus wide in scope, as shall be seen, however we attempt to provide a deep of investigation of each of the relevant components as we incorporate it into the account.

The outcome of this work is a proposal that takes both *lexical* and *grammatical* components into account. The *roots* are considered the lexical material that carry inherent aspectual meaning, and the morphological templates (in interaction with tense) provide a grammatical dimension of investigation. As there is no de facto theory of Hebrew aspect, I adopt theoretical and formal frameworks that were proposed in the general linguistic literature ([47] and [52]) and demonstrate how these two components might interact in an account of Hebrew aspect.

As partially evident from the scope if this study, this work is a result of efforts by more than one person, and members of academia as well as ordinary people actively took part in the course of the study. Thus, it is a pleasure for me to pay here my intellectual and personal debts.

First, I would like to thank Prof. Michiel van Lambalgen for introducing me to this fascinating subject, for encouraging to further investigate it, and for supporting me in exploring this path. Michiel provided me with a complete academic freedom in exploring and investigating aspect in a language that prima facie doesn't have any, and by thus taught an important lesson about what is called 'research'.

Second, I would like to thank Prof. Susan Rothstein from Bar-Ilan University in

Israel who kindly agreed to meet with me and discuss matters of Hebrew aspect in the summer of 2004. The discussion with Susan was eye-opening to say the least, and provided me new insights, worthwhile research questions, and a comprehensive list of relevant literature to start my research with.

In practice, I could never have learned and achieved as much as I did without the efforts of Darrin Hindsill. Darrin has spent long hours reading my notes and in discussion with me. His insightful questions and elucidating comments were invaluable in forming the theoretical proposal spelled out in part II of the study, and in devising the final version of the study as it is presented here.

In addition, I'd like to thank my sister, Noa Tsarfaty, without whom the execution of the experimental part (described in part III) would have been simply impossible. Noa helped with the design of the experimental material, professionally handcrafted the enhanced storybook, and above all, transcribed a wealth of audio recorded interviews in Hebrew writings. Also, she formed a 'forum' of Hebrew speakers (whom I later refer to as 'my informants') that discussed my ideas and questions, and suggested relevant examples and counterexamples.

Not of less importance, I'd like to thank each and every individual of a set (perhaps a transitive closure) of family, friends, family of friends, and friends of the family who volunteered for the interviews and allowed me to conduct a significant amount of 42 interviews during a relatively short visit to Israel in the summer of 2004.

In addition I would like express my deep appreciation to my colleagues Scott Grimm and Samson de Jager for professional proof reading and help in typesetting. As I was unsponsored during my Masters studies and for matters of this research I'd like also to thank Nuriel Shem-tov and 'de-bar' for providing me with the perfect job to financially support myself throughout. Special thanks to my friends in Tel-Aviv and in Amsterdam for making pressured times manageable and much more pleasant.

Last but not least, I'd like to thank my parents Nurit and Itsik Tsarfaty for their unconditional support throughout and dedicate this thesis to them with all my love.

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Part I

Prologue

Chapter 1

Introduction

This work is an attempt at a theoretical, formal and empirical investigation of verbal aspect in Modern Hebrew (hereafter, Hebrew).

Aspect is a term introduced, together with *tense*, to describe temporal phenomena expressed in natural language. Following [7, p. 3] we distinguish *tense*, the relation between the situation referred to and another point in time, from *aspect*, the ways of viewing the internal temporal constituency of situations.

To all appearances, Modern Hebrew does not 'have' verbal aspect. As opposed to Biblical Hebrew, Modern Hebrew has a three-way tense system that grammaticalizes past, present and future and it does not have any grammatical morphemes that are explicitly designated to mark aspectual distinctions as in other Indo-European languages (e.g., English [39], Russian [21] etc.).

As opposed to tense terminology which is well understood and successfully applied throughout the Hebrew verbal lexicon, aspect terminology is generally much less familiar to Modern Hebrew speakers. While tense terms like *past, present* and *future* have Hebrew equivalents, aspectual terms such as *perfective, progressive, inchoative* and the like occur only as English loan words (e.g., [14, in Hebrew]). While a Polish speaking seventh grader, for instance, learns aspectual distinctions in elementary school [34, p. 9], Hebrew speaking children/adults encounter explicit aspectual terms only when acquiring a second language, e.g., English.

Still, Comrie [7] presents verbal aspect as a part of a general linguistic theory rather then a feature of specific languages. Moreover, recent studies of aspect (e.g., [47, 52]) take aspectual distinctions to be cognitively grounded rather then language dependent. This in itself motivates our initial claim that Modern Hebrew must *have* aspect to allow its speakers to convey the same aspectual distinctions.

Linguists draw a clear distinction between *grammatical* aspect, which refers to distinctions that are conveyed by verb inflections defined in the grammar of the

language, and *lexical* aspect which refers to distinctions carried on top of lexical material, and is a part of a verb-inherent meaning. Due to the relatively limited set of grammatical morphemes in the tense system, one popular approach in the investigation of Modern Hebrew aspect is to focus on the lexical material and to investigate a verb's inherent meaning [55]. A similar approach is to investigate how Hebrew speakers compensate for the lack of grammatical aspect by using additional lexical material [3].

While it is clear that additional lexical material contributes to aspect (in Modern Hebrew as well as in other languages), I suggest that this is not all that there is to the story of aspect in Modern Hebrew.

This work forms a preliminary proposal in which the two basic ingredients (lexical and grammatical) interact in an account of Hebrew verbal aspect. The study focuses on peculiarities of the Semitic verbal system's morphological patterning and examines the contribution of the morphological patterns and tense inflections to the aspectual meaning conveyed by Hebrew verbs.

Following the motivation we have proposed, however, it seems desirable (if not obligatory) that the proposed account be *linguistically adequate* as well as *cognitively plausible*. Thus, the theoretical proposal is accompanied by a formal account that provides the semantics of the investigated forms and makes relevant predictions. Later, the proposal is empirically evaluated via the analysis of 22 children's and adults' Hebrew narratives.

Constructing and formalizing the theoretical proposal and applications is the main concern of part II. The design, execution, analysis and results of the experimental component are treated in Part III. In part IV we integrate the results of both parts and draw the final conclusions.

This chapter is dedicated to the introduction of the components that play a role in forming the theory, evaluating it, and relating the theoretical and empirical components to one another. First we explore the interrelation between language and cognition in the temporal domain (1.1.1). Then, we survey forms of temporal expressions in the language under investigation, Hebrew (1.1.2).

The remainder of the chapter is dedicated to spelling out the goals (1.2.1), methods (1.2.2), existing literature (1.2.3), and general hypothesis (1.3.1) of this study. Last, we present the general plan of this document (1.3.2).

1.1 Theoretical Background

1.1.1 Language and Cognition in the Temporal Domain

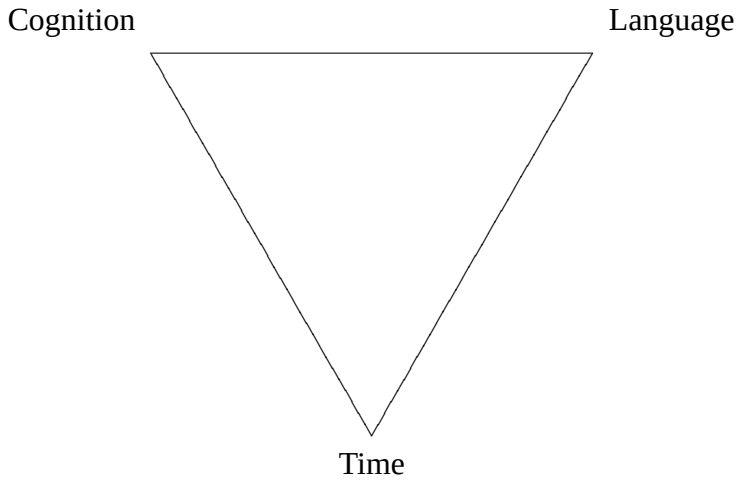
Language is a system that 'lives in time'.

> "Spoken language can be used to talk about the past, and it lives in a rapidly changing present. But it always looks forward, rushing towards a future that is [...] charted only a few words or syllables in advance." [2, p. 293]

Bates, Elman and Li [2] distinguish three dimensions of investigation: (i) language *in* time, which refers to talking about activities viewed as temporal sequences (including prediction, i.e., guessing what comes next), (ii) language *on* time, which refers to the use of language in real time (including the constraints that it puts on production or comprehension processes) and (iii) language *about* time, which refers to the various linguistic forms that are used to express temporal relations.

Clearly, all of these dimensions take cognitive capacities into account. Talking *in* time presupposes that we perceive sequential activities as happening 'through time'. Talking *on* time requires us to grasp temporal relations between these 'happenings' and the presupposed timeline, and talking *about* time requires us to acquire the relevant linguistic forms in which one can convey these temporal relations.

So it seems that time, language and cognition are closely intertwined as sketched in the following diagram;



However, van Lambalgen and Hamm [52] claim:

> "It is a truism that we express temporal relations because we are able to experience these relations. It is less clear why human beings [...] have a conscious experience of time at all." [52, p. 3]

Cognition and Time

The hypothesis is, in a nutshell, that we do not have a direct experience of time at all. Rather, *time* is a construction on top of our direct experience of *events*. The definition of events, however, remains uncomfortably vague.

Zacks and Tvesrky [56] offered the following definition of *event*: "A segment of time at a given location that is conceived by an observer to have a beginning and an end". This definition is fairly intuitive, however it is not clear how it can be equally applied to a knock on the door as well as World War II, both of which we perceive as events. It seems that humans can parse events at different levels of granularity, which suggests that events are organized in a part-whole hierarchy.

In this study we adopt the hypothesis that *planning* provides the medium through which we construct our conscious experience of time.

This claim was suggested and motivated by [52, chapter 2] on several grounds; first, goals and plans have hierarchical structure which is in accord with the part-whole structure of events. Second, there is some psychological evidence for the claim that our cognitive representation of the future is bound to the fact that we are goal-oriented, as opposed to animals governed by large sets of condition-action rules. Finally, recent studies have presented empirical evidence on the use of goal/plan knowledge in some forms of 'time talk'.

[3] presents a cross-linguistic developmental study in which children and adults were asked to narrate a story according to a wordless storybook. The stories were formally analyzed as causal networks that include various planning components (Settings, Events, Internal Responses, Goals, Attempts, and Outcomes). Following the analysis of narratives from different ages and different languages it has been shown that goal/plan knowledge is used increasingly with age to merge the past with the present and future in narrating the events on the story line. Thus, [49] concludes

> "The plan unites the past (the desire state) with the present (an attempt) and the future (the attainment of that state)."

In [50] I described the design, execution, analysis and results of a similar experiment that supports this view and in particular shows that it is also manifested for narratives in Modern Hebrew. Consequently, In this study I adopt the view that the cognitive capacity of *planning* is a prerequisite for our conscious experience of time and the baseline for making aspectual distinctions.

Time and Language

'Talking about time' makes the explicit link between an event and the linguistic forms that are used to describe and interrelate events. Although we concluded that

an event structure and interrelations between events are perceived via a general cognitive capacity, languages differ in the means they provide their speakers with to express these temporal relations.

Linguistic forms can be used to denote *tense*, that is, to express the location of the event on the timeline with respect to the time of speech or some other point in time, and to denote *aspect*, the internal structural characteristics and temporal extension of a situation (for instance, if it is punctual or extended, or whether it progresses towards an inherent terminal point).

The focus of the current investigation is on the *aspectual* category. *Aspect* as a linguistic phenomena has been extensively investigated in recent years, with many theories of aspect proposed both in general and for specific languages (e.g., [18, 39, 21, 47] etc.). However the literature on Hebrew aspect is scarce and no formalism was proposed or became the de facto standard for studying and formalizing such notions in Modern Hebrew.

This work attempts to make use of the extensive literature on the subject in order to pinpoint the linguistic devices that are used in Hebrew to express aspectual phenomena. By this we hope to shed some new light on the semantics of Hebrew verbs on the one hand, and reiterate the view of aspect as a general linguistic phenomena on the other.

Language and Cognition

The close relations between 'cognition and time' and 'time and language' make an implicit link between language and cognition. However, it turns out that this link is also explicit, and even bidirectional.

[3] suggests that this bidirectional relation is evident in language acquisition processes. On the one hand, cognitive development determines language development in the sense that cognitive capabilities trigger a search for (and the use of) new ways to express them in spoken language. Yet, language development determines cognitive development in the sense that newly acquired linguistic forms trigger a search for opportunities to use them, and gradually learning how to apply them.

This relation is explored in both directions in the current study. We start out with a quest for the linguistic forms that express aspectual distinctions based on the cognitive capacity of 'planning' in Modern Hebrew. Later, we test the use of these linguistic forms by analyzing child and adult narratives in different stages of language development.

The later component provides us with an opportunity to evaluate the cognitive plausibility of the proposed linguistic account, as the linguistic forms used to express aspectual phenomena should fit the cognitive capacities (varying with age) that are required to grasp the underlying concepts.

1.1.2 Temporal Expressions in Modern Hebrew

Many languages, including Modern Hebrew, distinguish three tenses: past, present and future. In Modern Hebrew, typically finite verb forms in simple sentences denote absolute tense.[1]

Aspect can be expressed in languages in several ways, it can be *grammaticalized*, i.e., manifested in the inflectional morphology of the verbal system, or *lexicalized*, i.e., based on the properties of event types denoted by verbal expressions. In Modern Hebrew there is no grammaticalization of aspectual distinctions within the tense inflectional morphology, and thus Hebrew is claimed to have only lexical aspect.

Following the assumption that temporal expressions reflect cognitive rather then linguistic phenomena, it is reasonable to assume that modern Hebrew speakers will try to compensate for the lack of grammatical aspect in the tense inflectional system by using other linguistic devices that express similar semantic content.

In [50] I presented the results of an experimental study that was inspired by [3]. In this study I analyzed the linguistic forms that were used by children and adult Hebrew speakers to describe the story of a picture book without words [45]. This provides an opportunity to relate verb phrases to the situation which they aim to describe, which, in turn, allows us to identify specific means that are employed by Hebrew speakers for expressing aspectual distinction such as static vs. dynamic, punctual vs. ongoing, incomplete vs. complete, etc.

In this study, several linguistic devices were identified as expressing various temporal relations other than the grammatical tense inflections. One way of expressing temporal relations beyond absolute tenses is by alternating between tenses. The alternation between tenses in adjacent/subordinate clauses gives rise to notions of simultaneity, anteriority and relative tense [50, p. 81–82].

Additional devices that are used to express aspectual distinctions have to do with lexical material, e.g., time adverbials. Also, similar to other languages, certain particular verbs stand in correlation with particular parts of events, e.g., aspectual verbs (start, continue, finish) and when combined with a finite verb complement they add a distinct temporal flavor to the situation description.

Lastly, perhaps the most interesting outcome of the study was that there seems to be some correlation between aspectual characteristics of verbs and the morphological templates from which they are derived.

If indeed such a correlation can be found between a grammatical device that is used to form verbs and their semantic aspectual content, it might be the case that Hebrew does, at some level, grammaticalize aspect. One of the main goals of this

[1] Non-finite verb complements and finite verbs in relative clauses can be seen as denoting relative tenses.

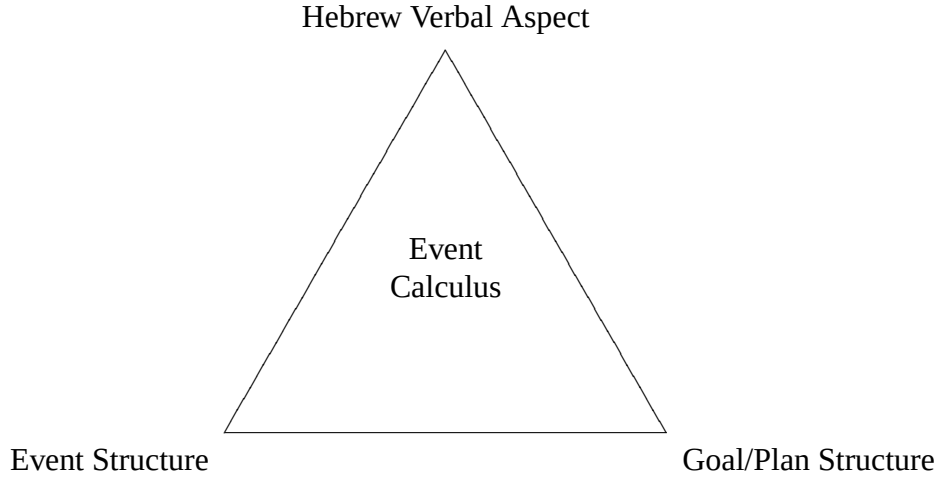
study is therefore to determine whether, and to what extent, the Hebrew morphological templates that are used to derive verbs have a role in determining the verb's aspectual value.

1.1.3 Summary

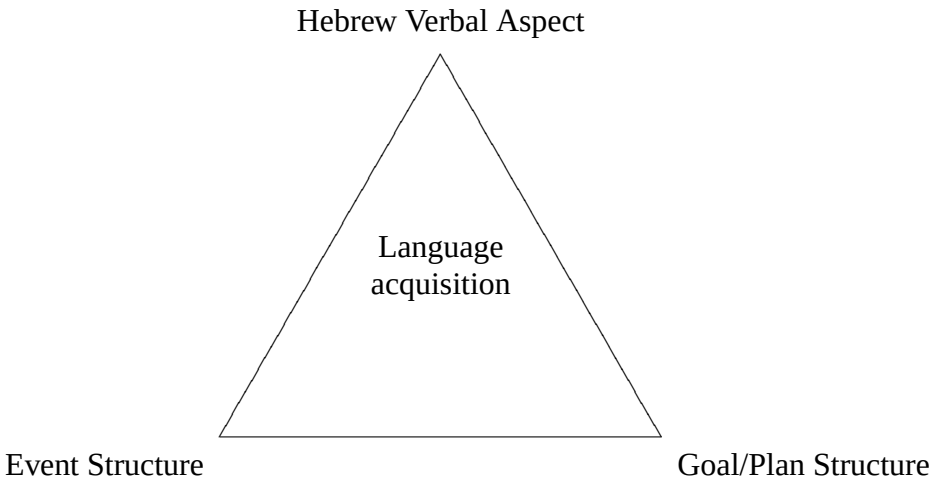
The current study adopts a *relational* theory of time, in which time is a construction on top of *events*, and temporal relations are descriptions of interrelations between different (kinds of) events. The cognitive capacity that provides the medium though which we construct our conscious experience of time is our planning capacity, and the way we perceive temporal relations and aspectual distinctions is related to our knowledge of *Goal/Plan* structures.

The linguistic forms that are used to express those temporal relations in languages in general belong to two linguistic categories, tense and aspect. However, while the semantic content of Hebrew tenses is well determined, Hebrew aspectual phenomena present a wide variety of open questions. How does Hebrew denote aspect? What linguistic forms can be used by native speakers to denote aspectual distinctions that are familiar from other languages? What is the aspectual semantic content of the morphological templates? Finally, how do all of the above interact with inherent aspectual meaning of the lexical material from which verbs are formed?

In the theoretical part of the study I make use of the *Event Calculus (EC)* formalism that allows us to integrate an (axiomatized) description of eventualities with the goal/plan structure hypothesis, as a vehicle to express the aspectual content of linguistic (lexical and grammatical) forms in the Hebrew verbal system.



In the empirical part of the study I examine the the interrelations between the Hebrew linguistic forms, the event structure of storybook episodes, and the cognitive capacities that are required to grasp and express these notions from a developmental point of view.



1.2 Goals and Procedures

1.2.1 Questions and Goals

The ultimate goal of the current study is to suggest what Hebrew verbal aspect actually is, or, in other words, what a theory of Hebrew verbal aspect might look like.

Starting out from aspect as defined in general linguistic theory, two theoretical questions have to be considered:

- What (if anything) constitutes the lexical component of Hebrew verbal aspect?
- What (if anything) constitutes the grammatical component of Hebrew verbal aspect?

Two additional, more technical questions, crucial for the successful resolution of this puzzle, have to be answered in the course of the study:

- Which formalism is adequate for expressing aspectual distinctions that are carried over lexical material as well as grammatical components?
- What kind of empirical setup can be used for evaluating the suggested formal theory from a cognitive point of view?

Upon establishing the theory, putting the formal machinery to work, and setting the empirical components in place, we shall have to answer the following, rather critical, questions:

- Is the proposed theory linguistically adequate? (in the sense that it allows to make correct predications but not overgeneralize)

- Is the proposed theory cognitively plausible? (in the sense that it fits trends that are evident from a language development point of view)

1.2.2 Method and Procedures

The departure point of this study is that aspectual distinctions are cognitively grounded rather than language dependent and that Modern Hebrew indeed 'has' verbal aspect that can be grounded in a formal theory.

In considering lexical aspect, I use event classification methods attributed to [53]. For this I rely on existing classification frameworks and evaluate them to according to our needs.

In considering grammatical aspect, I examine the Hebrew derivational morphology system by employing the *pairing* paradigm and a theory of *markedness*. In short, the pairing paradigm is concerned with arranging verbs in alternating pairs that are aspectually related and evaluating the contrast in their meaning. The pairs are determined according to the choice available to speakers. Consequently, a speaker's choice can be morphologically marked (in the sense that it carries more morphological material) or semantically marked (in the sense that it deviates from the 'standard' choice in some fashion). The evaluation of the meaning contrast in users' marked choices sheds some light on the aspectual distinction which the alternation serves to provide.

For matters of formalization I use the *Event Calculus (EC)*, a formalism proposed in [52] that is based on an underlying notion of planning in order to provide semantics for temporal relations. One reason for choosing the Event Calculus is that its representational format is cognitively plausible. Also, *EC* turns out to be particularly adequate for formalizing the semantic contribution of Semitic templates since it is sensitive to thematic roles — the roles certain participants play in situations — a notion that is central to the semantic content of the Semitic templates. Lastly, *EC* gives a computational sense to aspectual meaning, by allowing us to 'compute' the temporal extension of a situation using a formal (logical as well as computational) device.

For matters of evaluation, I use an experimental setup that is inspired by [3]. The reference point for the analysis is a picture book without words, where 45 pictures represent single events and together form a complete story that is accessible for children of a wide range of ages. The pictures are taken from a story book "Monkie" [45] and they offer many opportunities to explore the use of language to describe interaction over time of animate beings in different kinds of situations. Analyzing the narratives gives us an opportunity to look into real language use with respect to episodes with semantic content, and moreover, it allows us to look at different aspectual choices made by different users with respect to the storybook episodes and evaluate contrasts in their meanings.

1.2.3 A Note About Literature

A work like the present one lies at the intersection of linguistics, logic, cognitive science, and even computational science. However, a full mastery of the relevant literature of all these areas is far beyond the scope of a Master's thesis. Thus, throughout the work I focus on studies which are more recent, or particularly relevant to the treatment of Modern Hebrew.

In forming a two-component theory of aspect I rely on Smith's [47] study and adopt her terminology. For the details of the theoretical discussion and proposed formalisms I consult Dowty [18] and Rothstein [44] for Neo-Davidsonam approaches, and van Lambalgen and Hamm [52] for a cognitive-computational approach.

For language acquisition and the developmental point of view I closely follow Berman and Slobin [3] for experimental setup and design, and make reference to Weist [54] for basic notions of child language acquisition.

As opposed to the above subjects, literature about Modern Hebrew aspect is harder to find. Thus, I make reference to older grammar textbooks (Genesius [9], Horowitz [31], Berman [4], and Glinert [22]). For event classification in Hebrew I rely to some extent on the results of a Master's thesis about lexical aspect in Modern Hebrew [55], and Creason's study of semantic classes in the Hebrew verbal system [10].

Creason's study is extremely relevant to our investigation since it makes an explicit link between classification of verbs and the patterns they are derived from. However, his study in concerned with Biblical Hebrew and not Modern Hebrew as it is spoken today. Fortunately, this patterning mechanism has not changed a great deal throughout the years (as opposed to, for instance the tense system[2]) so theoretically Creason's discussion should be applicable to Modern Hebrew in a straightforward manner.

However, Creason deals with a closed set of verbs (which in fact constitutes a subset of the Modern Hebrew verbal system) and there might be a lot of exceptions or generalizations that are not captured by this study. Also, his treatment is not formal. Thus the results of his study should be treated with caution and cannot be used exclusively.

The most inspiring work, which in many senses influenced this study, is Doron's work on the semantics of Semitic templates [15]. The semantic account she proposes concentrates on the thematic domain. However, her systematic treatment and formal approach paved the way towards a parallel semantic account that is concerned with the aspectual content of the Hebrew Semitic templates.

Throughout the work I refer to Doron's study and rely on her results. This, together with other recent studies of Hebrew semanticists (e.g., Simons [46], Hatav [29])

[2] See further details in chapter 2.

provide this study with an up-to-date point of view and equip it with a fairly solid theoretical grounding of the underlying concepts.

1.3 Forward Outlook

1.3.1 General Hypothesis

My point of departure in the theoretical discussion of Hebrew verbal aspect is the two component theory proposed by Smith.[3] Under this view, a speaker who composes a sentence chooses a constellation of *lexical* and *grammatical* morphemes to express her aspectual choices of *situation type* and *viewpoint* respectively.

In order to apply the notion of *situation type* to Hebrew, I rely heavily on the extensive work done on event classification following Vendler [53]. I adopt the view that these classes are conceptual rather than language dependent and are manifested in Hebrew as well as in other languages. Consequently, I survey various systems that have been proposed in the literature and evaluate their adequacy for our needs.

Applying the notion of *viewpoint* to Hebrew is, however, far less straightforward. As mentioned before, Hebrew does not grammaticalize notions like perfective/imperfective, progressive, etc., that are traditionally known to contribute to the viewpoint of the situation (also known as *grammatical aspect*). Thus the common view is that Modern Hebrew lacks grammatical aspect altogether.

While I agree that grammticalization of such aspectual distinctions cannot be found under the rubric of 'grammatical tenses' as it is in other Indo-European languages, I argue that such grammatical morphemes can be found elsewhere.

Following Doron, I argue that the morphological templates that are fused with roots to form the verbs in the language (the *Binyanim* lit. constructions), are (i) grammatical, rather then lexical, morphemes, and (ii) have systematic semantic contributions to the meaning of verbs. Doron's discussion of the semantic contribution of the Semitic templates concentrates on the thematic domain. I extend this view and propose that (iii) the semantic contribution is relevant to the internal structure of events and affects their temporal schemata.

I do not claim, however, that the semantic contribution of the templates is strictly aspectual. Rather, I argue that they provide speakers with effective means to express distinctions that are relevant to the temporal domain.

My claim is that these templates provide grammatical environments that allow aspectual shifts in Hebrew sentences, and they can be (and in fact are) used to denote

[3] Although the same two components have been identified by many scholars, I adopt Smith's terminology as it is most adequate for our subsequent discussion of participants in situations.

meaningful aspectual distinctions. I argue that although the templates are not 'aspectual operators' per se, their contribution cannot and should not be overlooked, especially in light of the very limited set of grammatical means to denote aspect that native Hebrew speakers have in their disposal.

The outcome of this work is the formalization of these notions. Further, we provide preliminary empirical evidence that the proposed theory is indeed relevant and cognitively plausible.

1.3.2 Plan of the Thesis

The remainder of the document is organized as follows. We start out in chapter 2 by reviewing the uncommon trajectory of the evolution of the Hebrew language, pointing out relevant features of the Hebrew verbal system. Following Doron, I argue that these features are semantically meaningful and propose that they might be relevant to an aspectual account.

Chapter 3 develops the theoretical framework. First we present Smith's theory of aspectual systems, based on an underlying theory of markedness and aspectual choice. In order to discuss the choice of situation type, we survey properties of different kinds of events. In order to discuss the aspectual choice of a viewpoint, we discuss the thematic roles (i.e., the role that participants play in situations). Finally, we suggest which kind of situation types and viewpoints are denoted by Hebrew verbs.

Chapter 4 is concerned with the requirements for the formal framework. After reviewing available formalisms we discuss in detail the selected formalism, the *Event Calculus*. In addition to the introduction of the system's ontology, syntax and semantics, I show why and how it is adequate for formalizing both the *situation types* and *viewpoints* proposed by Smith, and moreover, the combination of the two.

Chapters 5 and 6 contain the theoretical core of this thesis. In chapter 5 I spell out the details of the formal account of Hebrew aspect I propose, including the formal considerations that are taken into account in arranging the verbs in aspectual pairs. Chapter 6 provides a theoretical and formal treatment of each of the seven Hebrew verbal templates (*Binyanim*) and applies the proposed formal machinery to the analysis of specific verbs in inflected utterances.

Chapter 7 presents the general outlook that emerges from the preceding discussion, and illustrates relevant predictions in the form of computational derivations. Then, we summarize the theoretical discussion and conclude.

Part III is dedicated to the empirical evaluation of the proposed account. Chapter 8 surveys some theoretical background for the proposed method and spells out the goals of the experiment. Chapter 9 describes the method: the task, materials, data set and the subjects that were used for the evaluation.

Chapter 10 presents two dimensions of analysis of the results. One is the identification of trends in verb usage based on statistical tables, and the other is individual qualitative analysis of verb usage by different narrators of different ages to express similar content.

Chapter 11 summarizes the preceding discussion from a developmental point of view and draws preliminary conclusions with respect to the adequacy and plausibility of the proposed account.

Lastly, in part IV, chapter 12, we integrate the results of the different parts, summarize our findings, conclude, and put forward our suggestions for further research.

Part II

A Quest for Modern Hebrew Aspect

Chapter 2

From Biblical Hebrew to Modern Hebrew

2.1 Background

2.1.1 Hebrew and Semitic Languages[1]

The *Hebrew Language* is one branch of a family of languages in western Asia which was indigenous to Palestine, Phoenicia, Syria, Mesopotamia, Babylonia, Assyria, and Arabia. These languages share many similar characteristics in the vocabulary as well as grammatical phenomena, so much so that it is unlikely that we are faced with a case of 'borrowing'. It is generally assumed that there existed a 'mother language' which they all descended from. The name *Semitic languages* (based upon the fact that Genesis describes all nations speaking these languages as descended from Shem) is generally accepted for this family of languages.

The better known Semitic languages are subdivided to four groups: the *South Semitic* or *Arabic* branch (that includes the classical literary language of the Arabs, Modern Arabic, and older Southern Arabic), the *Middle Semitic* or *Canaanitish* branch (that includes the Hebrew of the Old Testament, together with Phoenician, Punic, and various others Canaanitish dialects), the *North Semitic* or *Aramaic* branch (subdivided into the Eastern Syria Aramaic and the Western Palestinian Aramaic categories), and the *East Semitic* branch that is related to *Assyria Babylonia. Classical Hebrew* together with its descendents *Mišnaic, Rabbinic* and *Modern Hebrew* belong to the *Middle Semitic (Canaanitish)* branch.

The structure of Semitic languages exhibits numerous peculiarities of a distinct character, for instance, there are guttural consonants of different grades among the

[1] The content of this section is based mainly on [9].

consonants, the noun has only two genders (masc. and fem.), peculiar expedients are adopted for the purpose of case relations, etc. [9]

The feature that is perhaps the most significant for Semitic languages is the special status of the consonants; these form the substance of the languages. Within the same consonant framework, the vowels can be changed in order to express modifications of the stem-meaning. These stems (also termed *Roots*) are almost invariably triliteral (i.e., composed of three consonants).

The special status of the consonants is also evident in the writing system.[2] In Semitic languages consonants are written as real letters, while vowels are not. It was only later (post-biblical era, see below) that diacritics (points or strokes above/below the consonants) were introduced to reveal the vocalization to the eye of the reader. These are however superfluous for practiced readers and are commonly omitted in printed texts.

2.1.2 Sketch of the History

Biblical Hebrew

The name *Hebrew Language* (also *Classical Hebrew*, or *Ancient Hebrew*) refers to the language of the sacred writings of the Israelites which form large parts of the Old Testament. In addition to the Old Testament, there are a few remnants of old Hebrew or old Canaanitish that have been preserved, however *Ancient Hebrew* is generally equated with the language found in sacred texts, thus termed also *Biblical Hebrew*.

In the whole series of ancient Hebrew writing, (as found in the Old Testament as well as the non-biblical remnants that have been preserved) the language maintains its general character and apart from slight form and style differences it seems to be at the same stage of development. It may be that at an early time it was fixed as a literary language, and the fact that the books contained in the Old Testament were handed down as sacred texts has also contributed to this preservation.

Hebrew writing consists only of consonants. Thus, the present pronunciation of this consonantal text, its vocalization and accentuation, rest on the tradition of the Jewish schools, and was fixed by Jewish scholars at about the 7th century A.D.[3]

Even in the language of the Old Testament certain progress can be noticed from an earlier to a latter stage. Two periods may be distinguished, the *first* ,down to the end

[2] Almost invariably from right to left.

[3] In the interval between the completion of the Talmud (2nd century B.C.) and the earliest grammatical writers (around 18th century A.D.), the vocalization and accentuation of the Old Testament was done by the schools and synagogues according to their traditional pronunciation. This, together with greater part of the collection of critical notes, bears the name *Mesora* (tradition). From this, the currently received text of the Old Testament has obtained the name *Masoratic Text*. [9]

of the Babylonian exile, and the *second*, from the exile until the Maccabbees (160 B.C.). To the latter belong the larger half of the Old Testament books, including prose historical writing (e.g., Judges, Samuel and Kings), and the writing of earlier prophets (e.g., Amos, Hosea, Isaiah I, Micah etc.).

Mišnaic Hebrew

Around the time the old Hebrew language was gradually becoming extinct, and the formation of the Old Testament was approaching completion, the Jews begun to explain and critically revise their sacred texts. These *explanations* refer almost exclusively to civil and ritual law and dogmatic theology, and resemble much of the textual tradition of that period. These traditions are preserved in the *Talmud*, which is divided into two parts, the first the *Mišna*, and the remainder the *Gmara*.

The *Mišnaic text* was brought to its present form towards the end of the 2nd century A.D., and the *Gmara* was introduced in two parts; one was brought about in the middle of the 4th century A.D. and one in the middle of the 6th century A.D. The *Mišna* was written in Hebrew and it forms the beginning of the new Hebrew literature. The language of the *Gmara* is for the most part Aramaic. Thus, the literary Hebrew of that times is often referred to as *Mišnaic Hebrew*.

Hebrew linguists are confronted with a major change in the Hebrew verbal system between *Biblical Hebrew* and *Mišnaic Hebrew*. While the Hebrew was *aspect*-prominent in the Biblical period (up to the end of 2nd century B.C), it was *tense*-prominent in the Mišnaic period (from the beginning of the 2nd century A.D).[4] As yet it is not clear when this change came about.[5] However it is clear that this change was rather significant, and has been referred to as "the most revolutionary change between biblical Hebrew and Mišnaic Hebrew".[6]

Medieval Hebrew

Hebrew had been the everyday spoken language of the Israelite and Judean peoples for over 1300 years when, around the 2nd century A.D. it died as a spoken language, and was replaced by two international languages of the time: Aramaic and Greek. Although Hebrew died as a spoken language, it left behind two sacred texts, the Bible and the Mišna, each of which represented a distinct style and use of the language.

From then until the reintroduction of Hebrew as a spoken language in Palestine (in 1880 A.D.) these two textual styles served in various times and places as norms for

[4] See further details in chapter 3.

[5] The investigation of Hebrew dead sea scrolls shed some light on this matter, cf. [40].

[6] See numerous references in *ibid*.

further active, creative writings. Between 200 and 500 A.D. it was used in various religious poetic texts known as the *Piyutim*. From 500 A.D. onwards, the use of Hebrew in its written form gradually dominated Jewish communities outside Palestine, and from the 10th century A.D., all Jewish communities scattered throughout the diaspora used Hebrew "not only as a passive language of study and prayer but also for active communication in books, legal documents and private letters" [20, p. 12]. Thus, the Hebrew language widened to non-religious uses, and was used throughout the middle ages to create scientific, secular poetic, and philosophical writings.

Moreover, even as a spoken language Hebrew was not dead.

> "Jews were able to speak Hebrew on occasions. Jews from different countries have conversed in a sacred tongue, visiting scholars gave sermons in it, some spoke in Sabbath and festivals, and others in order to understand the gentiles." [20, p. 13]

From a linguistic point of view, during that time the language was subject to foreign influence. The introduction of new themes (scientific, philosophic, secular-poetic) required a larger vocabulary, and the development of a parallel rich Arabic literature based on the language of the Koran emphasized the deficiency of Ancient Hebrew in expressing such content. This situation allowed foreign influences and grammatical deviations from the language of the sacred texts. The *piyutim* used a 'revised' grammar, translated and original prose ignored standard biblical forms and rules, and scientific writings borrowed words and terms from Arabic literature.

This period also introduced what is known as *Rabbinic Hebrew*, a language blend of *Biblical Hebrew, Mišnaic Hebrew* and *Aramaic*, with influences of *Western German* (and later *Yiddish*) and borrowing terms from *Arabic*.

However it is true that nowhere in this period was Hebrew used for everyday speech. The language for spoken communication was the local language or dialect of the country in which they were living. In brief, it is said that until 1880 Hebrew was a 'half language', used for written purposes alongside various spoken tongues. This linguistic situation was not uncommon in the medieval world and is essentially the sociolinguistic situation known as *diglossia* [20, p. 13].

The case of Hebrew resembles other languages in the middle ages, for instance, *Latin* in medieval catholic Europe, *Classical Arabic* in Moslem South West Asia and North Africa, and *Sanskrit* in India. These languages were learned from primary sources, usually religious texts, and all written materials were composed in as close imitation of these texts as possible. The main difference between medieval Hebrew and those languages is that with Hebrew this diglossic situation lasted much longer.

Latin, for comparison, was gradually given up as a written language in favor of its spoken counterparts between the 14th and 17th centuries A.D., whereas in Hebrew

the situation continued well into the 19th century. The reason for this is that the languages of Europe used the overthrowing of Latin as a symbolic rejection of centralized religious authority. The Jews felt no such drive to overthrow the power of the medieval church. Moreover, for most Jews their religion was still significant for determining the person's identity (much more so than nationality).

Hebrew in Early Modern Ages

During the enlightenment period more and more Jewish people in Europe overthrow the post-Biblical language and returned to the Biblical style. The rebelion of the enlightened in Rabbinic Judaism brought them to reject *Rabbinic Hebrew* and return to the original Hebrew which was, in their view, "pure, correct and free from foreign influence".

Moreover, by cultivating the use of Biblical Hebrew the Jews too felt they were participating in the nationalistic trends of post-renaissance Europe, for Biblical Hebrew was the language spoken when the Jews were a nation living in their own territory, compared to post-Biblical Hebrew which already implied diaspora and exile.

The above linguistic trick succeeded rather well into the 19th century, however in this century a problem arose. Hebrew writings started to pass from a romantic to a more realistic emphasis, including the writing of newspapers and novels that dealt with contemporary life. In these areas the use of a vocabulary restricted to a closed corpus of 7000-8000 words (some of which are unclear or anachronistic) became increasingly awkward. Some younger writers began to use a small amount of post-Biblical words from the Mišnaic and Talmudic vocabulary, however this did not produce a satisfactory linguistic synthesis and by no means solved the problem.

In the middle of the 19th century more Jews had become secular-nationalists and didn't want to (nor had any reason to) use Hebrew material. The identification with European nationalism in the sense of a spoken language being also a written one, and the deficiencies of the use of ancient Hebrew for discussing modern times, led many authors to the conclusion that the time had come for Hebrew to follow Latin and die as a written langauge. The number of Hebrew writers were getting fewer and the language appeared to be doomed.

Within this background an article titled "*Še'ela nikbada*" ('A serious question') appeared in print and in the Hebrew periodical *Ha-šaar* (folio 7, p. 3-13, 1879) by one Elizer Ben-Yehuda, later known as 'The reviver of the Hebrew Language'. Ben-Yehuda was the first to make an explicit parallel between European and Jewish nationalism. His main point in this article was that if language is taken, based on the European model, as a criterion for nationalism and nationhood, "we have a language in which we can write everything we want and we can speak it if we only want to". This language was Hebrew.

The Revival of the Language

> "[Ben-Yehuda . . .] made it possible for several million people to order groceries, drive cattle, make love and curse out their neighbors in a language which until his day had been fit only for talmudic argument and prayer." [20, p. 9]

In October 1881 Ben-Yehuda arrived together with his wife Devora in order to prove his hypothesis and implement his idea of the 'language revival'. His first step towards the implementation of the 'revival' was his decision to speak only Hebrew and to establish the first Hebrew speaking household. He held that only if Hebrew became the language spoken at home would it be truly revived, and that he would have to set his own home as an example for others to follow.

The practical difficulties of speaking only Hebrew were manyfold. At the time, Hebrew lacked precisely the terms necessary for daily household tasks. When their first child was born in 1882 Devora Ben Yehuda became the first Hebrew speaking mother for over 1500 years, and the son became the first Hebrew speaking child.

What is relevant to our purpose is that with a newborn child Ben Yehuda was forced to coin terms used in everyday household life so that his son would not experience any inadequacy in the language that was to be his mother tongue. In doing this, ben Yehuda became an experimental 'word-factory' and the two parents would search for or invent words in Hebrew [20].

In his creation, Ben Yehuda tried to remain faithful to the language of the Bible. He wished to create "an almost new language that will be completely old, that is to say, a language in the spirit of our forefathers" [20]. His sources for the creation of new words were primarily Biblical Hebrew, then post-Biblical words when no Biblical Hebrew alternative existed, foreignism to some extent (but not excessively) and lastly, features of Jerusalem 'market Hebrew'.

Apart from adopting existing words Ben Yehuda also invented new words, either by taking Classical Hebrew words that were not in use and assigning them meaning or by using the following method:

> "He extracted roots from existing Biblical Hebrew, Mišnaic Hebrew, Biblical Aramaic, Targumic Aramaic and Talmudic Aramaic and invented new Hebrew words from them, based on common Hebrew word patterns." [20, p. 66]

The many areas and concepts he coined new terms for (nouns, adjectives and verbs) become publicly available through his work on the first Hebrew Dictionary.

However, Ben Yehuda did not have enough time nor the will to be the sole arbiter on the selection of new words in the language. In 1980 he established the *va'ad ha-sifrut* (the literature council), that was later renamed *va'ad ha-lashon* (the language

council). The roles of the council were

- "to enable Hebrew language to be used as spoken language in all aspect of life" (council protocol, I-1)
- "to protect oriental quality of the language and its special structure" (council protocol I-2)

Ben-Yehuda delegated to the council the task of "[filling] in the lack in the language by creating new words"(II-2). The sources for the council were similar to his own; they used Ancient Hebrew words and all those created throughout the ages, or Aramaic words when no Hebrew word existed for a given concept. "To these words the council will give a Hebrew form according to the grammar of the word" (III-1).

In their writings they state "The council has no need for non Semitic roots, even if they are found in Hebrew sources" (III-1-c). In filling the gap still remaining the council created new words according to the rules of grammar and by analogy with the Bibilical language, as much as possible from Hebrew roots in the Bible and talmudic literature and secondly from Semitic roots. Foreign words were only admitted by the council when they were already in common use.

In sum, the Biblical grammar was accepted, together with the Biblical writing, as the role model for the new Hebrew creation. Although this was criticized at that time as contradicting the historical evolution of the languages, Ben-Yehuda and the council ignored as much as they could the different traditions and the new grammatical inventions of post-Biblical Hebrew. Notwithstanding, when the grammatical means appeared insufficient for the development of a 'living language' some free development and foreignism was still allowed. The results of these efforts form the core of what is known today as *Modern Hebrew*.

Modern Hebrew

The language known as *Modern Hebrew*, *Israeli Hebrew* or just *Hebrew* nowadays is used only in Israeli society in the state of Israel.

Historically, the status of Modern Hebrew with respect to its ancient counterpart is different from other old and new languages (e.g., old vs. modern Greek). In those languages, the modern form is distinct from the old form. In Hebrew, the same linguistic forms are used, however the new dimension added to the language is the *use* of the very same means to express new content.

The unique nature of Modern Hebrew is in its new organization of the expressive means. Genealogically, the language remains in the same place as the classical Hebrew. Its new typological status, however, is determined by belonging to western civilization.

One significant exception in this respect is the grammatical tense system. Here, Hebrew continues the new situation that was brought about in Mišnaic Hebrew. Content that was expressed in Biblical Hebrew in its aspect-prominent verbal forms are now expressed using different means, and identifying these means is a core element of our investigation.

Summary

Evidently, the Hebrew language had gone through a lot of changes between becoming extinct and being reintroduced as a spoken language. Nevertheless, the current features and structure of modern Hebrew correspond rather closely to the ones of Biblical grammar (with the exception of the Mišnaic tense system).

It should be noted, however, that in a historical perspective Modern Hebrew is still young. Although it is true that all living languages keep changing, for Hebrew this is true to a greater extent. The stance taken by the current language academy with respect to those changes is different than the one adopted by Ben-Yehuda's Hebrew Council. Nowadays the language academy do not distinguish words based on their origin, and all forms should apply to the same grammar.

Hebrew words are still being created, in the Hebrew Academy as well as by ordinary people. Large portions of the nouns and technical terms are borrowed from foreign languages. Nevertheless, verbs are still being constructed according to the principles defined in the Biblical grammar due to the peculiar forms of Hebrew verbs. These forms and the way they are used to derive verbs are fundamental for our subsequent discussion, and are examined more closely in the next section.

2.2 Modern Hebrew Structure

2.2.1 A Three-way Tense System

Classical Hebrew Tense System

Interestingly, Biblical Hebrew did not manifest the category corresponding to the notion of 'tense' in modern European languages. Instead, the Biblical language made a distinction between perfective and imperfective aspect.

A major change appeared in Mišnaic times with the advent of a three-way tense system, correspondingx to *past, present* and *future*.

This system is retained in Modern Hebrew and it uses the Biblical perfective to denote *past*, the Biblical imperfective to denote *future*, and a *benony* form to ex-

	Past	Present	Future
masc. sing.1	gamarti	gomer	egmor
masc. sing.2	gamarta	gomer	tigmor
masc. sing.3	gamar	gomer	yigmor
fem. sing.1	gamarti	gomeret	egmor
fem. sing.2	gamart	gomeret	tigmeri
fem. sing.3	gamra	gomeret	tigmor
masc. plur.1	gamarnu	gomrim	nigmor
masc. plur.2	gamartem	gomrim	tigmeru
masc. plur.3	gamru	gomrim	nigmor
fem. plur.1	gamarnu	gomrot	nigmor
fem. plur.2	gamarten	gomrot	tigmorna
fem. plur.3	gamru	gomrot	tigmorna

Table 2.1: Modern Hebrew Tense Inflectional Affixes

press an intermediate domain which is neither *past* nor *future*, and can be roughly viewed as *present* [4, p. 140].

Modern Hebrew Tense Forms

The tense system in Hebrew is implemented by inflectional affixes, and displays features of number, gender, and (with the exception of the *present* form) person. This inflectional system is fully productive in the sense that all verbs can take all tense forms[7] of the sort demonstrated in Table 2.1.

It should be noted that in the past tense, the 3rd person masculine singular form serves as a base for all inflections. Thus, *gamar* represents the pattern $[C]a[C]a[C]$[8] and other forms are constructed using additional consonants and varying vocalization. This phenomenon, of a morphological template to which tense, gender and number inflectional affixes are added, is a general characteristic of the Semitic derivational morphology system.[9]

[7] Except for the 'defective' copula, which we leave out of the discussion.

[8] Where $[C]$ represents a consonant and a represents additional vocalization.

[9] In glossing Hebrew verbs we shall use the past singular masculine form since it coincides with the morphological template this verb is derived from. However, this form is presented only for matters of convenience and the translations will always abstract from its tense/gender/number features.

Modern Hebrew Tense Semantics

In Modern Hebrew the linguistic forms used to express the three tenses past, present and *future* express absolute tenses in the sense that they relate the time of the denoted event to the deictic center 'now' [8], and they incorporate various aspectual notions such as progressive and perfective. Thus, it should be clear (as demonstrated in (1)) that what we typically call *grammatical aspect* is not an integral part of the Modern Hebrew tense system.[10]

(1) a. hu avad maher
he worked fast
He worked/was working/has worked/had worked fast

b. hu oved maher
he works fast
He works/is working fast

c. hu ya'avod maher
he will-work fast
He will work/will be working fast

Aspectual distinctions in Hebrew can be produced by, for instance, time adverbials. Thus in (2) the time adverbials depict additional temporal characteristic of the situations.

(2) a. dani avad maher etmol/kšehaya ca'ir/kšeraiti oto
Dani worked fast yesterday/when-he-was young/when-I-saw him
Dani worked fast yesterday/
Dani had worked fast when he was young/
Dani was working fast when I saw him

b. dani oved maher aǩšav/bederǩ klal
Dani works fast now/usually
Dani is working fast now
Dani usually works fast

c. dani ya'avod maher maxar/kštagia
Dani will-work fast tomorrow/when-you-will-arrive
Dani will work fast tomorrow
Dani will be working fast when you arrive

Nonetheless, Hebrew tenses seem to have a *default* aspectual meaning. Past tenses are naturally associated with 'complete' and 'completed' situations, present is naturally associated with 'progressive' aspect, and situations that are yet to start are

[10] As opposed to, for instance, Biblical Hebrew. [29]

referred to in the future tense. However these are not pure meanings but implications (possibly based on the Gricean maxim of quality [23]) and can be easily canceled using an appropriate context as in (3)-(4).

(3) a. dani avad etmol
Dani worked yesterday
Dani worked yesterday

b. dani avad etmol vehu adayin oved
Dani worked yesterday and-he still works
Dani was working yesterday and he is still working

(4) a. dani oved
Dani works
Dani is working

b. dani oved kol yom
Dani works every day
Dani works every day

2.2.2 Semitic Morphology

Verbs, nouns, and adjectives in Semitic languages are derived from a (tri-)consonantal root by different *templates* of Consonant/Vowel skeletons, vowel sequences, and affixes. The root is usually the only common element shared by derivationally related forms. For example, the Hebrew forms in (6)-(8) share the root $[y][l][d]$ (birth, child) but do not share an underlying stem (example adopted from [15]).

(5) Root
a. $[y][l][d]$ birth, child

(6) Verbs
a. $[y]a[l]a[d]$ gave birth
b. $[y]i[l]e[d]$ delivered a child

(7) Nouns
a. $[y]i[l]o[d]$ beget
b. $[y]e[l]e[d]$ child (masc.), boy
c. $[y]a[l][d]a$ child (fem.), girl
d. $[y][l]a[d]on$ small child (masculine), boy
e. $[y]e[l]i[d]$ native
f. $[y]a[l][d]ut$ childhood

(8) Adjectives
a. $mu[]a[l]a[d]$ innate[11]

[11] $[y]$ is omitted here for phonological reasons.

Roughly speaking, the pattern (including vowels, prefix, and or suffix) provides a template into which the root consonant letters can be plugged, in order to get the required meaning.

The Semitic verbal system is rather limited and of a distinct character compared to the possibilities for deriving nouns in Hebrew. The term *binyanim*, (literally 'building', 'constructions') refers to a set of traditional *templates* (formally 'conjugations') that are used to derive verbs in the language. Any inflected verb-form in the language can be uniquely characterized by a combination of *Root+Binyan* (for example, all verbs in table 2.1 are characterized by the root $[g][m][r]$ and the template $[C]a[C]a[C]$). All verbs, without exception, must adhere to one of the seven verb templates, *binyanim* denoted in 9.

(9) a. *Paal (kal)*
b. *Piel*
c. *Hiphil*
d. *Pual*
e. *Huphal*
f. *Niphal*
g. *Hitpael*

For example, these are the results of putting the root $[x][l][k]$ through each of the templates (example adopted from [27]):

(10) a. $[x][l][k] + Paal = xalak$ (to apportion)
b. $[x][l][k] + Piel = xilek$ (to divide)
c. $[x][l][k] + Hiphil = hexelik$ (to make smooth, to slide)
d. $[x][l][k] + Pual = xulak$ (to be divided)
e. $[x][l][k] + Huphal = huxlik$ (to be smoothen)
f. $[x][l][k] + Niphal = nexlak$ (to differ)
g. $[x][l][k] + Hitpael = hitxalek$ (to be divided, to slide, to glide)

These templates are, however, not fully productive in the sense that not all roots are available in all patterns. Some roots can be put through only three, two, or even one template, as in (11)-(12).

(11) a. $[l][k][x] + Paal = lakax$ (to take)
b. $[l][k][x] + Piel = *lika'ax$
c. $[l][k][x] + Hiphik = *Hilki'ax$
d. $[l][k][x] + Pual = ?lukax$[12]

[12]This form can be found in the bible but not in colloqial use

e. $[l][k][x] + Hiphik = *hulkax$

f. $[l][k][x] + Niphal = nilkax$ (be taken)

g. $[l][k][x] + Hitpael = hitlakex$ (to catch on fire)

(12) a. $[p][c][r] + Paal = *pacar$

b. $[p][c][r] + Piel = *picer$

c. $[p][c][r] + Hiphil = hi\check{p}cir$ (to opt)

Moreover, the resulting meaning of a root put through a certain pattern may seem rather surprising, as in (13).

(13) a. $[k][b][l] + Paal = ka\check{b}al$ (to complain)

b. $[k][b][l] + Piel = kibel$ (to receive)

c. $[k][b][l] + Hiphil = hikbil$ (to parallel)

For these reasons, the morphological templates are often viewed as a grammatical device but *not* as semantic operators.

However, in a prescriptive view sets of verbs that are derived from the same *Binyan*, (template) tend to have common characteristics, as roughly described in basic Hebrew grammar books. For instance, the following informal description of the templates is compiled from the definitions in [22].

> The *Paal* is the simplest, most common template, also referred to as *kal*. The literal meaning of *kal* is 'light' and it received this name because it has no additional affixes rather then the root consonants. This binyan is often used to describe one's actions and activities, but can also describe things that 'happened' to one.
>
> The pattern *Hiphil* is often used to denote 'cause something to happen', when this 'something' often corresponds to the same root in binyan *Paal*.
>
> The *Piel*, also referred to as a *heavy* conjugation (due to doubling of the middle consonant), is sometimes used for transitive verbs, i.e. to denote 'doing something to/with somebody/something'.
>
> The *Hitpael* is the so-called middle-voice counterpart of binyan *Piel*. For *Piel* verbs denoting 'doing something to someone' *hitpa'el* is the intransitive counterpart denotes 'happening to itself'.
>
> The *Niphal* is often the passive voice of binyan *Paal* but can also indicate reflexive-middle voice.
>
> *Pual* is the passive voice of *Piel*.
>
> *Huphal* is the passive voice of *Hiphil*.

Active stems	Paal	Piel	Hiphil
Passive stems	(none)	Pual	Huphal
Middle stems	(none)	Hitpael	(none)
	Niphal		

Table 2.2: The Classical Hebrew 'Missing' Verbal System

From this informal overview it is evident that subsets of alternating patterns in the same root are, at least intuitively, semantically related, as illustrated in (14)–(15).

(14) *Paal/Hiphil/Huphal*

a. $[l][b][s] + Paal = la\check{b}as$ (to put on)

b. $[l][b][s] + Hiphil = hilbis$ (to dress (someone))

c. $[l][b][s] + Huphal = hulbas$ (to be dressed (by someone))

(15) *Piel/Pual/Hitpael*

a. $[x][b][r] + Piel = xiber$ (to connect)

b. $[x][b][r] + Pual = xubar$ (to be connected (by someone))

c. $[x][b][r] + Hitpael = hitxaber$ (to become connected)

The first step towards a systematic formal treatment of the semantic contribution of the Semitic templates was undertaken by Doron in [15]. Also, It was stated in [55] that a combination of the semantic content of the root and predictable morphology may be relevant to aspectual properties.

However, the question of the precise definition and formal treatment of the aspectual contribution of the various templates is, to the best of my knowledge, still open.

Thus, one of the main tasks of this work is to pinpoint the aspectual contribution of the templates and incorporate them into a general aspectual account. The upcoming sections review in detail the form and semantic features proposed by [15] for the verbal templates,and chapter 6 is concerned to a large extent with formalizing precisely the aspectual contribution of these proposed features.

2.2.3 Semitic Templates in Modern Hebrew

Biblical Hebrew Verbal System

The templates (*binyanim*) form a system that is not at all symmetric. This is shown in table 2.2 and described in [5] as the 'missing' Classical Hebrew verbal system.

The first row lists the Paal, Piel, and Hiphil (also known as the 'active') templates. The second row lists the corresponding 'passive' templates and the third row lists

the ‘middle’ templates, also known as ‘t forms’ because of the *t* that is added in front of the root.

Leaving passive/middle variations aside, each Hebrew verb is derived from one of exactly three active templates, also found in Akkadian, Syriac, and Arabic [15]. These templates are traditionally named

(16) a. The *simple* template (Paal)
b. The *intensive* template (Piel)
c. The *causative* template (Hiphil)

In principle, all Semitic templates are supposed to be the same. However, the actual forms and structure of the entire scheme vary from language to language. In Hebrew, the three templates are morphologically realized as in (16) (where $[C]$ is a consonant, vowels indicate the vocalization pattern, other characters indicate consonants additional to the root):

(17) a. The *simple* template $[C]a[C]a[C]$
b. The *intensive* template $[C]a[C][C]a[C]$
c. The *causative* template $hi[C][C]i[C]$

In short, the *simple* form, Paal, is characterized by the vocalization *a-a* and no additional consonants. The *intensive* form, Piel, is characterized by a different vocalization *i-e* and doubling of the middle consonant. The *causative* form, Hiphil, is characterized by the consonant *heh* (*h*) prefixed to the root and the vocalization *i-i*.

Only the intensive active form (characterized by a double middle consonant) has both the passive and middle form counterparts. In the Bible there are traces of the passive form of Binyan Paal.[13] At that time the Niphal was used as the middle form of Paal. However, through the passage of time the Niphal inherited the Passive form, the use of which had become more and more limited.

It is assumed [5] that ‘t forms’ had typically characterized a middle status action. In Aramaic, for instance, there were ‘t forms’ for all active stems, however in later stages when the passive disappeared the ‘t form’ took over the passive forms of the verbs. In Hebrew, the ‘t form’ survived only for the Intensive forms, however there is some evidence (e.g., Hebrew names such as ‘Eshtaol’ and ‘Eshtamoa’ [5, p. 127]) that it existed for all other active stems as well. It is assumed that during the vocalization of the mesoratic text the ‘t forms’ had assimilated into the one Hitpael template we know today.

If the proposed hypothesis is correct, then the original complete *binyanim* system of the Classical Hebrew is as presented in table 2.3 [5, p. 127].

[13]The Biblical Paal passive forms are known as ‘Kutal’/‘Kitol’. Further details can be found in

Active stems	Paal	Piel	Hiphil
Passive stems	Passive Paal	Pual	Huphal
Middle stems	Hitpael	Hitpael	Hitpael
'Back' forms	Niphal		

Table 2.3: The Classical Hebrew Complete Verbal System

Active stems	Paal	Piel	Hiphil
Passive stems	(none)	Pual	Huphal
Middle stems	Niphal	Hitpael	(none)

Table 2.4: Modern Hebrew Verbal System

Modern Hebrew Verbal System

The structure and overall organization of the various templates (*binyanim*) was subject to changes throughout the history of the Hebrew language. In modern Hebrew, the complete system is commonly sketched as in table 2.4 [15].

According to the current account, the Niphal stands in the place of the middle form of Paal, and Paal and Hiphil have only their passive form counterpart.

The traditional view of the templates, evident in their traditional names (e.g. *intensive*, *causative*), is that the choice of the template is not arbitrary, and that it indicates some factor of the meaning of the derived verb. Put in Simons's words:

> "Ideally, it should be possible to show that the properties of the verb are a combination of the properties of the root and the properties of the binyan itself." [46]

However, modern linguists have argued [4] based on numerous examples (e.g., (13)) that the semantic contribution of the template is unpredictable, and that any attempt for systematic analysis is doomed to failure.

Doron, in her semantic account [15], disagrees:

> "Though I agree that the semantic contribution of the templates is not transparent, I disagree that it is not systematic." [15, p. 7]

I argue together with Doron that the semantic contribution of the distinct templates help Hebrew native speakers to make meaningful distinctions when alternating between patterns of the same root. Moreover, I claim that *some* of the semantic distinctions are aspectual (although others indicate distinctions that are not necessarily part of a temporal phenomena).

[10].

2.3 The Semantics of Semitic Templates

2.3.1 Agency and Voice in the Semitic Templates (Doron 2003)

Doron [15] provides an elaborate account of the derivation of transitive verbs from basic predicates and shows how Hebrew verbs are syntactically and semantically derived from roots using the *binyanim*.

The point of departure for Doron's discussion is that the lexicon of the language consists of coarse-grained *roots* and that verbs are derived from the roots by merging them with other morphemes realized in the Semitic templates.

The two-dimensional morphology of the verbal templates' grid presented in table 2.4 mirrors two orthogonal dimensions of semantic derivation of verbs. These dimensions are *agency* and *voice*, and their semantic contribution is mediated by the syntactic structure of the verb.

Under the present account, roots are basic predicates, and internal arguments are arguments of the root. The external argument is contributed by what is called in the literature the *light verb v* functional head[14] (see [26] and [15]). Whether or not an external argument is projected is a property of the root (formally, the root *licenses* the light verb *v*). Semantically, the functional head *v* contributes the thematic relation of an *agent*.

The semantic contribution mirrored in the morphology of the Semitic template is realized in two functional heads in addition to the light verb *v*. These functional heads alter or modify the thematic relations of the (internal/external) arguments assigned by the root and the light verb *v* (if it is indeed licensed).

Put briefly, the *agency* functional head has two possible values realized in two different morphemes on one dimension of the grid, *intensive* and *causative* heads. The intensive morpheme contributes an *actor* relation, whereas the causative morpheme contributes a *cause* relation. Similarly, the *voice* head has two possible values, *passive* and *middle*, both of which change the grammatical function of the arguments of the root, which in turn alters their thematic roles.

Based on these principles, Doron shows the syntactic and semantic derivation of verbs from roots and provides evidence, via the discussion of the altered thematic relations, that the semantic contribution of the morphological templates is indeed systematic.

However, she concludes:

> "Different grammatical operators depend on different classifications of verbs. For example, aspectual operators presuppose the static/dynamic telic/atelic classification. Aspectual classification, then, is based on

[14] The light verb *v* is the unambiguous projection of verb's arguments.

> the concept of change and culmination. Voice classification, *on the other hand*, is based on the concept of action and causality." [15, p. 63, italics added]

Evidently, the thematic dimension and the aspectual dimension are orthogonal under this view. However, there is something counterintuitive in completely the separation of aspectual phenomena from operators that manipulate notions of *action* and *cause*.

Doron's account is the most elaborate and systematic formal treatment of the semantic contribution of Semitic templates. However, it does not indicate if or how the semantic contribution of the templates is relevant for the temporal domain. Thus, the question remains: what, if anything, constitutes the semantic contribution of the Hebrew verbal template to the aspectual distinction between different kinds of eventualities under Hebrew verbs' denotation?

2.3.2 The Semitic Templates and Event Structure

In her paper "Aspect, Aktionsart and the time line" Galia Hatav [29] writes:

> "In Modern Hebrew (MH), the distinction between the state of loving and the inchoative event of falling in love is encoded in the verb patterns (called the *binyanim* or conjugations) [...] MH love is '*ahav*' while 'fell-in-love' is '*Hitahev*'; and compare, too, pairs like '*amad*' 'stand' vs. '*ne'emad*' 'stand up' [...] Because of its rich aspectual system, BH [Biblical Hebrew] does not need this lexical distinction for the contrast."[29, p. 496]

Hatav deals with the Biblical Hebrew verbal system, which grammatically marks perfective/imperfective distinctions. According to her account speakers do not need to use further information denoted by the *binyanim* to mark aspectual distinctions.

However, the acknowledgements of such distinction encoded by the templates, makes it plausible to hypothesize that in Modern Hebrew, which does not have such grammatical distinctions, speakers will employ additional information denoted by the *binyanim* to mark aspectual distinctions between similar kinds of eventualities.

This is precisely where the motivation for the present account comes from. To make the connection with Doron's view, the lexicon of the language is assumed to consist of consonantal roots, presumably with some default inherent meaning for their event type. Operators that modify the meaning of the root might also affect its event type and/or temporal characteristics.

Evidence for such a modification can be found in various verb alternations.

(18) a. $[a][h][v] + Paal = ahab\check{}$ (to love)

b. $[a][h][v] + Hitpael = hitaheb\check{}$ (to fall in love)

(19) a. $[']['][m][d] + Paal = amad$ (to stand)

b. $[']['][m][d] + Niphal = ne'emad$ (to stand up)

Also, note that some Hitpael/Niphal verbs do not have a Paal (simple) verb alternation, which menas that they are not derived from a simpler verb, but from a different element, from the root.[15]

(20) a. $[']['][p] + Hitpael = hit'alep\check{}$ (to faint)

(21) a. $[s][a][r] + Niphal = ni\check{s}'ar$ (to stay)

Further evidence for the relevancy of the binyanim to an aspectual account is provided by Simons [46]. In her account of the Hitpael she defines three functions which it is intended to serve:

(22) Reciprocal

a. raa (to see)

b. $hitraa$ (to see each other (in a social context))

(23) Reflexive

a. $la\check{b}a\check{s}$ (to dress)

b. $hitlabe\check{s}$ (to dress oneself)

(24) Inchoative

a. $ya\check{s}a\check{b}$ (to sit)

b. $hitya\check{s}e\check{b}$ (to sit down)

The third group denotes precisely an aspectual distinction of the kind we are interested in. Here, a static situation of 'sitting' is contrasted with a dynamic situation of 'sitting down'. Moreover, the inchoative situation of 'sitting down' has an inherent terminal point which makes it also telic.

Finally, additional evidence for the aspectual characteristics of the templates comes from denominal roots. Hebrew verbs are known to be derived from two kinds of roots [9, p. 11]: (i) verbal stems proper, and (ii) denominative stems whose basic meanings correspond to nouns (or adjectives).

(25) Noun

a. $[g][d][r] + noun = gader$ (a fence)

b. $[g][d][r] + Hiphil = higdir$ (to define)

(26) Adjective

[15] We shall see later that some of the morphemes operate on fully constructed verbs rather then on roots. However evidently these ones are less likely to change the verb's default event classification.

a. $[m][l][a] + adjective = male$ (full)
b. $[m][l][a] + Hitpael = hitmale$ (to fill, to fill-up)

In such cases, it was acknowledged by [15] that the underlying event is introduced by the template, not by the meaning of the root.

Thus it seems reasonable to believe that the Semitic templates, which we have already acknowledged as grammatical devices to derive verbs, have a semantic contribution that does more than alter thematic relations. We propose here that they systematically contribute aspectual distinctions. The task we are left with is to pin down their precise aspectual contribution and define it in formal terms.

2.4 Summary

In this chapter we saw that the Hebrew verbal system is based on tri-consonantal roots with basic meanings and seven morphological templates, and claimed together with several recent Hebrew semanticists that both the root and the morphological patterns in which it is realized contribute (in some fashion) to the semantics of the result verb.

We reviewed the history of the verbal system showed that their scheme is not symmetrical. However, the templates of Modern Hebrew can be arranged in correspondence to two orthogonal dimensions. Doron defines the orthogonal dimension according to *agency* and *voice* semantic features, for which the various values (*simple/intensive/causative*, *active/middle/passive*) form some sort of continuum. The semantic contribution of these constructions, she claims, is manifested in altered thematic relations.

We have consequently shown that it is plausible to argue that those constructions contribute relevant temporal characteristics of the event under the verb denotation. Thus, we are left to show (i) how the verbal templates contribute aspectual distinctions to Hebrew verbs, and (ii) how those aspectual distinctions interact with the thematic domain.

Chapter 3

A Theory of Aspect

3.1 Defining Aspect

In the introduction we defined *aspect* as a (sort of) temporal relation between the event and the timeline, that, as opposed to tense, is not concerned with the event's location in time, but rather with the event's internal temporal constituency. In this chapter we define more precisely the linguistic notions that are related to 'aspect'.

Intuitively, *aspect* is concerned with how events are accommodated on top of the timeline. There are different kinds of 'happenings' in the real world which we perceive as 'events'. Events may be short and primitive, e.g., 'a knock on the door', or extended and constructed of gradual stages e.g., 'The olimpic games'. Also, events may have an inherent terminal point, e.g., 'eating a cake' (in the real world such an event is most likely to end once the cake is finished) or may go on indefinitely e.g., 'walk', 'ride' or 'breath'. Also, events may be looked at from different angles. 'Building a house' for instance, can be looked at 'from the inside' as an ongoing process, or it may be looked at in its entirety as a complete event with a house coming into existence as its result. Such distinctions are all denoted under the rubric of 'aspect'.

The distinctions between different kinds of events is reflected in the way events are described in a spoken language, and following Davidson [11] it is associated with *verbal* expressions. Different languages provide their native speakers with different means to express aspectual distinctions. They can be or *lexicalized*, i.e., based on the properties of event types denoted by verbal expressions, or *grammaticalized*, i.e., manifested in the inflectional morphology of the verbal system.

The term *lexical aspect* refers to the inherent properties of the event under the denotation of a verb. For example, the verb 'break' differs from the verb 'build' in its temporal extension. While something 'breaks' in an instant, 'building' must con-

tinue for some period of time.[1] These inherent differences have motivated linguists and philosophers to propose classification systems that assign verbs to semantic classes according to their event structure and temporal extension. These categories are also known as *Aktionsart*.[2]

The term *grammatical aspect* refers to distinctions that are expressed via inflectional/derivational morphology on top of the lexical material. The English distinction between the simple past phrase 'I ate a cake' and the past progressive phrase 'I was eating a cake' is of such a kind. Another grammatical distinction common in Slavonic languages is the distinction between perfective and imperfective [34, p. 8]. Expressing such distinctions is usually *obligatory* as the speaker is forced to choose from closed set of alternatives.

A discussion of Hebrew aspect relies primarily on the inherent meaning of the verbs in the lexicon, and in section 3.2 we discuss existing classification frameworks and try to apply them to the Hebrew verbal system. However, Hebrew does not have grammatical aspect categories such as progressive, perfective, etc. Rather, Hebrew derivational morphology grammaticalizes notions that are relevant to the *thematic* domain, as seen section 2.2.3. We claim that thematic relations might affect the event structure and influence its temporal constituency, and so in order to take them into account we would ideally want to formalize and categorize *thematic* properties in the same way we do for events.

However, *thematic roles* or *thematic relations* are creatures of the syntax-semantics interface, and this general term is ill-defined. So, in section 3.3 we survey semantic properties of *thematic roles* or, *thematic relations* and show how they are related to event types.

It shall be seen that thematic roles do not constitute an orthogonal dimension to the event classification but are relative to it. Also, since in Hebrew thematic contribution is grammaticalized on top of lexical material we would like a theory that allows us to integrate the two.

Thus, in section 3.4 we propose a framework based on [47] in which both grammatical and lexical aspect can be combined, and allow for the interaction between the kinds of events denoted by the lexical material of verbs and the thematic relations that are grammaticalized.

[1] It is highly debateable whether putting one block in place is considered 'building'.

[2] Although the term *Aktionsart* has been used in linguistics to denote various different notions, in the context of this work I use the term *Aktionsart* precisely for 'classification of events into semantic classes according to their inherent aspectual properties' (as in [52, 10] and others).

3.2 Event Classification

3.2.1 Introduction

There is a long tradition in the linguistic and philosophical literature of dividing sentences into categories. This tradition goes back to Aristotle's *Metaphysics* (1048), in which he discusses *kinesis* (movement) actions, actions that progress towards an end, vs. *energia* (actualities), actions that are complete in themselves.

Aristotle's original discussion naturally reads as characterizing actions rather then linguistic expressions. However, later linguists and philosophers, such as Ryle (1947) and Kenny (1963), have classified linguistic expressions (i.e., verbs) rather than objects in the world. [53, p. 98] discusses "the *time schemata* presupposed by verbs", and suggests using these schemata to make predictions about the behavior of verbs.

Indeed, much linguistic work has focused on the classification of linguistic expressions rather than events in the world (e.g., [18, p. 51], [33, p. 208]). Moreover, [39] claims that events do not have inherent structure themselves, rather, that their particular descriptions do. Other theories, (e.g., [10, 52]) deal with properties of events themselves.

In section 3.2.2 we review existing classification frameworks, the semantic properties that underly the classification and the objects that are being classified. In 3.2.3 we consider these frameworks and assess which of them is the most adequate for capturing semantic properties of Modern Hebrew verbs.

3.2.2 Event Classification and *Aktionsart*

Vendler 1967

Vendler's original work [53] classified verbs into lexical-aspectual classes. He makes the distinction between verbs that have *successive phases* (e.g., 'run', 'push a cart', 'draw a circle') from ones that do not (e.g., 'know', 'recognize'). Among the *successive* verbs he distinguishes those that have a *climax* (e.g., 'draw a circle') and those that do not. Within the other set of verbs he distinguishes *momentary* verbs (e.g., 'recognize') from ones that can span over a longer period of time (e.g., 'know').

Using these semantic features (*+/- 'phases'*, *+/- 'climax'*, *momentary/interval*) he proposes the well-known four-way classification of English verbs into *states, activities, accomplishments* and *achievements* and develops linguistic tests for distinguishing between these categories, exemplified in (27).

(27) a. *States*

i. know, love
ii. for how long did you . . . ?

b. *Activities*
i. run, push a cart
ii. what are you doing?

c. *Accomplishments*
i. draw a circle
ii. how long did it take?

d. *Achievements*
i. recognize, reach the top
ii. at what time (exactly) did you . . . ?

Vendler uses "clear cut examples" (as he puts it) and as already evident in his work there is a significant difference between the verb 'running', an *activity*, and the verb phrase 'running a mile', an *accomplishment*. This phenomenon of changing a verb's semantic class due to additional lexical items in the verb's environment is known as *coercion* and drove linguists to explore different solutions for the classification puzzle, some of which we review below.

Dowty 1979

Dowty further examined the Vendlerian four-way classification and in order to deal with the phenomena of 'lexical ambiguity' of verbs in different environments Dowty suggests that "Not just verbs but the whole verb phrase should be taken into account" [18, p. 62].

The semantic properties that are used in Dowty's definition are *momentary/interval*, *telicity* and *agentive/non-agentive*. The *momentary/inverval* property refers to the portion of time that is needed to evaluate events. While states and achievements can be evaluated in a specific moment, activities and accomplishment require a longer portion of time. *Telicity* is associated with having an inherent terminal point of the event, and thus achievements and accomplishment are defined as telic events.

The *agentive/non-agentive* property classifies events as 'voluntary' vs. 'being under control of a volitional agent'. The addition of *agentivity* as a semantic property already foreshadows the relevance of the roles of participants in the events to the event classification. However, in Dowty's account as it stands this feature doesn't add a further dimension to the classification but just further characterizes existing ones (i.e., activities and accomplishments are more naturally related to agency, as opposed to states and achievements).

Rothstein 2004

Rothstein [44] argues against the view that "it is really VPs that have to be classified"(Dowty 1979). According to her, "Verbs denote sets of events and are classified into lexical classes depending on the properties of the events in their denotation relative to the particular description" [44, p. 4]. According to her, lexical classes are more than generalizations over verb meanings, they manifest themselves as a set of constraints on the way grammar individuates events.

Rothstein [44] claims that features that do not present additional classes in the classification are in fact superfluous. Thus, her four-way classification of events is similar to the previous two however it is based solely on only two aspectual properties; one is the *telic* distinction which refers to verbs that naturally head VPs with an inherent terminal point, and the other is *stages* which refers to verbs that can occur in the progressive.

Her resulting classification corresponds to the traditional vendlerian classification, and she assigns them the meaning of, roughly, the following semantic 'templates'.

(28) a. *States*
   i. $[-stages], [-telic]$
   ii. $\lambda e.P(e)$
   b. *Activities*
   i. $[+stages], [-telic]$
   ii. $\lambda e.(DO(P))(e)$
   c. *Achievements*
   i. $[-stages], [+telic]$
   ii. $\lambda e.(BECOME(P))(e)$
   d. *Accomplishments*
   i. $[-stages], [+telic]$
   ii. $\lambda e.\exists e_1 \exists e_2 [e =^s (e_1 \vee e_2 \wedge (DO(P))(e_1) \wedge Cul(e) = e_2]$

In addition, she presents *semelfactives*, verbal predicates that denote single instant events. As opposed to [47] she does not assign them a new category but but rather picks them out as the *minimal* event of activity predicates. Intuitively, since semelfactives can occur in the progressive they also have an activity reading (e.g., 'jump', 'wink', 'knock', etc.). However, not all activities have a semelfactive reading (e.g., 'run', 'walk'). So, verbs that can occur with modifiers such as *at time* t or *twice* can be interpreted as semelfactives.

In order to deal with verbs that head verb phrases of different classes she introduces *meaning shift*. The implementation of this shifting is based on Dowty's decompositional approach. Suppose a verb admits a default logical template as proposed

in (28). When a verb is used in a non-natural construction, (contra the predictions/constraints defined for it, e.g., achievements in the progressive) the default semantic template of the verb is put through the semantic template characterized by the construction, and the event is characterized by the resulting template. The meaning of a derived accomplishments is thus one of an achievement template pushed through an accomplishment template:

$$\lambda e.\exists e_1 \exists e_2 [e =^s (e_1 \cup e_2 \wedge (DO(P))(e_1) \wedge (BECOME(P))(e_2) \wedge Cul(e) = e_2]$$

Van Lambalgen and Hamm (2005)

[52] takes a cognitive oriented approach in identifying the semantic features that underly the event classification, based on the notion of *planning*.

A *plan* in this account requires an agent that wants to achieve some goal, and believes that by performing a sequence of actions, he or she will achieve this goal. Thus, the features that underly the classification are precisely the ones that constitute a plan:

1. an activity that typically exerts some sort of a force,
2. a changing object or state that is driven by the exertion of a force,
3. a canonical goal which represents the inherent terminal point,
4. the state of having achieved the goal.

Thus, they propose the following six way classification characterized by the following quadruples.[3]

(29)
- a. *States*
  - i. know, love, be happy
  - ii. $\langle -, -, -, + \rangle$
- b. *Activities (strict)*
  - i. sit, stand
  - ii. $\langle +, -, -, - \rangle$
- c. *Activities (wide)*
  - i. run, push cart
  - ii. $\langle +, +, -, - \rangle$
- d. *Achievements*
  - i. begin, notice, reach

[3]The precise formal meaning of the following quadruples will be explicated in chapter 4, however for the time being assume they represent presence or absence of listed plan components, i.e., $\langle 1, 2, 3, 4 \rangle$.

ii. $\langle -, -, +, + \rangle$

e. *Accomplishments*

i. cross the street

ii. $\langle +, +, +, + \rangle$

f. *Points*

i. flash, spot, blink

ii. $\langle -, -, +, - \rangle$

In this account the objects that are being classified are events in the real world (*eventualities* in their terminology) rather than verbs. Thus, one and the same verb can be used in different verb phrases to describing different kinds of eventualities (e.g., 'run' vs. 'run a mile') characterized by two different quadruples.

Creason 1995

Creason's account [10] aims to classify Hebrew verbs attested in the Bible to *Aktionsart* according to their semantic classes. His classification system is based on real world situational semantic properties and is inspired by data on Aktionsart from similar systems in English. Later, he applies it to verbal occurrences in the Hebrew text of the Bible.

Creason defines the following four features which are not fully productive (in the sense that not all of feature combinations are allowed)

- $+/-POINT$ defines whether the truth value of a sentence can be evaluated in a point in time or not.
- $+/-DURATIVE$ defines the temporal length of the situation: momentary or interval (not applied to states)
- $+/-CHANGE$ indicates the presence or absence of change of one of the participants in the situation (not applied to states)
- $+/-TELIC$ indicates the presence or absence of an inherent terminus or goal (not applied to states)

Thus, he ends up with the following classification (examples adopted from [10, p. 54–55]:

(30) a. *States*

i. $[+POINT, -CHANGE]$

ii. The fly was on the wall

b. *Semelfactives*

i. $(-POINT, -DURATIVE, -CHANGE, -TELIC)$

ii. John hit the door

c. *Atelic achievements*
   i. $(-POINT, -DURATIVE, +CHANGE, -TELIC)$
   ii. Bill noticed the fly

d. *Telic achievements*
   i. $(-POINT, -DURATIVE, +CHANGE, +TELIC)$
   ii. Bill arrived

e. *Unchanging activities*
   i. $(-POINT, +DURATIVE, -CHANGE, -TELIC)$
   ii. stayed, waited, sit

f. *Changing activities*
   i. $(-POINT, +DURATIVE, +CHANGE, -TELIC)$
   ii. "The men shall eat with me at noon" (Genesis 43;16)

g. *Accomplishments*
   i. $(-POINT, +DURATIVE, +CHANGE, +TELIC)$
   ii. "She . . . went back to her country" (Kings 10;13)

Clearly, he classifies situational descriptions rather than verbs and thus the accomplishment example (literally translated 'walked to her country') uses the verb 'walk' which typically denotes a changing activity.

The differences between Creason's classification and the one suggested by Vendler are, first, that he distinguishes telic and atelic achievements, and second, that he distinguishes changing from unchanging activities.

3.2.3 Event Classification in Modern Hebrew

The adequacy of the original vendlerian four-way classification (also investigated by [18] and [43]) for classification of Hebrew verbs was examined at [55]. Through a detailed examination of a number of specific case studies she shows that the semantic properties identified in English are also relevant for the treatment of lexical aspect in Hebrew.

However, it seems that the semantic features that underlie the classification systems (momentary, vollitional involvement, telicity) regardless of the kind of object which is classified, are properties of events in the world 'out there' rather than depending on the language. This view is particularly adequate to [52] account where the semantic features are based on a human cognitive capacity planning and thus the proposed classification system aims to be universal.

Creason, however, claims that the properties he proposes are "correlated with certain morphological features in biblical Hebrew [. . .]" [10, p. 80].

To exemplify he refers to a widely recognized ambiguity of (a certain set of) Hebrew stative verbs (e.g., *yašaḇ* sit, *yašaḇ* sleep, etc.). Those may refer to a *state*, a *change of state*, or *remaining in a state*.

(31) $ya\check{s}a\check{b}$ (sit)

a. hu yašaḇ bakita (bemeshekh shaot)
He sat in-the-class (for hours)
He was sitting in the class (for hours)

b. hu yašaḇ al hakisa (vehitxil lilmod)
He sat on the-chair (and-started to-study)
He sat down on the chair and started studying

However, this set of verbs appears to be problematic in English, too. We can classify these verbs as states according to various linguistic tests (e.g., that they can be evaluated on an instant, and they do not denote change). However, they can appear in the progressive and as activities. This distinction was also motivated on cognitive grounds by [52] and it is assigned a specific class in their account, the *strict activities* (note that in their account refraining from action is also a sort of exerting of a force, e.g., the English verb 'stay') correspondig to Creason's *unchanging activities*.

Creason also makes a distiction between telic and atelic achievements (e.g., 'notice' vs. 'arrive'). This distinction however, is not related to a specific feature of Hebrew but poses a more general question of whether or not telicity should be equated with the existence of a new result state. This question was also raised by [55], and it seems that indeed some features of Hebrew verbs make such a distinction more apparent. However, it is not clear how exactly to draw the distinction between the telic and atelic achievements categories in Creason's account.

Events that indeed do not indicate any change of state (hit, knock) are identified in both accounts classified as semelfactives. So, we maintain the semelfactive category and leave the investigation of the distinctions between *telic/atelic* achievements out of account.

Thus, the resulting semantic classification for Hebrew verbs we adopt coincides with the classification system suggested by [52]. This choice is motivated on cognitive grounds, for the underlying semantic features correspond to universal cognitive capacity rather than language dependent features, and also it represents a sufficient level of elaboration, as evident from the comparison to Creason's elaborated account for verb classes in Moderb Hebrew.

3.3 Thematic Roles

3.3.1 Introduction

> "There is perhaps no concept in modern syntactic and semantic theory which is so often involved in so wide a range of contexts, but on which there is so little agreement as to its nature and definition." [17]

The terms *thematic roles*, *thematic relations*, or *case relations* (henceforth, *thematic roles*) refer to semantic distinctions between different NP complements of verbs. Semantically, these complements represent different participants in situations (note that the term 'participant' need not refer to animate beings, see further discussion in [10, ch. 2]). The intuition behind such a distinction can be explained as follows: take for instance the following Hebrew and English verbs:

(32) hayeled imen/heexil/liteף et hakelev
the-child trained/fed/pet ACC the-dog
the child trained/fed/pet the dog

The term *thematic role* refers to the apparent regularity of 'the child' as an *agent* of an action and the dog as its *receiving end (theme)*. This regularity holds across a wide range of verb meanings, and even more appealingly, it seems to be manifested in a grammatical phenomena (the realization of the agentive role as the *subject* of the sentence and the receiving end as its *direct object*).

This simple intuition has triggered extensive use of the term *thematic roles* in syntactic, semantic, and pragmatic discussions with a lot of confusion with respect to their meaning. The purpose of this section is to clarify the semantic content of the kind of phenomena denoted by different the so-called *thematic roles*.

3.3.2 The Role of Thematic Roles

Traditional Thematic Roles

The first to propose a closed set of *thematic relations* was Gruber (1965). He presented a fixed set of roles (agent, theme, location, goal and source), and his *thematic relation hypothesis* is that our conception of motion/location may be analogous to our conception of a wide range of other semantic fields.[4]

[4]This hypothesis is demonstrated in his distinction between the verbs 'look' and 'see', accounted for by means of the different prepositions that are allowed to be used with any one of them (towards/away from/at can be used with look but not with see).

Fillmore (1967) was concerned with the *deep structure* of sentences. In his well-known 'case grammar' theory he makes use of 7 pre-defined case categories (Agentive, Instrumental, Factitive, Locative, and Objective) and classifies verbs according to their case-frames. The case-frames that accompany verbal predicates define the roles that may be associated with the verb as its arguments. Subsequent syntactic transformations are in turn not arbitrary, but dependent on the case label.

A different use of the traditional thematic roles was within syntactic theories and is further explicated by their derivative, the θ*-role*. Θ*-roles* were introduced by Chomsky (1981) into Government Binding (GB) theory and have been used to index arguments in the syntax in order to distinguish one from another.[5] Thus, they are required to fulfill the following requirements, known as the θ*-criterion*: (i) each NP argument is assigned exactly one role, and (ii) roles are uniquely assigned within arguments of the same predicate. In this context the θ-role is a purely syntactic notion and its semantic content is totally irrelevant.

Traditional approaches view the thematic roles as a fixed set of roles that have the following properties (compiled from [12]):

1. Thematic roles are discrete, primitive categories.
2. Each argument in a sentence can be assigned only one role.
3. Each thematic role can be assigned only one argument in a sentence.
4. Thematic roles are absolute (non-relational).

These properties appear to be problematic when trying to assign roles to complements of Hebrew verbs that are derived from the same lexical material but alternate between morphological patterns.

First, consider the *Niphal/Hiphil* alternation of the Hebrew root $[s][a][r]$ (to stay).

(33) a. dani nišar babayit
Dani stayed at-the-house
Dani stayed$_{\mathrm{niphal}}$ at home

b. ima hiširaet dani babayit
Mom stayed$_{\mathrm{hiphil}}$ ACC Dani at-the-house
Mom made Dani stay home

In (33) the agent is either causative (Mom in (b) causes Dani to stay home), or permissive ('Dani' in (a) refrains from taking any action of leaving). This distinction corresponds to Gruber's C(ausautive)-agent and P(ermissive)-agent, what means that the traditional thematic role of an agent can be further decomposed. This was later handled by creating a more fine grained role distinction that is based on a

[5]The use of indices in such theories is to keep track of arguments upon their movement in derivation.

thematic hierarchy with divisions into roles and sub-roles (e.g., [24]). However, this still has two problems: (i) a fixed thematic hierarchy is also hard to be agreed upon, and (ii) it undermines the main strength of the theory which is its general categorization (as appealed to in the introduction).

Second, consider the following Hebrew *Paal/Hitpael* alternation of the root $[l][b][s]$ (to dress):

(34) a. ima hilbiša et dani
Mom dressed$_{\text{hiphil}}$ ACC Dani
Mom dressed Dani

b. dani hitlabeš
Dani dressed$_{\text{hitpael}}$
Dani dressed (himself)

In (a) 'Mom' is the agent of the action and 'Dani' is the so-called theme. In (b) Dani is both agent and theme of the reflexive stem 'hitlabeš'. In this case two roles may be assigned to a single participant. This characterizes a general kind of situations called 'reflexive'/'double status' situations and they cannot naturally accommodate the 'uniqueness of roles' requirement of the θ-criterion.

Third, consider the following *Paal/Hiphil* alternation of the verb $[b][r][x]$ (to escape/run-away):

(35) a. haxatul barax
The-cat escaped$_{\text{paal}}$
The cat ran away

b. hakeleb̆ hib̆riax et haxatul
The-dog escape$_{\text{hiphil}}$ ACC the-cat
The dog caused the cat to run away

In (a) the cat is the agent of the run-away action. In (b) we can relate the agent role to the dog who made the cat run away. However, the cat is now also an agent of a 'running away' action, which prevents the fulfillment of the 'uniqueness of participants' requirement of the $theta$*-criterion*.

Finally, consider the following *Paal/Piel* alternation with the root $[y][b][s]$ (to dry)

(36) a. dani yab̆aš
Dani dried$_{\text{paal}}$
Dani dried (intrans)

b. *dani yibeš
*Dani dried$_{\text{piel}}$
*Dani dried (trans)

Piel typically denotes a transitive action (i.e., do something to somebody or something) and so in (a) The verb

$ya\check{b}a\check{s}$ in (a) Paal is perfectly grammatical. However since Piel typically denotes a transitive action (i.e., do something to somebody or something) it requires a direct object complement to serve as the theme of the sentence. So, whether or not a thematic role is required is not an absolute semantic property of the inherent meaning of lexical material but relative to other components, in our case the morphological pattern of the verb.

In sum, the alternation between verbs that are derived from the same lexical material (roots) in different grammatical environments (templates) challenges traditional observations about the semantic content of thematic roles. [12, p. 25] notes that

> "certain components of verb meanings involve relationships between two participants in the action denoted by the verb. A set of role labels independent of each other cannot hope to capture this."

In our case these components are the morphological templates we surveyed in chapter 2. Traditional non-relational approaches for the semantic content of thematic roles cannot be incorporated into an account of the semantics of such alternations.

Thematic Proto-roles

The difficulties with the traditional view of thematic roles were surveyed in [16] and [17] and was challenged by Dowty's Proto-roles theory.

Crucially, Dowty's account shows evidence for the fundamental role that events under denotation of verbs play in determining the semantic content of the thematic roles assigned o their complements. Moreover, under this view roles are not treated as discrete primitive categories but rather they form some sort of a continuum between the two extreme cases of a *Proto-agent* and a *Proto-patient*.

The point of departure of Dowty is that 'thematic roles' are 'sets of entailments'. To illustrate, 'x does a volitional act is an entailment shared by 'x murders y', 'x nominates y', 'x interrogates y' and not shared by, for instance, 'x kills y', as 'x' might have killed 'y' by accident. The term *lexical entailment* denotes "the implication that follows from the meaning of the predicate in question alone"[17].

The domain on which Dowty focuses on is *argument selection* and he proposes (i) not to account for distinctions that can be shown to be irrelevant for argument selection, and (ii) to count all semantic distinctions that can shown to be relevant to argument selection. As a direct consequence, he suggest to rule out *perspective*

dependent notions such as figure/ground and concludes that "all roles are event-dependent in meaning" [17, p. 564]. As his general hypothesis he puts forth two prototypical roles, the *Proto-agent* and *Proto-patient* which are characterized by the following sets of entailments:[6]

(37) Contributing properties of *Proto-agent* role
   a. volitional involvement in the event or state
   b. sentience (or perception)
   c. causing an event or change of state in another participant
   d. movement (relative to the position of another participant)
   e. (exists independently of the event named by the verb)

(38) Contributing properties of *Proto-patient* role
   a. undergoes change of state
   b. incremental theme[7]
   c. causally affected by other participants
   d. stationary relative to movement of other participants
   e. (does not exist independently of the event named by the verb)

The *argument selection principle* is therefore to select as subject (respectively object) the argument for which the predicate entails the greater number of *Proto-agent* (*Proto-patient*) properties. This allows combinations of properties from the two lists and thus locating a participant somewhere within the scale between one of the two extreme cases.

All the properties defined in Dowty's list correspond to certain (kinds of) events; volitional involvement is compatible with agents of activities, sentience is compatible with agents of states, etc. The present discussion leaves the selection criteria and its corollaries aside, however adopts Dowty's property lists for characterizing participants in situations *relative* to the different classes discussed in 3.2.

Recent Approaches

While it seems intuitive that semantic content of 'thematic roles' is important to the discussion of the syntactic-semantic interface, any attempt to define them independently of the different semantic classes of verbs failed to provide the desired status quo. However, the suggestion that the thematic roles are actually properties of semantically defined verb classes underlies a lot of recent proposals [41, 26].

Put in Hale and Keyser's words:

[6] Parenthesis in the original
[7] See below.

> "There are no thematic roles. Instead, there are just thematic relations determined by the categories and their projections, and these are limited by a small inventory of lexical categories and by unambiguous projection." [26]

The 'unambiguous projection' of lexical categories is the role of 'functional heads' [8], and they play the crucial role in the assignment of thematic relations to participants in situations in Doron's account of the semantic of the Semitic templates (see also chapter 2).

3.3.3 The Role of the Incremental Theme

One proof for the the relevancy of thematic roles to aspectual phenomena is given by the so-called *Incremental theme*.

The term *Incremental theme* was proposed by Dowty [17] and is roughly defined as 'the participant whose part-whole relation homomorphically determines the part-whole relation of the event'. To illustrate, in 'Dani ate an apple' the extent to which the apple is eaten determines the extent to which the event occurs. The event's temporal extension is thus determined by the extent to which the incremental theme has been created/changed/consumed, and the 'inherent terminal point' is the required state of the object on which the event 'operates' (e.g., a house created, an apple consumed, an picture painted, etc.).

This relation has been investigated extensively with respect to the internal structure of activities, accomplishments, and and phenomena of *shift/coercion* between them [33, 44, 52]. It has been shown that aspectual properties such as the telicity of events in different verb phrases is affected by properties of the incremental theme. For example, in (39) the distinction between a count/mass noun in the direct object position corresponds to the distinction between a telic and an atelic event.

(39) a. I drank a glass of wine
b. I drank wine

Also, the incremental theme was used to decompose and analyze what is known as *the imperfective paradox*.

The term *imperfective paradox* refers to the following phenomenon. Take for instance the following minimal pair:

(40) a. John built a house
b. John was building a house

[8] Also referred to as LRS in [26] and as the *light verb v* in [15].

In (40a) it is implied that a house indeed came into existence, whereas in (40b) this is not necessarily the case. In (41a), John's broken leg might have prevented him from completing the building of the house.

(41) a. John was building when he broke his leg

The incremental theme was incorporated into the formal account in [52, 44] to allow analyzing the temporal schemata of an event with respect to its changing theme.[9] This, in turn, allows us to formally capture the semantic distinction between utterances (40a) and (40b), and to avoid this paradox.

3.3.4 Thematic Roles in Modern Hebrew

Doron's account of the semantics of Semitic templates avoids the problems of the traditional approaches and assigns roles to verb complements unambiguously according to unambiguous projection of various functional heads. This shows one direction of the connection between event types and thematic relations.

We claim that this relation is bi-directional. Just as an event type determines the thematic relations projected by the basic predicates, the external modification of the thematic relations (as the one depicted by the Hebrew templates) might affect the semantic properties of the event at hand. This latter direction is for us to explore and its implications are fully discussed in chapter 6.

However, to allow such bidirectional interaction to take place we extend in chapter 4 the formalization of the verb classification system with semantic properties of different participants based on Dowty's lists. In chapter 6 we rely on Doron's results and show how the thematic modification may result in a modification of aspectual properties denoted by the original event.

3.4 Aspectual Systems

3.4.1 Introduction

We have seen that the discussion of the lexical content of various kinds of situations and discussion of the semantic properties of participants in situations are inseparable. In Hebrew semantic classes are identified with a verb's lexical meaning, and thematic relations are associated to some extent with a grammatical device, the Semitic derivational morphology.

[9] In [44] this is done using an 'incremental chain' that converges towards an inherent terminal point, in [52] it is done using a 'parameterized fluent' that progresses towards a certain critical value. Further details follow in chapter 4.

Thus we need a system that allows us to account for distinctions in the lexical material as well as ones conveyed by grammatical components. To this end we introduce Smith's theory of aspect [47] and discuss a notion which is central to the application to both of these dimension, a theory of *markedness*.

3.4.2 Aspectual Systems and Aspectual Choice

Smith [47] develops a theory of aspect in which aspectual meanings are conveyed via linguistic forms and pragmatic conventions. According to her, aspectual meaning conveyed by a sentence allows us to grasp the kind of event that is talked about. In her discussion she emphasizes the *subjective factor*, and relates aspectual meaning with *aspectual choice* that users make in constructing a sentence, as users often have different alternatives available to them.

Smith presents a two-component theory in which users have two orthogonal dimensions of aspectual choice. One is the choice of a *situation type* and the other is a choice of a *viewpoint*.

(42) a. The bird was flying
b. The bird was in flight

(43) a. John built a rock garden last summer
b. John was building a rock garden last summer

(42) exemplifies the choice between two different *situation types*, (a) presents the situation as dynamic and (b) presents the situation as static.[10] (43) exemplifies the choice between different *viewpoints* of a situation, (a) views it in its entirety and (b) views it in progress.

Aspectual meaning results from the interaction between these two independent aspectual components. *Aspectual systems* provide the speaker with a choice of *situation type* and *viewpoint*. The choice of the speaker with respect to *both* of these dimensions is essential to construct the aspectual meaning of a sentence.

The two aspectual components are realized in the *grammar* of the language, where the term grammar here is broadly understood as a system of morphological, syntactical, lexical and semantic rules that generate a sentence in the language and relate underlying structures to surface forms.

In order to distinguish the two aspectual components, she distinguishes two classes of surface linguistic forms: (i) *lexical morphemes* which refer to entities, events and concepts. (e.g., verbs, nouns, adverbs), and (ii) *grammatical morphemes* which express grammatical functions and relationships (e.g., determiners, English tense marking).

[10] An 'event' and a 'state' in her terminology.

The *situation type* is expressed by a constellation of lexical morphemes, and *viewpoint* is usually signalled by an obligatory choice of grammatical morphemes.

Situation Types

The choice of a *situation type* is expressed via the choice of lexical morphemes (verbs, complements, modifiers, etc.) that construct the sentence.

The choice of a lexical morpheme constellation seems essentially unbounded. However, Smith employs a view in which the semantic content of situation types is organized in categories according to prototype theory, and it is based on cognitive abilities. There are several central exemplars of idealized situations with a typical time schemata. These alternatives have been explored in details in section 3.2.2.

According to Smith situation type choices imply a basic neutral set of associations, in which situations in the real world are associated with idealized situation types. Cognitively, people categorize events and states in predictable ways. However, under certain circumstances a speaker might choose to describe an event in an unconventional way, which in turn allows her to endow one situation with the properties of another. In the choice of (42b) for instance, one chooses to endow a dynamic situation of 'a flying bird' with properties of a state 'be in motion' (example adopted from [47]).

Viewpoints

The *viewpoint* on a situation is indicated morphologically with affixes and/or special forms, i.e., via grammatical morphemes.

Grammatical morphemes have a wide range of functions, and their syntactic scope need not correspond to their semantic scope (e.g., tense inflections in English appears low on the syntactic tree while semantically they have the full sentence at their command). The concepts expressed by these morphemes are defined in the grammar of the langauge.

In composing a sentence the user must select grammatical morphemes as required by the language, and the choices are limited to a small fixed set of alternatives provided by the grammar of the language. A single choice contrasts with other available alternatives, and this contrast between the actual choice and its alternatives is a part of the value of that choice.

To illustrate, contrast English number morphemes *singular* and *plural* with Arabic number morphemes *single, dual* and *plural*. Thus, the choice of *plural* morpheme in Arabic has different implications then the choice of *plural* in English (e.g., the number of element in the set is greater than two).

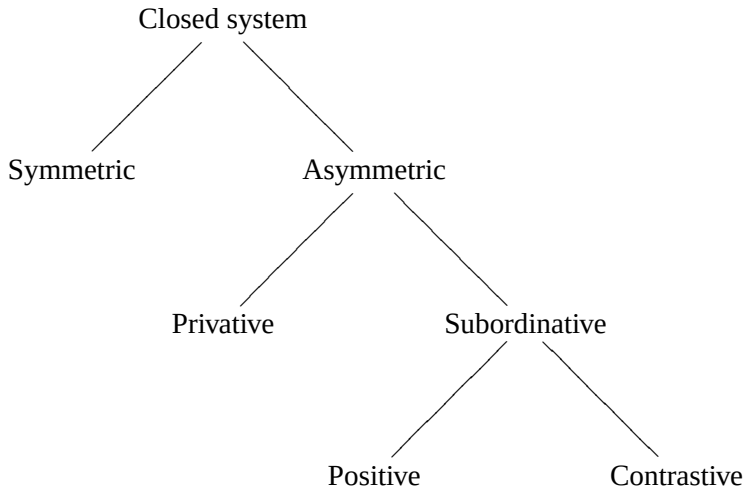
3.4.3 A Theory of Markedness

Systems with closed domains of alternatives are called *closed systems*, and the aspectual domain of languages is an example of one. The selection of *viewpoints* and *situation types* that are available to speakers is limited by what is offered by the language, and the 'aspectual systems' of different languages (which can refer either to categories of lexical morphemes or to obligatory grammatical inflections) provides their speakers with a closed set of alternatives.

The notion of *markedness* is useful for dealing with closed systems. It is concerned with the *symmetrical, contrastive* or *asymmetrical* relations between the members of a closed system. It was introduced by linguists in the structural tradition and members of the Prague School.[11] These scholars dealt with the analysis of phonological and morphological closed systems. They were interested in the underlying meanings associated with closed systems, and the contrast inherent in users' choices.

The theory of markedness, in a nutshell, is as follows. Within a domain, there is often one term which is simpler or more general than the others. Others may be more complex and/or more specific. The general terms are referred to as *unmarked*, and the specific ones are referred to as *marked*. For example, the progressive tenses in English are marked with respect to the simple ones as they denote a more complex (less standard), specific aspect of the situation.

There are several types of closed system, that give rise to several types of contrast. A closed system might be *symmetrical* or *asymmetrical*. In *symmetrical* systems the domain is divided between contrasting positive values. (e.g., past/present), while in *asymmetrical* systems there are two types of contrast, one *privative* and one *subordinative*, as illustrated in the following diagram.



[11] See full reference list [47, p. 15].

In *privative* systems one term gives positive information about a property and the other gives negative information about the same property (e.g., some languages have past/non-past inflections in their tense system [8]). In *subordinative* systems one term gives positive information which for the other remains unspecified. In that case the positive term is marked because of its specificity. This is for instance the case for progressive inflections versus simple tense forms in English.

When dealing with *asymmetrical subordinative* systems, there are several possible analyses. One possible analysis is based on contrasting values. In this view an *unmarked* term denotes the entire category. In our example it would mean that the simple forms denote situations with several possible viewpoints, one of which might be the progressive. The other possible analysis focuses on information rather then the contrast. Under this view, different marked options are providing different (orthogonal) kinds of positive information. In this view the progressive aspect is orthogonal to the aspects provided by the simple forms.

Both analyses may be correct, however in the contrastive analysis the pragmatics of the contrastive values affects the choice of the speaker and plays a role in conventional uses of the different options. For example, following Grice's maxim of quality it can be claimed that when the progressive is *not* used the implication is that the viewpoint is *not* progressive (since if it was, it should have been explicitly specified).

In closed systems marked choices distinguish the standard from the unusual. Unmarked choices are standard, conventional uses of the languages, while unusual choices are marked. Non-neutral choices are marked in the general sense that they depart from the standard. She

In making aspectual choices, the speaker chooses a *situation type* and *viewpoints* from the available alternatives in a way that emphasize certain properties of the situation in the real world. Some of these properties may be in accord with typical use and conventions, and others are meant to present a particular focus.

Usually marked descriptions of situations are perfectly grammatical. However, it should not be a surprise that some marked choices are grammatically odd, for certain situation types are more natural with certain viewpoints, e.g., '*He is knowing the answer' [47, p. 20] is ungrammatical since states are incompatible with the progressive.

However, one might want to mark a certain situation type with a non-conventional viewpoint, as in '?He is understanding the answer now'. Whether or not marked aspectual choice affects grammatically depends on the language. In general, the more restricted the language is with respect to the viewpoint (the grammatical morpheme), the more possibility there is that aspectually marked choice will be grammatically marked as well.

3.5 Summary

The preceding discussion put forth the building blocks for a theory of Hebrew verbal aspect. As our general framework we adopt Smith's two-component theory that constructs aspectual meanings from the choice of a *situation type* and a *viewpoint*.

The choice of *situation types* in Hebrew manifests itself in the inherent meaning of the lexical item within the verb/verb phrase. The choice of a *viewpoint* is manifested in the various morphological templates that are used to derive verbs. The morphological templates alter the viewpoint on the situation since they focus on specific relations between different participants in the same situations.

The notion of *viewpoint* is particularly appropriate to the treatment of the grammatical device of the Hebrew verbal system, as it is indeed related to different *viewpoints* that different kinds of *participants* have on a situation (manifested in what we have defined as *thematic relation*).

Moreover, the choice of a combination of a *situation type* and a *viewpoint* is essential for constructing aspectual meanings of Hebrew sentences, especially in light of the fact that some combinations are not conventional or not grammatical. In cases where the use deviates from the standard, an analysis of a specific intention or emphasis in the situation is called for.

Chapter 4

Semantics for Aspect

In this chapter we introduce the formal system we chose for analyzing Modern Hebrew verbal aspect, the *Event-Calculus (EC)*. The Event-Calculus (EC) will be introduced to the reader, but not before motivating our choice of the EC over other *Neo-Davidsonian* approaches. We argue that the EC is a productive vehicle for expressing temporal relations in general and aspectual distinctions is Modern Hebrew in particular. After introducing the formal system EC and its logical-computational machinery we show how the system is applied for formalizing the two basic components we have identified so far, situation types and viewpoints.

4.1 Why Event Calculus?

4.1.1 Requirements

Cognitive Plausibility

The requirement for a semantics framework to be *cognitively plausible* has been motivated rather extensively by now. In chapter 1 we argued that language and cognition are intimately connected as language is used to speak about 'things' that we are (cognitively) able to perceive in real life. This general idea was explored by Jackendoff in [32]:

> "There is a single level of mental representation, a conceptual structure, at which linguistic, sensory, and motor information are compatible [...]. Conceptual structure must be rich enough in expressive power to deal with all things expressible by language." [32, p. 17]

Put differently, the 'mental representation level' may be seen as the interface between the linguistic forms (or rather, the grammar of the language) and our con-

scious experience. This interface is precisely what allows us to express in language what we consciously perceive in real life.

Also, the bidirectional relation between language and cognition may be seen from a developmental point of view. When acquiring a first language, a bidirectional process takes place; one direction is the search for linguistic form to express newly acquired concepts, and the other is the search of opportunities to express new concepts using newly acquired linguistics forms.

The close relation between language and cognition is particularly relevant for *time-talk*. Following [52] we have argued that time is not a direct experience but rather a construction on top of our direct experience that constitutes events. Indeed, the proposal to relate the (cognitively based) notion of 'event' to (the linguistic form) 'verb' is not a new one. Following Davidson (see below) an underlying event argument is asserted by every verbal utterance.

The clear, intimate connection between language and cognition calls for a semantic framework which is expressive enough to express cognitively based distinctions, and its formal structure should ideally fit what Jackendoff has called the 'conceptual structure' of our mental representation.

Linguistic adequacy

Up till now we have identified two dimensions of linguistic forms that can be used to express aspect, *lexical material* and *grammatical operators*. So, it is crucial that the proposed system will allow us to express both kinds of information.

In Hebrew, we would like to account for the role that thematic roles have in situations, and how they affect its temporal structure. Since thematic roles are notions of the syntax-semantic interface, we are interested in a system that allows both lexical information and grammatical operations to *interact*, that is, both kinds of information should be allowed to affect each other, rather than simply be added one on top of another.

Also, a formalism which is linguistically adequate should allow us to make precise predictions with respect to new expressions. One way to anchor this idea is to reinterpret the Fregean notions of 'sense and reference' as follows

> "The sense of an expression is the algorithm which computes its reference." [52, p. 183]

Under this reinterpretation, the proposed formalism should allow us to compute the aspectual meaning of a given form. The result of the computation is the way for the theory to express its predications.

Finally, in Hebrew the situation is further complicated as the meanings of verbs that share the same patterns has been shown to manifest a lot of idiosyncracy,

and we cannot hope to predict their complete meaning. Thus, it would be useful to have a system that abstracts from such idiosyncracies and computes strict *aspectual* meanings.

4.1.2 Neo-davidsonian approaches

One reasonable candidate for the formal treatment of verbal aspect is the Neo-Davidsonian approach which was used by [18, 39, 44, 15] and others. Davidson [11] argued that sentences assert the existence of events by an existential quantification over an event argument introduced by the verb.

Thus the interpretation of (44) has changed from (45) to (46) (example adopted from [43]).

(44) a. The choir sang the Marseillaise

(45) a. $SING(C, M)$

b. $\lambda y \lambda x . SING(x, y)$

(46) a. $\exists e[SING(e, C, M)]$

b. $\lambda y \lambda x \lambda e . SING(e, x, y)$

Much work has been devoted to showing evidence for the event argument, although it doesn't surface as a syntactic argument. It has been established based on different phenomena (e.g., the behavior of adverbial modifiers) that the event-based theory is favorable over the simpler ones (see also the introduction to [43]). Moreover, contra Davidson's original view, it was extended by [39] to account for stative verbs as well.

A variation of the Davidsonian theory presented by Parsons [39] and others holds that verbs are one-place predicates of events denoting sets of events, and that thematic roles are partial functions between events and individuals. Thus, (44) is interpreted as follows:

(47) a. The choir sang the Marseillaise

(48) a. $\exists e[SING(e) \wedge Agent(e) = C \wedge Theme(e) = M)]$

b. $\lambda y \lambda x \lambda e . SING(e) \wedge Agent(e) = x \wedge Theme(e) = y$

Introducing conjuncts that add thematic roles specifies subsets of the set of events introduced by the verb. In this case, the sentence refers to a subset of singing events in which the 'agent' is the choir and the 'theme' is the Marseillaise. Thus thematic roles appear to play an important role in distinguishing between different kinds of events.

However, the contrast between Davidsonian and Neo-Davidsonian approaches brought up more questions. One is whether arguments and adjuncts are essentially different, and the other is about the number and the formal structure of the thematic roles (the adjuncts' 'labels') and their semantic content. In order to tackle the second question several Neo-Davidsonian theories make use of the 'unique role requirement' formulated by Parsons [39] as a constraint on thematic relations. According to him, a thematic role can be filled only once.

However, in chapter 3 we discussed the difficulties with this view. Neo-Davidsonian theories bypass the issues we discussed by defining the formal role of thematic relations as distinguishing between different arguments without making reference to their semantic content [44]. Under this view the 'names' of the labels simply do not matter, and the above sentence could be expressed as follows:

(49) a. The choir sang the Marseillaise

(50) a. $\exists e[SING(e) \wedge X(e) = C \wedge Y(e) = M)]$

b. $\lambda y \lambda x \lambda e.SING(e) \wedge X(e) = x \wedge Y(e) = y$

Since we related the semantic contribution of a Semitic template's alternations of role assignments, our formal treatment of the aspectual properties must interact with the semantic content of these labels, and not stipulate them.

This problem is of a more general kind. Sometimes additional information is needed in order to express differences between eventualities, e.g., their telicity or durativeness. In Neo-Davdisonan theories the only straightforward way to add such information is via additional predicates (e.g., $BECOME$, $ACTIVITY$, DO in [18], $INCR$ in [44]).

Event arguments à-la Davidson by no means allow us to look *into* the event and examine its internal structure. This is relevant both for the participants in the events and other relations between different parts of the event and the environment. This point is even more crucial if we look at a hierarchy of events with different levels of granularity.

Recent formalisms have been proposed to tackle this issue by presenting a decompositional approach. For instance, the definition of accomplishment in [44] is a sum of two subevents. Then, however, further stipulation is required in order to identify the participants in the two subevents, bearing in mind that we are concerned with a single higher level event (for which the formal theory requires a 'unique role assignment').

As the complexity of the hierarchical structure of events increases, the treatment of such nested definition becomes more complex and less intuitive. In the following we propose a cognitively based alternative that is hoped to make the treatment of such phenomena more intuitive and less cumbersome.

4.1.3 Event Calculus

Event Calculus is a formalism for reasoning about time and change. The Event Calculus and its ancestor the Situation-calculus were first developed in AI to deal with *planning* problems for robotics.

> "By definition, planning means setting a goal and computing a sequence of actions which provably suffice to attain that goal. It involves reasoning about events, both actions of agents and events in the environment, and about properties of the agent and the environment which may undergo change as a consequence of those events." [52, p. 36]

The advantages of adopting a planning-based formalism are several. First, since we assumed that our conscious experience of time has to do with our cognitive ability to construct plans it is more likely to provide a *representation* format that fits our presupposed mental representation of time well. Second, the notion of a plan as presented in the quote above has *logical-computational* applications, in the sense that a plan can be 'provably correct', and the steps for the attainment of the goal can be 'computed' .

The *representation* format of the event calculus is based on two types of entities, primitives (event-types) and temporally extended (fluents). It axiomatizes different notions of change and allows for causal relations between events, individuals, and properties in the environment.

Such a format allows representation of the internal structure of temporally extended and/or complex events, and it naturally accommodates thematic roles. Within a plan-based situation, it is inherently clear what is the semantic content and the interrelations of an agent, goal, and partially changing objects in the environment.

Logically, a plan is *provably correct* if in every model of the premises (the description of the situation and the causal relations) the goal can be shown to be achieved. However, some of these models may include non-intended events that prevent the attainment of the goal. Practically, it is impossible to enumerate the things that can go wrong. We can only hope to show that a plan 'works to the best of one's knowledge'.

The Logic employed by the Event calculus is, thus, non-monotonic, and in order to be able to prove that a plan is 'correct' its class of models is restricted to 'minimal models' in which nothing happens unless it is explicitly required to happen (i.e., explicitly stated or axiomatized).

The computational machinery employed to deal with such models is logic constraint programming. The reinterpretation of the model plus the computational machinery allows one to make predictions by means of computational *derivations*.

In sum, we choose the *Event-calculus* formalism for several reasons: (i) it is *cog-*

nitively plausible since its representation format fits a convincing hypothesis about the human representation of time, (ii) it is *linguistically adequate* as it accommodates different kinds of entities (actions, individuals, properties) and interrelations, and (iii) it provides computational machinery that sharply delineates its set of predictions.

4.2 Introduction to Event Calculus

Event Calculus (EC) is a formalism for *planning* that was applied by [52] to natural language semantics. The term *planning* refers to the process of setting a goal and computing the actions which suffice to achieve this goal.

In order to reason about planning, this formalism is designed to reason about *events* as well as *properties*, where *events* may be actions of some agent or events in the environment, and *properties* may refer to agents as well as the environment, and may undergo change as a consequence of the denoted events.

In order to prove a plan correct to the best of one's knowledge, the formal system EC axiomatizes the following ideas:

1. All changes are due to a cause
2. Spontaneous (non-intended) events do not happen

The first idea is employed using the commonsense idea of *inertia*, i.e., that a property persists unless it is caused to change by an event, and the second is employed by restricting the class of models of the system to those that are *minimal*, i.e., events and changes are only the ones required or forced by explicit statements or the axioms.

4.2.1 The formal system EC

Ontological overview

Formally, EC requires a many-sorted logic for the following sorts:

1. individual objects (e.g., humans chairs, tables),
2. real numbers (to represent time and variable quantities),
3. time dependent properties (e.g., states, activities),
4. variable quantities (e.g., spatial position, degree of sadness, state of completing a picture),

5. event types, whose instantiations (tokens) mark the beginning and end of time dependent properties.

Time is represented by the structure $(R, <, +, \times, 0, 1)$. This continuum is not intended to represent how humans conceive time, but rather, it provides the raw material out of which the cognitive representation of time is constructed in some fashion.

The event calculus formalizes two notions of 'cause'

1. instantaneous change that affects a time dependent property (e.g., balls colliding affects the balls' location and momentum)
2. change due to a force which exerts its influence continuously (e.g., filling a bucket)

Time-dependent properties can be affected by an instantaneous cause, a continuous cause, or cause continuous changes themselves in other time dependent properties. These time-dependent properties are central notions for the EC models and are called *fluents* (the corresponding objects will be formally defined in section 4.2.2).

Predicates

EC uses the following predicates:

(51)
a. $\mathsf{Initially}(f)$
"fluent f initially holds"
b. $\mathsf{Happens}(e, t)$
"event e happens at time t"
c. $\mathsf{Initiates}(e, f, t)$
"event e initiates fluent f at time t"
d. $\mathsf{Terminates}(e, f, t)$
"event e terminates fluent f at time t"
e. $\mathsf{Trajectory}(f_1, t, f_2, d)$
"fluent f_1 is a force that causes a change in f_2 and holds from t to $t + d$
f. $\mathsf{Releases}(e, f, t)$
"event e lets fluent f start changing at time t"
g. $\mathsf{Clipped}(t_1, f, t_2)$
"fluent f ceases to hold sometime between time t_1 and t_2"
h. $\mathsf{Declipped}(t_1, f, t_2)$
"fluent f holds between time t_1 and t_2"
i. $\mathsf{HoldsAt}(f, t)$
The truth predicate: "fluent f is true at time t"

The Axioms

EC formalizes the commonsense principle of inertia and two notions of 'cause' using the following axioms:

(52) a. $\mathsf{Initially}(f) \rightarrow \mathsf{HoldsAt}(f, 0)$
"if a fluent f initially holds then it started to hold at time 0"

b. $\mathsf{HoldsAt}(f, r) \wedge r < t \wedge \neg\exists s < r \mathsf{HoldsAt}(f, s) \wedge \neg\mathsf{Clipped}(r, f, t) \rightarrow \mathsf{HoldsAt}(f, t)$
the principle of inertia: "If a fluent f holds at time r and is not clipped between times r and t then it still holds at time t"

c. $\mathsf{Happens}(e, t) \wedge \mathsf{Initiates}(e, f, t) \wedge t < t' \wedge \neg\mathsf{Clipped}(t, f, t') \rightarrow \mathsf{HoldsAt}(f, t')$
instantaneous change: "If an event e happens at time t and initiates a fluent f and the fluent is not clipped between times t and t' then the fluent f still holds at time t'"

d. $\mathsf{Happens}(e, t) \wedge \mathsf{Initiates}(e, f_1, t) \wedge t < t' \wedge t' = t + d \wedge \mathsf{Trajectory}(f_1, t, f_2, d) \wedge \neg\mathsf{Clipped}(t, f_1, t') \rightarrow \mathsf{HoldsAt}(f_2, t')$
continuous change: "If an event e happens at time t and initiates a fluent f_1 which is not clipped between times t and t', and if fluent f_1 exerts a force that causes change of another fluent for $d = t' - t$, then the fluent f_2 holds at time t'"

e. $\mathsf{Happens}(e, s) \wedge t < s < t' \wedge (\mathsf{Terminates}(e, f, s) \vee \mathsf{Releases}(e, f, s) \rightarrow \mathsf{Clipped}(t, f, t')$
"If an event e happens at time t and either terminates f or allows it to change (e.g., due to another fluent that exerts force on it) then f is clipped "

4.2.2 Models for EC

A Model for EC

Fluents (time dependent properties) are represented in models of EC as objects. A function $f(x)$ may be thought of as a function that maps x to a fluent object, where x can be an individual, a property, etc. In a model for EC ***fluents*** are sets of intervals of the form $(a, b]$ where a is the instant in which an initiating event occurs and b is an instant where 'the next' terminating event occurs. Note that by definition, fluents start to hold immediately *after* the initiating event.

Events (event types) are derivatives of fluents. Each event can either initiate or terminate an event. *Instants* are non-negative reals. More formally, a fluent f is a finite set of disjoint halfopen intervals of the form $(a, b]$ (with the possible addition of an interval $[0, c]$ or $[0, \infty]$). Event types e can be of the form $e =$

$e_f^+ = \{\exists s((r,s] \in f\}$ (i.e., the set of initiating events of a fluent f), or of the form $e = e_f^- = \{\exists r((r,s] \in f\}$ (i.e., the set of terminating events of a fluent f).

Thus, the distinguished predicates get the following interpretations:

1. HoldsAt $:= \{(f,t|\exists I \in f(t \in I)\}$
2. Initially $:= \{f|\exists s > 0([0,s] \in f)\}$
3. Happens $:= \{(e,t)|\exists f[(e = e_f^+ \vee e = e_f^-) \wedge (f,t) \in e])\}$
4. Initiates $:= \{(e,f,t)|e = e_f^+ \wedge (f,t) \in e)\}$
5. Terminates $:= \{(e,f,t)|e = e_f^- \wedge (f,t) \in e)\}$
6. Declipped $:= \{(t_1,f,t_2)|\exists t(t_1 < t < t_2 \wedge (f,t) \in e_f^-\}$
7. Clipped $:= \{(t_1,f,t_2)|\exists t(t_1 < t < t_2 \wedge (f,t) \in e_f^-\}$
8. Releases $:= \{\}$

Theorem 1. *EC is true under the above interpretations.*

(A complete proof can be found in [52, p. 42].)

Coding of event types and fluents

In previous sections that the use of an event argument à-la Davidson since it is not capable of differences *internal* to the event structures. Next we show how EC allows us to construct various kinds of events on the time line from the same 'material', so-to-speak.

All kinds of entities in the formal system of EC are derived from the same raw material, namely VPs. A nominalized VP is an example for an extended ***fluent*** that is coded as an ***event***. Fortunately, we are allowed to do encode fluents as event types within the EC formal system by means of the Feferman calculus [19].

Let L_0 be some first order language extending the language of the reals, containing at least axioms for $+$ and $\times$. Formulas in L_0 can be coded as natural numbers via Gödel numbering. Furthermore, it is possible to define a binary pairing function π with two projection functions π_1 and π_2 such that

(53) $\pi_1(x,y) = x \wedge \pi_2(x,y) = y.$

We can define tuples inductively using $(\tau) = \tau$ and $(\tau_1,\ldots,\tau_{k+1}) = ((\tau_1,\ldots,\tau_k),\tau_{k+1})$ and now the corresponding projection function is as follows:

(54) $\forall \pi_i^k 1 < i < k[\pi_i^k(x_1,\ldots,x_k) = x_i]$

Thus, if $\ulcorner\psi\urcorner$ is the Gödel number in L_0 for ψ then:[1]

Definition 1. $\triangle_n\psi[\hat{x}_1,\ldots,\hat{x}_k,y_1,\ldots,yk] = (\ulcorner\psi\urcorner, y_1,\ldots,y_n)$

In particular, for $n = 1$

(55) $\triangle_1\psi[\hat{x},y_1,\ldots,yk] = \{x|\psi(x,y_1,\ldots,y_n)\}$

As a result, various kinds of events can be constructed from verb phrases, say $run(x,t)$ with its time parameter t. In particular, event types are given formally by $\exists t.run(x,t)$ and fluents are given by $run[x,\hat{t}]$. Note that if x is substituted for a concrete object, then the former is an object and the latter is a function from time to truth values.

The Truth Predicate HoldsAt

In the presentation of the EC predicates we have identified the predicate HoldsAt with our truth predicate. Making one of the predicates in the language play a role of a truth predicate leads to a problem of the type introduced by Tarski.

The problem stems from self reference, and in this context, the construction of a sentence of the form 'it is true at time t that f is false at time t' leading to a contradiction [52, p. 74].

This problem is remedied by adding the truth predicate T_n to L_0

(56) $\forall\psi \in L_0 \vee \{T_n|n \in N\}, \forall n \in N$
$T_n(x_1,\ldots,x_n,\psi[\hat{u}_1,\ldots,\hat{u}_n,y_1,\ldots,y_m]) \leftrightarrow \psi(x_1,\ldots,x_n,y_1,\ldots,y_m)$

Then, in particular;

(57) $T_1(x,\psi[\hat{u},y_1,\ldots,y_m]) \leftrightarrow \psi(x,y_1,\ldots,y_m)$

This allows us to replace occurrences of HoldsAt in axioms (and scenarios) of the event calculus with T_1. This can be shown to maintain consistency within the framework of EC. The interested reader should consult [52, p. 73–78] for the complete formal treatment of the solution.

Minimal Models

The kind of models presented so far will not suffice to guarantee that a goal can be achieved, as they do not prevent spontaneous events from happening and unintended changes from occurring.

[1] using standard set theoretical notations, see [52]

To illustrate, suppose we would like to create a plan for having the light 'on' during the time interval $(a, b]$. We can construct a plan to switch on the light at time a and switch it off at time b. Different models allow for additional terminating switch-off events in between this time interval or even do not preclude a spontaneous turning-off of the light with no explicit reason.

Thus, we take the *closed world assumption*, in which:

1. unintended events do not happen. The only events that happen are ones specifically stated in the premises/axioms.
2. all changes are due to a cause of the type axiomatized in (52a)–(52e).

In practice, however, there are different ways to define *minimality*. The one advocated in [52] is by means of *constraint logic programming*, which in addition provides a computational means to compute execution of the plan using *computational derivations*, as we required in section 4.1.1. Also, it restricts the class of models depicted by EC to a decidable fragment. The interested reader can turn to [52] for a full survey of this computational machinery.

4.3 Situation Types in Event Calculus

When formalizing situation types we are concerned with the inherent meaning of various verb classes. Let us specify how lexical inherent meaning can be expressed in this formalism.

Fluents and event types are derived from natural language expressions using *nominalization* according to the principles

perfect nominal $\longrightarrow$ event type
imperfect nominal $\longrightarrow$ fluent

Roughly speaking, lexical meaning is represented by a sequence of formulas that uses events and fluents to denote the 'micro-theory' that is associated with them. Some of the formulas are universally quantified with respect to time and they denote the formal causal relationship between expressions. Others refer to specific time points, and/or fix the individual or properties in the situations.

4.3.1 Scenarios

States and scenarios provide the EC with means to define 'micro-theories' that state the specific causal relationships that hold in certain situations.

Definition 2. A *state* $S(t)$ at time t is a first order formula built from:

1. literals of the form $(\neg\mathsf{HoldsAt}(f,t))$, for t fixed and possibly different f
2. equalities between fluent terms and between event terms
3. formulas in the language of the structure $(R, <; +, \times, 0, 1)$

Definition 3. A *scenario* is a conjunction of statements of the form:

1. $\mathsf{Initially}(f)$
2. $S(t) \rightarrow \mathsf{Initiates}(e, f, t)$
3. $S(t) \rightarrow \mathsf{Terminates}(e, f, t)$
4. $S(t) \rightarrow \mathsf{Happens}(e, t)$
5. $S(t) \rightarrow \mathsf{Releases}(e, f, t)$
6. $S(f_1, f_2, t, d) \rightarrow \mathsf{Trajectory}(f_1, t, f_2, d)$

where $S(t)$ is a state in the sense of the previous definition

The characterization provided is somewhat restricted, as we want to keep it suitable for logic constraint programming and avoid looping computation. Thus, we provide the following additional definitions:

Definition 4. A definition of an *event* e is a statement of the form $\psi \rightarrow \mathsf{Happens}(e, t)$, where ψ contains only Happens formulas, and e does not occur in ψ.

Definition 5. A definition of a *fluent* f is a statement of the form $\psi \rightarrow \mathsf{HoldsAt}(f, t)$, where ψ contains only HoldsAt formulas, and f does not occur in ψ.

4.3.2 Aktionsart

The departure for the formalization of situation types is their *default* scenario (in the sense of definition 3). The default scenarios defined by EC correspond to the verb classes we have defined in chapter 3.

Informally, verbs refer to events, which are conceptualizations of a certain portion of time span. Our hypothesis is that human conceptualization of events is driven by goals. Under this hypothesis, EC formalizes *eventualities* using the following definition (we drop the informal term 'event' to avoid confusion with the primitive event (types)):

Definition 6. An *eventuality* is a structure (f_1, f_2, e, f_3) where:

1. f_1 is a fluent that represents an activity which exerts a force,

2. f_2 is a parameterized fluent which represent a parameterized object or state which is driven by force f_1,
3. e is a culminating event, representing a canonical goal,
4. f_3 is a fluent which represents that state of having achieved the goal.

Aktionsarten are specific types of eventualities, that are characterized by the following quadruples:

1. *States* $\langle -, -, -, + \rangle$
2. *Activities (strict)* $\langle +, -, -, - \rangle$
3. *Activities (wide)* $\langle +, +, -, - \rangle$
4. *Achievement* $\langle -, -, +, + \rangle$
5. *Accomplishments* $\langle +, +, +, + \rangle$
6. *Points* $\langle -, -, +, - \rangle$

The proposed model has a starting point that gives verbs and verb phrases richer structure than an single event argument. This richer structure allows us to account for the internal structure of eventualities and causal relations that are inherent to them.

States

A state is represented by a fluent, i.e., a time dependent property that holds over a (set of) disjoint halfopen interval(s). States are causally inert, and they do not change unless an explicit event cause them to change. Also, they cannot occur as the first argument of the Trajectory predicate.

Example: be happy

1. $\mathsf{HoldsAt}(happy, t)$

States can be inherently bounded; this is expressed formally by using an external 'clock' that provides the external trajectory of time change [52, p. 92].

Example: be a president (for 4 years)

1. $\mathsf{Initially}(time(0))$
2. $\mathsf{Releases}(inauguration, time(0), t)$
3. $\mathsf{Initiates}(inauguration, f, t)$
4. $\mathsf{Initiates}(inauguration, clock, t)$
5. $\mathsf{HoldsAt}(time(x), t) \rightarrow \mathsf{Trajectory}(clock, t, time(x + d), d$

6. HoldsAt$(time(4_years) \wedge$ HoldsAt$(clock, t) \rightarrow$ Happens$(finish, t)$
7. Terminates$(finish, f, t)$
8. Terminates$(finish, clock, t)$

Activities

Activities are represented by fluents, that, as opposed to states, cause changes. They are characterized by dynamics Trajectory, and ought to specify the fluent f_1 that exerts a force (first slot), and a fluent f_2 that is changed under the influence of force f_1 (third slot).

Example: push a cart

1. Initiates$(start, push, t)$
2. Releases$(start, position(x), t)$
3. HoldsAt$(position(x), t) \rightarrow$ Trajectory$(push, t, position(x + d), d)$

Activities can also be *strict*, in the sense that there is no parameterized fluent $f_2(x)$ that is due to change, and thus they are characterized only by an initiating event and a fluent of type f_1 (note that refraining from action is also a kind of exertion of a force).

Example: stay

1. Initiates$(e, stay, t)$

Achievements

Achievements are specified by a terminating event type, which initiates a resulting state represented by a fluent of the same type that is used by states (f_3 in the quadruple).

Example: Reach the top

1. Initiates$(reach, be_at_the_top, t)$

Points

Points are specified by event (types) that do not initiate any fluent.

Example: blink

1. Happens$(blink, t)$

Accomplishments

Accomplishments are characterized by a dynamic Trajectory, (similar to the one denoted by activities) and by a culminating event that initiates a result state (similar to the ones denoted by achievements). In accomplishments, however, there is a clear connection between the denoted activity and the resulting state, in the sense that the result state f_3 triggered by a specific value of the parameterized fluent f_2 (the parameterized fluent f_2) should remind us of the *incremental theme* (see also section 4.3.3).

Example: build a house

1. $\mathsf{Initially}(house(a))$
2. $\mathsf{Initiates}(start, build, t)$
3. $\mathsf{Releases}(start, house(x), t)$
4. $\mathsf{HoldsAt}(house(x), t) \rightarrow \mathsf{Trajectory}(build, t, house(x + g(d)), d)$
5. $\mathsf{HoldsAt}(build, t) \wedge \mathsf{HoldsAt}(house(c), t) \rightarrow \mathsf{Happens}(finish, t)$
6. $\mathsf{Terminates}(finish, build, t)$
7. $\mathsf{Initiates}(finish, house(c), t)$

4.3.3 Thematic Roles

Dowty in [17] defines one of the goals of his article as follows:

> "[...] to make [...] all linguists recognize the danger in continuing to take this notion [thematic roles] for granted [...] and to encourage others to invent and explore other novel theories in thematic roles." [17, p. 551]

Following this encouragement, we show how thematic roles are assigned to individuals/objects in an EC framework based on the properties in Dowty's proto-roles lists.

A *plan* requires that an *agent* desires to obtain some *goal* and believes that a series of actions can be carried out to achieve that desire. Goals and purposes refer to desired states that are *experienced*, whereas actions and activities, are controlled by some *agent*, and can possibly affect a *patient* or an (incremental) *theme*.

Several notions familiar as 'thematic roles' are inherent to planning; *agent* and *goal* are a part of the *plan* definition, and actions, activities, and states entail existence of volitional agents, changing objects, and state experiencers respectively.

Thus, starting out from Dowty's 'Proto-roles' lists we can make the following assertions about the individuals that are associated with the different fluents. In

practice, we choose a label by a 'voting' mechanism similar to Dowty's selection principle:

(58) a. f_1 is a fluent representing an activity which exerts a force. Thus, the properties from Dowty's list it correspond to are *a,c,e* from the Proto-agent list.

b. f_2 is a parameterized fluent representing a parameterized object or a changing state which is driven by force f_1. Thus, the properties from Dowty's list that correspond to it are *a,b,c,e* from the Proto-patient list. We shall refer to it as the *theme*. More specifically, the relation between different values of the function $f_2(x)$ and its critical value $f_2(c)$ is precisely the relation required for an *incremental theme*.

c. f_3 is a fluent which represents the state of having achieved the goal. The properties that are relevant to the participants associated with it from Dowty's lists are *relative* to the denoted situation. Participants of states correspond solely to Dowty's *b* item in the Proto-agent list, and thus can be defined as *(experiencer) agents*. In accomplishments they corresponds to items *a,c,e* in the Proto-patient list, and can be defined as the theme.

4.4 Viewpoints in Event Calculus

Up till now we have provided a formal description of the lexical material carried by verbs including properties of eventualities and participants in those eventualities. However, the same lexical material can be looked at from different viewpoints. One way to look at an eventuality is from within its temporal extension (thus providing an on-going or progressive viewpoint) and another way is from a later point (thus giving rise to perfective or perfect viewpoints[2]). Also, an eventuality viewpoint can focus on different participants (the agent, the theme, or even a single participant that corresponds to both of them).

In order to express specific features of the situation description provided by the general scenarios, the Event calculus allows us to fix specific individuals or time points using a notion that is borrowed from database theory: *integrity constraints*. Moreover, integrity constraints allow definition of *hierarchically planned* complex events which are internally complex, and look at them as a single whole, from a *perfective* point of view. These notions will be explained and formally defined in further detail in the following section.

[2]Note that these are not the same. See section4.4.4 and also [7].

4.4.1 Integrity Constraints

Integrity constraints are mechanisms that are used to maintain consistency of databases. Their aim is to make sure that when the database is being updated in one spot, other updates are triggered elsewhere in order to ensure that the database content remains consistent. Imagine, for instance, a database containing an inventory list with prices. Once an item is added to the items list with its price, an integrity constraint can make sure the total value of merchandize in the store is updated to include these new items.

In EC we use integrity constraints in a slightly different manner. Given a viewpoint on a situation, an IC makes sure that the database is updated to accomodate this viewpoint. For instance, if a situation is claimed to have happened in the past, an integrity constraint is introduced to ensure that the situation's temporal location is prior to some constant R that is located before the time of speech *now*.

Definition 7. Let $R, R', R''...R_n$ be a finite set of constants that belong to the constraint language. Each of these constants denotes a reference time. A conditioned integrity constraint is a statement of the form

$$\textit{IF } ?\phi \textit{ succeeds THEN } \psi(R, R', R'', \ldots, R_n) \textit{ succeeds/fails}$$

or

$$\textit{IF } ?\phi \textit{ fails THEN } \psi(R, R', R'', \ldots, R_n) \textit{ succeeds/fails}$$

where ψ, ϕ are formulas of the Event calculus. The operational meaning of the first statement is that one first has to investigate whether $?\phi$ succeeds. *If* the scenario indeed satisfies ϕ, *Then* the goal $\psi(R, R', R'', \ldots, R_n)$ must be made to succeed (or to fail finitely).

To determine whether the scenario satisfies ϕ one has to investigate whether the goal ψ succeeds.

However, there are cases in which we would like not only to ask whether a certain query succeeds, but to exclude the cases in which it does not succeed [52, p. 111]. This is done by adding the query in the antecedent to the subsequent goals list. Thus we end up with following simplified version of integrity constraints:

Definition 8. Let $R, R', R'' \ldots R_n$ be a finite set of constants that belong to the constraint language. Each of these constants denotes a reference time. A simple integrity constraint is a statement of the form

$$?\psi(R, R', R'', \ldots, R_n) \textit{succeeds/fails}$$

where ψ, ϕ are formulas of the event calculus. The operational meaning of this statement is that the goal $\psi(R, R', R'', \ldots, R_n)$ must be made to succeed (or fail finitely).

The difference between the two definitions can be explained by means of an example. The model depicted by the following simple integrity constraint makes sure that the general model fits the specific world of the reader at this moment.

$$?\mathsf{HoldsAt}(reading(you, x), R), R = now \textit{ succeeds}$$

The following conditioned integrity constraint makes sure that if you are reading at this moment, the subject of your reading at this moment is indeed this thesis.

$$\textit{IF } ?\mathsf{HoldsAt}(reading(you, x), now) \textit{ succeeds}$$
$$\textit{THEN } ?\mathsf{HoldsAt}(thesis(x), now) \textit{ succeeds}$$

4.4.2 Hierarchical Planning

In addition to the primitive event types and fluents, EC allows us to treat complex eventualities with elaborated internal structure.

This is done by means of hierarchical planning. Let us look at one of the more complex eventualities we have constructed, the accomplishments. In our view the activity and the goal are inherently connected. So, the event is considered to be complete only if the exerted force enables achieving the goal.

Definition 9. A *hierarchically planned accomplishment* is a new event type defined as follows

$$\mathsf{Happens}(start_f, s) \wedge \mathsf{Happens}(finish_f, r) \wedge s < t \leq r \wedge \mathsf{HoldsAt}(f, t) \rightarrow \mathsf{Happens}(e, t)$$

For activities, however, there is no inherent terminal point. Thus to account for complete activities we would like to express that 'it ain't over till it's over'.

Definition 10. A *hierarchically planned activity* is a new event type defined as follows

$$\mathsf{Happens}(start_f, s) \wedge \mathsf{Happens}(stop_f, r) \wedge s < t \leq r \wedge \mathsf{HoldsAt}(f, t) \rightarrow \mathsf{Happens}(e, t)$$

Trivially, achievements and points are not extended events and thus we cannot define them as hierarchically planned. However, states might be of an extended/bounded nature, and by explicitly stating their initiating and terminating events we can view them as hierarchically planned as well.

Definition 11. A *hierarchically planned state* is a new event type defined as follows

$$\mathsf{Happens}(start_f, s) \wedge \mathsf{Happens}(finish_f, r) \wedge s < t \leq r \wedge \mathsf{HoldsAt}(f, t) \rightarrow \mathsf{Happens}(e, t)$$

where

$$\mathsf{Initiates}(start_f, f, s) \wedge \mathsf{Terminates}(stop_f, f, r)$$

4.4.3 Causes and Effects

By definition, a fluent is required not to hold at the moment it is initiated. Consider for instance axiom 3 (repeated here for convenience):

$$\mathsf{Happens}(e,t) \wedge \mathsf{Initiates}(e,f,t) \wedge t < t' \wedge \neg \mathsf{Clipped}(t,f,t') \rightarrow \mathsf{HoldsAt}(f,t')$$

Using the notion of minimality it can be shown that if e is instantaneous then f *cannot* hold at the same time it is initiated, and by similar argument f *must* hold at the time it is terminated.

However, we have just shown that e can be temporally extended in time. In this case, the completion of (52d) forces f to be true as soon as there is an instant in which $\mathsf{Happens}(e,t) \wedge \mathsf{Initiates}(e,f,t)$ holds. Similarly, f is false as soon as $\mathsf{Happens}(e,t) \wedge \mathsf{Terminates}(e,f,t)$ holds.[3]

4.4.4 Perfectivity

Finally, we include the following definition of perfectivity in EC with reference to the French Passé Simple.

> "Nothing in the setup of the EC requires that events occur instantaneously. Even if events and fluents are extended in time they are distinguished by the role they play in the EC. This is worth bearing in mind when thinking about linguistic examples. For example, it is sometimes maintained that in French the Passé Simple has the effect of making the event described punctual, to be placed inside the temporally extended background provided by a sentence in the Imparfait. As against this, Comrie [7] rightly argues that what matters is not punctuality, but lack of internal structure. The Passé Simple presents an event as a whole, disregarding its internal structure. Of course points do not have internal structure, but punctuality is not a necessary requirement for lack of structure." [52, p. 63]

The distinction between 'punctual' and 'perfective' should be kept in mind for subsequent discussion of the viewpoints contributed by various templates. It will turn to be crucial for the discussion of the *imperfective* viewpoint in the empirical part of the study.

[3] This arguments only work a minimal models.

Chapter 5

Modern Hebrew Verbal Aspect

5.1 Towards an Account of Hebrew Verbal Aspect

The proposed account of Hebrew verbal aspect advocates a view in which a verb in Hebrew is a constellation of *lexical* and *grammatical* morphemes that expresses aspectual choices of *situation type* and *viewpoint* respectively.

The lexical morpheme, the root, is assigned a situation type according to the classification we proposed in chapter 3. These classes are in turn extended with the formal description of thematic relations in the situation type.

We further advocate a view in which the grammatical morphemes are contributed by the Semitic templates that are fused with roots to form verbs in the language. According to our general hypothesis, (i) the Semitic templates are manipulated by the grammar (crucially, patterns of verbs are not determined in the lexicon), (ii) they have semantic contribution, and (iii) their semantic contribution is relevant to the internal structure of the event and affects its internal structure and temporal constituency.

However, these statements are far from trivial and therefore before elaborating the formal account I answer the following questions:

1. Do Hebrew verbs belong to the syntax or the lexicon of the language?
2. Do Hebrew verbal templates contribute to a verb's meanings?
3. Do Hebrew verbal templates carry aspectual meaning?

The first question belongs to the debate between lexicalists and non-lexicalists about the basic units of the form/meaning correspondence. The second and third are seen in the equivocal treatment given in the literature on *Binyanim* in Hebrew. On the one hand, they are treated as sharing semantic characteristics (e.g., [22]), and on the other they are rejected for making semantic predictions (e.g., [4]). In the

coming sections I review the contrasting approaches and justify the stance I take in this work.

5.1.1 Do Hebrew templates belong to the syntax or the lexicon?

There is a long-standing debate between lexicalists and non-lexicalists about the basic units of form/meaning correspondence. In lexicalist approaches 'words' have a special status. According to lexicalism words are created in a so-called 'lexicon', which is seen as "a place from which items are drawn for the syntax" [36, p. 201]. Words are created in the lexicon by processes distinct from syntactic processes of putting words/morphemes together. The underlying assumption here is that we 'know' about words things that we don't know about phrases or sentences, and these things we 'know' are essentially what we know about atomic morphemes, i.e., sound/meaning correspondence.

Marantz [36] argues against this view. He shows that special sound, special meaning and special structure/meaning do not coincide in the word level. Crucially, he shows that there is no sharp division between word and phrasal special meanings (as evident, e.g., in special meanings of idiomatic phrases). He argues against the special status of words, delegeting it to *roots*, claiming that they are the units that have 'special meanings'.

The proposed alternative is the framework of *Distributed Morphology (DM)*, that shows how grammar might look like without the lexicalist assumption. *DM* replaces the single lexicon with a number of distributed lists: (i) a 'narrow lexicon' which most directly replaces the lexicon and contains atomic roots and atomic bundles of grammatical features, (ii) a 'vocabulary' that includes connections between sets of grammatical and phonological features, thus providing the phonological form for terminal nodes in the syntactic tree, and (iii) an 'encyclopedia', a list of special meanings. The encyclopedia lists special meanings of roots, relative to their syntactic context.

If the morphology (of a word *or* a phrase) justifies decomposition into a complex structure of terminal nodes, the syntax creates this structure, and it is interpreted in the standard way, in which roots might have special meanings relative to a certain context.

A general theory in this framework is therefore one in which words and phrases are created in the syntax by the same mechanisms, and whether 'putting together' two constituents results in a word-like unit (formally 'fusing') or a phrasal category (formally 'merging') depends on the function(s) of the constituents themselves, not on the 'merger'.

The proposed framework is particularly appropriate for dealing with derivation of verbs in Hebrew. Doron [15] proposes that the Hebrew lexicon contains primitive

roots, and functional heads that are realized in the Semitic morphological templates. Hebrew verbs are constructed in the grammar by fusing roots with these morphemes, resulting in a word-like unit. The upshot of the discussion is that if the construction of verbs by the syntax is essentially the same as the construction of phrases then it can be subject to the same semantic predictions (allowing for some idiosyncracy at different levels of derivation).

Thus, we see the morphological templates as an integral part of the syntax, and crucially, they are *not* inherent in the verbal lexicon.

5.1.2 Do Hebrew verbal templates contribute to verbs' meanings?

The question of whether the templates have inherent meanings which they contribute to the meaning of the verb has received an equivocal treatment in the Hebrew Linguistics literature and textbooks.

Theoretically, Hebrew textbooks tend to characterize verbs that share morphological templates as sharing some semantic properties (as explained in chapter 2). Moreover, it is claimed by Hebrew theoretical linguists that *ideally*, the meaning of the verb should be predictable based on the meaning of the root and the corresponding templates (e.g., [46, 15]; this view is referred to by [4, p. 87–91] as 'total regularity').

In practice, linguists have argued against the possibility of making predictions based on root-template combinations (e.g., [4]). The reasons for this are, firstly, that Hebrew verbs show a lot of idiosyncracy (e.g., different root-template combinations can have the same meaning, the same root in different templates might have only remotely connected meanings) under which the morphological forms seem 'accidental', and secondly, the system is not fully productive (as required by the 'total regularity' view).

Doron [15] argues convincingly that while the semantic contribution of the templates is not transparent it is indeed systematic. The reasons for it being not transparent are that (i) the semantic contribution is mediated by an underlying classification (in her case, of the thematic domain), and (ii) according to principles of *DM* there is still some room for idiosyncracy in special meanings of roots relative to their contexts.

In this work I adopt the latter view. I conclude that while syntactically speaking roots are fused with templates to form verbs, semantically, *both* components make contributions to the verb meaning. The effect of the combination is, then, to some extent, predictable.

5.1.3 Do Hebrew verbal templates carry aspectual meaning?

The few works that deal specifically with Hebrew Aspect make it seem intuitively appealing that the verbal templates make a semantic contribution that is relevant to temporal phenomena. We quoted some evidence from various recent linguists work in section 2.3).

However, the aspectual contribution of the verbal templates has never been precisely defined and formalized. Doron's study [15] characterizes systematically the semantic contribution of the templates, but it focuses solely on the thematic domain and stays neutral with respect to aspectual phenomena (durativity, telicity, perfectivity, etc.). A different study [55] about the semantics of Hebrew lexical aspect concludes:

> "We have shown that the Binyanim system is related to aspectual classification in a number of ways but it still needs a more systematic observation to reveal the exact way in which these two interact." [55, p. 88]

It seems that the difficulty in tackling this problem stems from two empirical facts, that

1. verbs of a certain template do not form aspectually homogenous classes and it is easy to find states as well as accomplishments, punctual as well as temporally extended events, that adhere to the same template.
2. the system is not fully productive, as opposed to other more familiar grammatical aspectual morphemes.

However, we are now in a better position to tackle these issues. First, we have been shown by Doron how the thematic contribution is mediated by the thematic underlying classification. Thus, let us assume an underlying aspectual classification (in fact, the event classification framework proposed in chapter 3) and examine the semantic contributions *relative* to the preliminary semantic class of the verb.[1]

Secondly, according to the theory of markedness, aspectual choices should be evaluated relative to the available alternatives. So, we need not look for a seven-way alternation of all roots in all templates in order to evaluate their semantic value. Rather, we examine the semantic contribution of a template to a verb only in contrast to other existing alternative templates in the same root.

To do so we employ a *pairing* paradigm, which is useful for a treatment of aspectual phenomena (e.g., [48, 34]). We define aspectual *pairs* and evaluate the aspectual choices between the coupling verbs in order to reveal their contrastive values . The arrangements of the verbs in *aspectual pairs* is done according to an underlying theory of *markedness*.

[1] a formal definition of 'preliminary' will follow in the next section.

Equipped with this methodological foundation we are ready to explore various phenomena that may shed some light on the aspectual contribution of the verbal templates in Modern Hebrew, for instance, (i) how the changes in the thematic domain are relevant to the internal event structure, (ii) how, in fact, denominative verbs (derived from roots that correspond to nouns) 'get' their underlying event structure, and (iii) how such aspectual contributions interact with the grammatical tenses in Hebrew.

The remainder of this chapter is dedicated to the presentation of formal ingredients of the full account, and to elaborating the methodology we briefly mentioned . In chapter 6 this framework will be applied to the treatment of each of the Semitic templates, showing how their aspectual contribution *can* in fact, be systematized.

5.2 The Basic Account

5.2.1 Syntax

A model of distributed morphology assumes a narrow lexicon which contains the basic units of the langauge on which the syntax operates. In our case, the relevant units are a coarse-grained (tri-)[2]consonantal[3] roots (59) and the morphological templates (60).

(59) (Tri-)consonantal roots
  a. $\{R : R = [C][C][C]$, *[C] is a consonant*$\}$

(60) The templates
  a. i. Paal: B_{simple} (B_s)
  ii. Piel: $B_{\text{intensive}}$ (B_i)
  iii. Hiphil: B_{cause} (B_c)
  iv. Pual: $B^{\text{passive}}_{\text{intensive}}$ (B^p_i)
  v. Huphal: $B^{\text{passive}}_{\text{cause}}$ (B^p_c)
  vi. Niphal: $B^{\text{middle}}_{\text{simple}}$ (B^m_s)
  vii. Hitpael: $B^{\text{middle}}_{\text{intensive}}$($B^m_i$)
  b. $B = \{B_{\text{s}}, B_{\text{i}}, B_{\text{c}}, B^{\text{p}}_{\text{i}}, B^{\text{p}}_{\text{c}}, B^{\text{m}}_{\text{s}}, B^{\text{m}}_{\text{i}}\}$

[2]There exist also roots with 2,4 and even more consonants but they receive a slightly different treatment. We leave them out of the discussion, making only the point that they are invariably consonantal.

[3]Although roots may contain one of the vowel-letters *alef, heh, vav, yod* they are treated as consonants in this context. However they might introduce phonological constraints on the verb patterning. See [5] for further details.

(61) The verbal patterns[4]

a. Paal: $[C][C][C] + B_{\mathrm{s}} = CaCaC$
b. Piel: $[C][C][C] + B_{\mathrm{i}} = CiC(C)eC$
c. Hiphil: $[C][C][C] + B_{\mathrm{c}} = HiCCiC$
d. Pual: $[C][C][C] + B_{\mathrm{i}}^{\mathrm{p}} = CuC(C)aC$
e. Huphal: $[C][C][C] + B_{c}^{p} = HuCCaC$
f. Niphal: $[C][C][C] + B_{\mathrm{s}}^{\mathrm{m}} = NiCCaC$
g. Hitpael: $[C][C][C] + B_{\mathrm{i}}^{\mathrm{m}} = HiTCC(C)eC$

Following Doron [15, p. 37] I assume that verbs are constructed in the syntax by merging roots with other morphemes realized in the morphological templates. By principles of distributed morphology the phonological form for these syntactic combinations is supplied by a 'vocabulary'.[5] These combinations are unique in the sense that every verb in Hebrew must adhere to exactly one root and one template, and when a combination between a root and a template is grammatical, it is also unique.[6]

Definition 12. Let R be a consonantal root and $\mathsf{T} \in \{B_{\mathrm{s}}, B_{\mathrm{i}}, \ldots, B_{\mathrm{i}}^{\mathrm{m}}\}$ be a morphological template. The result of from fusing $\mathsf{R} + \mathsf{T}$ is unique verb V.

Definition 13. Let V be a verb in Hebrew. Let R be its consonantal root and $\mathsf{T} \in \{B_{\mathrm{s}}, B_{\mathrm{i}}, \ldots, B_{\mathrm{i}}^{\mathrm{m}}\}$ be the template it adheres to. So, let us call R_V and T_V *the root of* V and *the template of* V respectively.

Note that extracting the root of a verb need not be a trivial task because of the constraints and exceptions of the phonology/morphology interface (e.g., [13]). However, this need not change the fact that it is always determined.[7]

[4] Verb patterns may be subject to additional morphological enhancement based on phonological constraints, see [5] for further details.

[5] The 'vocabulary' in DM determines the relation between the terminal nodes in the morphosyntactic structure and their phonological realization. This component also takes care of morphological deviations from the template that are caused due to phonological constraints (e.g., when a root consists of a vowel). In the present account I ignore such phonological based alternations.

[6] In the present account I ignore lexical ambiguity in which a verb simply has two different meanings as in the form *pasak* in the following phrases

1. hagešem *pasak*
   the-rain *stopped*
   The rain *stopped*
2. hašoṗet *pasak* [...]
   the-judge *decided* [...]
   The judge *decided* [...]

[7] The method of extracting roots in order to derive new words was extensively used in the revival of the language, see chapter 2.

Now we can define different classes of verbs in Hebrew by virtue of their templates.

Definition 14. Let V be a verb in Hebrew, R_V be its consonantal root, and T_V be its template.

If $\mathsf{T}_V = B_{\mathrm{s}}$ we call V *a simple verb*.

If $\mathsf{T}_V = B_{\mathrm{i}}$ we call V *an intensive verb*.

If $\mathsf{T}_V = B_{\mathrm{c}}$ we call V *a causative verb*.

If $\mathsf{T}_V = B_{\mathrm{i}}^{\mathrm{p}}$ we call V *a passive intensive verb*.

If $\mathsf{T}_V = B_{\mathrm{i}}^{\mathrm{p}}$ we call V *a passive causative verb*.

If $\mathsf{T}_V = B_{\mathrm{s}}^{\mathrm{m}}$ we call V *a medio-passive verb*.[8]

If $\mathsf{T}_V = B_{\mathrm{i}}^{\mathrm{m}}$ we call V *a middle intensive verb*.

In addition, If $\mathsf{T}_V \neq B_{\mathrm{s}}$ we call V *a non-simple verb*.

Definition 15. Let V be a verb in Hebrew and let R_V be its consonantal root. The *simple form the verb* V_{s} is the result of fusing the root R_V of V with the simple template B_{s}

$$\mathsf{R}_V + B_{\mathrm{s}} = V_{\mathrm{s}}$$

Note that for simple verbs, the term *the simple form of the verb V* simply refers to the verb itself. For all others, we get a meaningful alternation that will play a role in our aspectual pairing paradigm.

The morphological patterning mechanism is not fully productive in the sense that not all possible $\mathsf{R}+\mathsf{T}$ combinations are allowed. Rather, some $\mathsf{R}+\mathsf{T}$ combinations are *ungrammatical*.

Definition 16. Let R be a consonantal root and T be a template. Let V be the result of form fusing $\mathsf{R}+\mathsf{T}$. We call the form V *grammatical* if it has a listed phonological form in the langauge 'vocabulary' and *ungrammatical* otherwise.

Note that *the simple form* V_{s} of a non-simple verb V might or might not be grammatical. For example, in (62) the simple form *yaǩan* of the verb *heǩin* is not listed in the vocabulary and is thus ungrammatical.

(62) a. $[y][\check{k}][n] + B_{\mathrm{c}} = he\check{k}in$ (to make)[9]

[8] I use this non-standard naming following other linguistic work in the area (e.g., [10]. This name stems from the non-standard trajectory of the semantic role of this form. See chapter 2 for further details.

[9] When we discuss constellations of roots with templates we illustrate the result by means of the masculine singular past form of the verb. This form is used since it reflects clearly the template, however, the translation abstracts from any tense/gender/number features.

b. $[y][\check{k}][n] + B_{\text{s}} = *ya\check{k}an$

5.2.2 Semantics

Verb meaning

The lexicon of Hebrew is assumed to consist of coarse-grained *consonantal roots*. These roots are primitive lexical morphemes that carry *basic meanings*. Ideally, the meaning of a particular verb is determined by the lexical morpheme together with the contribution of the template it adheres to.

By the principles of distributed morphology, the model assumes an *encyclopedia*, a list of special meanings ([36, 28] and see also [15, p. 38]). The encyclopedia lists the idiosyncratic meanings of particular syntactic combination. Crucially, linguistic expressions in the encyclopedia may be of any size, ranging from primitive lexical morphemes to fully constructed idiomatic phrases.

With respect to cognitive capacities, I assume that this list of meanings is stored in the *semantic memory* under 'encyclopedic knowledge'[10] [52, p. 37]. For practical applications, I assume that the encyclopedic meaning of a root can be approximated by the meaning of the simplest morphological environment in which the root is realized.

The simplest morphological environment in the verbal domain is the *simple form* of the verb. If the simple form alternation is not grammatical, the simplest morphological environment might be realized in a noun, an adjective, or even an adverb[11] (e.g., the simplest morphological environment of the root $[m][h][r]$ is $maher$ (quickly)).

Last, I assume that the 'regularities' (the semantic features) manifested in the template are also stored in the semantic memory.

Following Doron [15, p. 37] I assume that templates make systematic contributions to verb meanings that are realized in two dimensions of functional heads. These functional heads, in turn, are realized in the Semitic templates. These functional heads are the *agency* heads ι and γ, and the *voice* heads π and μ. Their semantic contribution with respect to the thematic domain is captured according to Doron by the following features:

1. The *agency* heads:
   (a) ι intensive agency

[10] Semantic memory contains conceptual and encyclopedic knowledge, that is, knowlegde about word meanings and about regularities in the world. In the EC framework, it is the component which in effect allows us to incorporate 'world knowledge' into the account.

[11] By 'simplest' I mean, basically, no additional consonants, and low(er) vowels.

(b) γ causative agency

2. The *voice* heads
   (a) π passive voice
   (b) μ middle voice

The features are realized by the various templates as follows:

1. The *active* templates:
   (a) B_{simple} The simple template
   (b) $B_{\text{intensive}}[+\alpha]$ The intensive template
   (c) $B_{\text{causative}}[+\gamma]$ The causative template
2. The *passive* templates:
   (a) $B^{\text{passive}}_{\text{intensive}}[+\alpha, +\pi]$ The intensive passive template
   (b) $B^{\text{passive}}_{\text{causative}}[+\gamma, +\pi]$ The causative passive template
3. The *middle* templates:
   (a) $B^{\text{middle}}_{\text{simple}}[+\mu]$ The simple middle template
   (b) $B^{\text{middle}}_{\text{intensive}}[(+\gamma), +\mu]$ The (intensive) middle template

I claim that the very same semantic features are relevant for systematically explicating aspectual phenomena. The purpose of this study is to define how exactly they affect the internal event structure and its time schemata.

Verbal Aspect

The current proposal advocates a view in which the 'aspect' of Hebrew verbs (in the sense of their 'internal temporal constituency') is jointly determined by the Root and the Template.

In our formal framework, events under the denotation of verbs may correspond to any one of the quadruples presented in chapter 4, repeated here together with their characterizing scenarios (as 5.2.2) for convenience.

(63) *State:* $\langle -, -, -, + \rangle$
   1. $\mathsf{HoldsAt}(f_3, t)$

(64) *Activity (strict):* $\langle +, -, -, - \rangle$
   1. $\mathsf{Initiates}(e, f_1, t)$

(65) *Activity (wide):* $\langle +, +, -, - \rangle$
   1. $\mathsf{HoldsAt}(f_2(x), t) \rightarrow \mathsf{Trajectory}(f_1, t, f_2(x'), d)$

2. $\mathsf{Initiates}(e, f_1, t)$
3. $\mathsf{Releases}(e, f_2, t)$

(66) *Achievement:* $\langle -, -, +, + \rangle$
1. $\mathsf{Initiates}(e, f_3, t)$

(67) *Accomplishment:* $\langle +, +, +, + \rangle$
1. $\mathsf{Initiates}(e, f_1, t)$
2. $\mathsf{Releases}(e, f_2(x), t)$
3. $\mathsf{HoldsAt}(f_2(x), t) \rightarrow \mathsf{Trajectory}(f_1, t, f_2(x'), d)$
4. $\mathsf{HoldsAt}(f_1, t) \wedge \mathsf{HoldsAt}(f_2(c), t) \rightarrow \mathsf{Happens}(e_1, t)$
5. $\mathsf{Initiates}(e_1, f_3, t)$
6. $\mathsf{Terminates}(e_1, f_2, t)$

(68) *Semelfactive:* $\langle -, -, +, - \rangle$
1. $\mathsf{Happens}(e, t)$

The adopted event classification framework refers to descriptions of situations rather than verbs, and they might as well be phrases or sentences. Also, according to the principles of distributed morphology any kind of linguistic expression can be subject to a form/meaning correspondence. Thus, there is no apparent reason to limit ourselves to verbs. However, since we would like to account for the contribution of the templates to the result aspectual meaning of Hebrew verbs *regardless* of other lexical morphemes in the verb environment, I associate eventualities with verbs in the following sense:

Definition 17. A Hebrew verb V is said to be *associated* with an eventuality e in the sense of definition (5.2.2) if it typically heads phrases that denote this kind of eventuality.

According to the eventuality associated with the verb, we can apply a default scenario to it.

Definition 18. Let V be a verb in Hebrew, let e be the eventuality denoted by V, and Let $SCEN$ be the scenario of e (in the sense of the definition (5.2.2)). Thus, $SCEN$ is defined to be the default scenario $DSCEN$ of V.

Moreover, we assume that the aspectual meaning of the verb is jointly determined by the root and the template. Roots are primitive lexical morphemes that have basic meanings, which in turn can be related to one of the semantic classes. In order to evaluate the semantic contribution of the templates it is not sufficient to assign eventualities to verbs, we need to assign them to roots.

We approximate the basic meaning of roots via their simplest morphological environment. If the root is grammatical in the simple form, the meaning of the simple form of the verb is used to determine the aspectual class of the root.

Definition 19. Let R be a root and let $V = \mathsf{R} + B_{\mathrm{s}}$ be its simple verb form. If V is grammatical, and is associated with eventuality of type e, then, e is associated to the Root R.

If the root, when put through the simple form, doesn't yield a grammatical result, we need to refer to available nouns or adjectival forms in the language.

Definition 20. Let R be a root and let $V = \mathsf{R} + B_{\mathrm{s}}$ be its verbal simple form. If V is ungrammatical, we call R a denominal root.[12]

Definition 21. Let R be a denominal root. Then, the basic meaning of the root is the meaning of the simplest morphological environment in which the root is realized (noun/adjective).

Definition 22. For a denominal root R let $P(x)$ be its noun/adjective predicate value. We define a parameterized fluent $f(x)$ such that $\exists c[P(f(c))]$ and $P(f(c))$ is some[13] meaning of the noun/adjective associated with the root.

Now, according to the eventuality associated to the Root, we can apply a default scenario to it.

Definition 23. Let R be a verb in Hebrew, let e be the eventuality denoted by R, and Let $SCEN$ be the scenario of e (in the sense of the definition 5.2.2). Thus, $SCEN$ is defined to be the default scenario $DSCEN$ of R .

Roots are primitive lexical morphemes with basic meanings that are used by the syntax to derive verbs. When a combination of the root with the simple form is grammatical, the resulting simple verb approximates the basic (i.e., unmodified) aspectual class of the root. This aspectual meaning provides a preliminary scenario for the derivation process.

Definition 24. Let R be a root and let $V = \mathsf{R} + B_{\mathrm{s}}$ a simple verb. Suppose V is grammatical, and is associated with an eventuality of type e . Let $DSCEN$ be the default scenario denoted by e . $DSCEN$ is defined to be the *preliminary scenario* $PSCEN$ of V and of R .

[12]Note that the current definition of *denominal roots* is internal to the current study and is used for two practical reasons: (i) to precisely partition the set of roots into verbal and nominal for the purpose of systematic analysis, (ii) to allow approximation the meanings of roots when a simple form is not applicable. However, there may be roots we refer to as verbal (e.g., $[y][l][d] + B_{\mathrm{s}} = yalad$ (give birth)) but that conceptually can be claimed to be derived from nouns (as in [15]). The discussion of whether such roots are inherently verbal or nominal is diachronic, speculative, and in any case out of the scope of this study.

[13]For degree predicates this need not be a definite value.

For denominal roots, $PSCEN$ contains a single statement that Releases the value of the parameterized fluent to change.

Definition 25. For a denominal root R associated with a predicate $P(x)$ and a parameterized fluent f such as $P(f(c))$, the $PSCEN$ contains a single statement Releases(e, f, t) universally quantified with respect to time, where e is a canonical start event and f is the parameterized fluent. This scenario is in turn associated with an eventuality e which is abbreviated as $\langle -, +, -, - \rangle$.

Note that $DSCEN$ is a general notion associating (any) verb with a default scenario. $PSCEN$, however, is the default scenario of the basic lexical morpheme of the verb, the root. For simple verbs in which the meaning of the root is assumed to remain unmodified $DSCEN = PSCEN$. For non-simple verbs, $DSCEN$ might differ from $PSCEN$ due to the contribution of the functional heads.

The functional heads realized in the morphological templates introduce *criteria* for the event structure of the result verb, in the sense that they specify components of the event structure that must be introduced in the scenario, and/or alter its reference point.

Definition 26. Let T be a non-simple template. *Criteria* C_{T} of T may contain:

1. General statements, universally quantified with respect to time and unknown parameters for the required fluents/event types
2. Integrity constraints that (re)define the *reference point* of the scenario of the fully constructed verb

Roots are associated with eventualities. The criteria of a template is applied to the root and this might change the scenario. The criteria, however, remain compatible with features of the eventuality associated with the root. We say that the contribution of the template is *mediated* by the underlying classification, and the template criteria are *relative* to $PSCEN$.

Now, we are ready to formulate our main hypothesis:

Definition 27. Let V be a verb in Hebrew and let $\mathsf{R}_V, \mathsf{T}_V$ be its root and template respectively. Let $PSCEN$ be the preliminary scenario of R and let $C^{\mathsf{e}}_{\mathsf{T}}$ be the criteria of the template relative to the eventuality e associated with the root R .

1. The situation type of V can be calculated by *adding* the general statements in C^e_T to $PSCEN$. The result scenario $RSCEN$ (together with its abbreviated quadruple) defines the situation type of the result verb.[14]
2. The Reference point for the result scenario can be calculated by *adding* the

[14] cf. additive coercion [52, p. 171]

integrity constraints to the ones defined by the grammatical tense of the inflected verb. In case of a contradiction the integrity constraints defined in the criteria override the ones defined by the tense.

The result of *adding* criteria general statements to the preliminary scenario is defined as follows:

Definition 28. The result scenario $RSCEN$ is the result of *adding* $C_{\mathsf{T}}^{\mathsf{e}}$ statements to $PSCEN$ and is calculated as follows:[15]

1. *a union of the statements:* take the union of the statements of $PSCEN$ and the criteria $C_{\mathsf{T}}^{\mathsf{e}}$ (no repetitions).
2. *unification of fluents/event types:* if a general statement in $C_{\mathsf{T}}^{\mathsf{e}}$ is identical in its form to a statement in $PSCEN$ delete it and identify its parameter fluents/event types in $C_{\mathsf{T}}^{\mathsf{e}}$ with the corresponding ones in $PSCEN$. Update the instantiated parameters in the other statements that refer to it in $C_{\mathsf{T}}^{\mathsf{e}}$.
3. For remaining uninstantiated fluents/event types, semantic memory provides appropriate instantiations (based on world knowledge).

It is worth mentioning that the above algorithm for calculating situation type *does not* calculate the complete *meaning* of the verb. This might be subject to some idiosyncracies and have a listed meaning in the encyclopedia. Our goal is a more modest one. The calculation abstracts away from the full meaning of the verb and produces as output the internal temporal constituency of the result verb. Thus we can predict (via a computational derivation) the situation type of the result verb and still allow for a certain amount of idiosyncracy.

5.2.3 Tense

Hebrew grammaticalizes three absolute tenses, *past*, *present* and *future*, each of which encompasses various aspectual categories known from other languages as exemplified in chapter 2.

Technically, our formalization of the tenses relies on a Reichenbachian [42] notion of reference time (R). Tense relates the reference time (R) to the speech time (S), in practice the deictic center *now*. In Reichenbach's framework, the reference time needs to be common knowledge between the hearer and the speaker, while the event time (E) (the time of the event's actual occurrence) need not. Thus the reference time and event time are distinct.

In Hebrew, R and E coincide in the definition of the three absolute tenses. We maintain Reichenbach's distinction bearing in mind that in all the cases we are

[15] An illustration of the algorithm will follow in the discussion of the intensive template.

going to treat $E = R$ holds. It is worthwhile maintaining the distinction since it might play play an important role in the analysis of tenses in subordinate clauses.[16]

In the EC formal framework the reference time R is introduced by means of integrity constraints (see chapter 4). These integrity constraints are introduced on top of the lexical material provided by the scenario, and force the relation between the reference time and speech time to be updated in the database, creating a distinct model of the discourse.

The objects that are referred to by the reference time need not be punctual. In fact, reference time can be defined for primitive event types, fluents, and hierarchically planned events. In languages that grammaticalize aspectual distinctions (e.g., (im)perfectivity) this plays a role in the definition of the reference time.

Following [52] we propose that tense should be defined *relative* to the situation type. The intuition behind this is that in order for an extended event to lie in the past (e.g., an accomplishment) we need to account for more than a punctual event occurrence at an instant prior for the time of speech. In Hebrew we rely on the default aspectual properties of the event defined by its default scenario $DSCEN$.

Definition 29. Tense for states $\langle -, -, -, + \rangle$
For states represented by a fluent f_3, the past/present/future is given by the following integrity constraints:

$$?\mathsf{HoldsAt}(f_3, R), R < now \textit{ succeeds}$$

$$?\mathsf{HoldsAt}(f_3, R), R = now \textit{ succeeds}$$

$$?\mathsf{HoldsAt}(f_3, R), R > now \textit{ succeeds}$$

Definition 30. Tense for (strict/wide) activities $\langle +, \pm, -, - \rangle$
For (strict/wide) activities represented by a fluent f_1, the past/present/future is given by the following integrity constraints:

$$?\mathsf{HoldsAt}(f_1, R), R < now \textit{ succeeds}$$

$$?\mathsf{HoldsAt}(f_1, R), R = now \textit{ succeeds}$$

$$?\mathsf{HoldsAt}(f_1, R), R > now \textit{ succeeds}$$

[16] When dealing with sentences like the following

1. hu ra'a shehem holxim
   he saw that-they walk (lit. he saw they were walking)
2. hu avad kshehem nixnesu
   he worked when-they came-in (lit. he was working when they came in)

It seems that the subordinate clause reinstantiates the reference time, giving rise to notions of anteriority and simultaneity, allowing expression of temporal relations similar to those found in English present/past/future progressive. Unfortunately, the treatment of tense in subordinate clauses is beyond the scope of this study.

Definition 31. Tense for points/achievements $\langle -, -, +, \pm \rangle$
For points/achievements represented by an event type e, the past/future is given by the following integrity constraints:

$$?\mathsf{Happens}(e, R), R < now \textit{ succeeds}$$

$$?\mathsf{Happens}(e, R), R > now \textit{ succeeds}$$

Interestingly, the present tense in Hebrew is not compatible with instantaneous events. Thus, in the following examples the original meaning of the achievement (punctual) is shifted in various ways to accommodate the present tense. In (69) the present verb is coerced to a run-up achievement (in the same way it is done for progressive achievements in English), in (70) it is coerced to an extended activity and in (71) the event will take place in the near future. With certain adverbial modifiers, it can also get a habitual reading as in (72).

(69) a. hu nafal etmol
he fell yesterday
He fell yesterday

b. hu nofel achshav
he falls now
He is falling now

(70) a. hu hivxin ba etmol bacohorayim
he noticed her yesterday at-the-noon
he noticed her yesterday at noon

b. hu mavxin ba hayom kol hayom
he notices her today all the-day
He is noticing her today all day[17]

(71) a. hu higia
he arrived
He arrived

b. hu magia
he arrives
he is arriving

(72) a. hu hivxin ba etmol bacohorayim
he noticed her yesterday at-the-noon
he noticed her yesterday at noon

b. hu mavxin ba kol yom bacohorayim
he notices her every day in-the-noon
He notices her every day at noon

[17]This utterance is equally strange in Hebrew, providing the meaning of, roughly a repetitive/extended activity

This shows us the distinct nature of the present tense, the *benoni*. We noted in chapter 2 that the present tense in Hebrew is distinct in its properties, historically and syntactically. With respect to aspect, the present tense represents an intermediate level between past and future and gets a default on-going interpretation. Thus, it is not compatible with punctual events, and is not natural for treating events as a 'complete whole' (perfective).

Further evidence for this default feature comes from contrasting the passive voice of the simple verb with its present participle.

(73) a. habayit nivna
the-house built_{v}
The house is (being) built

b. habayit banuy
the-house $\text{is-built}_{\text{adj}}$
The house is built

The verbal utterance in (73a) differs in meaning from (73b), the present participle. (73a) does not entail the existence of a house and (73b) does. The present participle has different properties than the verbal present forms and is sometimes taken to denote 'perfectivity'.[18]

I conclude that the present tense in Hebrew has a default feature of 'imperfectivity', and that punctual or completed events in the present need to be coerced into different kinds of situation types to accommodate the present tense.

Definition 32. Tense for run-up achievement[19]/accomplishments $\langle +, +, +, + \rangle$
For achievements/accomplishments represented by a full quadruple the past/present/future is given by the following integrity constraints,

$$?\mathsf{HoldsAt}(f_1, R), R < now \textit{ succeeds}$$

$$?\mathsf{HoldsAt}(f_1, R), R = now \textit{ succeeds}$$

$$?\mathsf{HoldsAt}(f_1, R), R < now \textit{ succeeds}$$

Note that for Hebrew accomplishments there is no guarantee of the completion of the accomplishment. Thus both of the following utterances are felicitous:

(74) a. Dani bana bayit vesiyem liv̌not oto
Dani built house and-finish to-build ACC-it
Dani was building a house and finished building it

[18] For an elaborated discussion of this specific construction and relevant aspectual distinctions consult [14].

[19] A run-up achievement is an achievement with an extended preparatory phase (cf. progressive achievements in [52, p. 172] and [44, ch. 2])

b. Dani bana bayit ve'adayin lo siyem liv̆not oto
Dani built house and-still not finish to-build ACC-it
Dani was building a house and still has not finish building it

These definitions are the departure point for the resolution of queries regarding the scenarios of Hebrew verbs, and they are construed in accord with the default internal structure of situations. The templates may alter these definitions by means of additional integrity constraints which in turn trigger a different (temporal) interpretation of the analyzed piece of discourse.

5.3 Methodology

5.3.1 Aspectual Choice in Hebrew

Our methodology is based on our discussion of aspectual choice and the theory of markedness in chapter 3.

Ideally, a speaker conveys some basic meaning by choosing basic lexical morpheme(s) (i.e., roots) and conveys a viewpoint by choosing the morphological template in which she would like to convey it. However, in Modern Hebrew not all root-template combinations are allowed. So, according to the theory of markedness the choice is evaluated only to the extent that it contrasts with its alternatives. Within the subset of alternatives, a choice of one template over the other may be marked or not.

In order to characterize the (un)marked choice of speakers we need to (i) define the option space, (ii) identify subsets of alternating templates, and (iii) within such subsets identify which are the *marked* choices of the speakers.

In practice, we are going to arrange the templates in alternating *aspectual pairs* and analyze aspectual choice in every alternating pair. We then show how this method can be extended to account for choices between larger subsets of alternatives.

5.3.2 Markedness in Hebrew

The Semitic morphological templates form a *closed system* which is a set of exactly seven patterns (table 5.1). In order to define the kind of system we are concerned with let us first try to identify the unmarked/marked members in it.

(75) $B = \{B_{\mathrm{s}}, B_{\mathrm{i}}, B_{\mathrm{c}}, B_{\mathrm{i}}^{\mathrm{p}}, B_{\mathrm{c}}^{\mathrm{p}}, B_{\mathrm{s}}^{\mathrm{m}}, B_{\mathrm{i}}^{\mathrm{m}}\}$

	simple	*intensive*	*causative*
Active	B_{s}	B_{i}	B_{c}
Passive	—	$B_{\mathrm{i}}^{\mathrm{p}}$	$B_{\mathrm{c}}^{\mathrm{p}}$
Middle	$B_{\mathrm{s}}^{\mathrm{m}}$	$B_{\mathrm{i}}^{\mathrm{m}}$	—

Table 5.1: The Morphological Templates Grid

	Simple	*Intensive*	*Causative*	*(vocalization)*
Active	$CaCaC$	$CiC(C)eC$	$HiCCiC$	
Passive	—	$CuC(C)aC$	$HuCCal$	*u-a*
Middle	$NiCCaC$	$HiTC(C)aeC$	—	*i-a(-e)*
(consonants)		doubled (C)	prefixed H	

Table 5.2: Morphological Templates Morphological Material

Morphological markedness

According to Comrie, marked categories tend to have more morphological material then unmarked categories [7, p. 114]. With regard to the morpho-syntactic account we presented we describe the morphological material (consonants and vowels) added to the root in the various templates as follows in table 5.2.

Comrie's morphological criterion already gives us one level of (un)markedness, namely that the simple form of the verb is unmarked with respect to the others. The other forms are morphologically marked with respect to the simple form with additional consonants and/or varying vocalization.

This marked/unmarked partition is reflected also in our semantic account as we have identified the simple form with the *unmodified* meaning of the root, and the rest of the templates as semantically marked with *agency* and *voice* features.

With respect to the partition into simple/non-simple templates the system is *asymmetrical* in the *subordinative* sense. Non-simple forms of verbs give additional (specific) information about the meaning of verbs, of which the simple form of the verb in the same root remains silent.

Agency marking

In order to identify the marked choice between templates that realize different agency heads let us first fix our domain to the three active templates

$$\{B_{\mathrm{simple}}, B_{\mathrm{intensive}}, B_{\mathrm{cause}}\}$$

In this set, the simple form B_{s} is morphologically and semantically unmarked with respect to the others. Morphologically, it has the least additional morphological material with respect to the root and semantically, it is not modified by any semantic features.

In this case the *unmarked* choice refers to the 'general' and the marked choice refers to the 'specific'. The simple verb form may denote any kind of eventuality, with any internal event structure. The intensive and causative agency heads provide additional information with respect to the event structure that makes it of a more specific kind. Thus, in the alternation between $B_{\mathrm{s}}/B_{\mathrm{i}}$, $B_{\mathrm{s}}/B_{\mathrm{c}}$, B_{s} refers to the 'general' and $B_{\mathrm{i}}/B_{\mathrm{c}}$ refers to the 'specific'.

The crucial point is that the unmarked/marked choice is relevant only to the alternation between the simple form B_{s} and any of the other two active forms, B_{i} and B_{s}. There is no marked choice in the alternation between B_{i} and B_{s} because they are both marked with features which are symmetrical in the sense that each feature specifies information that the other remains silent about.

The system formed by this triple is, thus, *asymmetric* in the *subordinative* sense (according to the definition on chapter 3) and the marked choice adds specific information that the unmarked option remains silent about.

Interestingly, this dimension is 'consonantally' marked; the intensive template is marked with a doubled middle morpheme (that can be seen as iconically marking *intensity*), and the causative template is marked with a prefixed *heh* (h) (that can be seen as iconically marking a preceding cause).

Fortunately, the conclusions in the discussion of this triple can be replicated in the other parallel sets of template (namely the *passive* and the *middle* templates that form the parallel lines in the table 5.2). Morphologically, the alternations are consonantly marked (with additional consonants and sometimes an added prefix), and semantically with specifying additional information that the simple form remains silent about.

Voice marking

In order to identify the marked choice between templates that realize different voice heads let us first fix our domain to the fully specified triple of the intensive templates

$$\{B_{\mathrm{intensive}}, B^{\mathrm{passive}}_{\mathrm{intensive}}, B^{\mathrm{middle}}_{\mathrm{intensive}}\}$$

All the members in this triple are characterized by a double middle consonant but differ in the vocalization that is assigned to the consonants. Here, the intensive form B_{i} is morphologically and semantically unmarked and $B^{\mathrm{p}}_{\mathrm{i}}$,$B^{\mathrm{m}}_{\mathrm{i}}$ are modified by varying vocalization and the voice semantic feature.

On a par with the morphological material of the three, we assign the *unmarked* category with the feature of *active* voice and the marked categories *u-a* and *i-a(-e)* with the features of *passive* voice and *middle* voice respectively. The system is thus *symmetric* and the domain is divided between three positive contrasting values, *active, passive* and *middle*.

However, the morphologically *marked* choices in this system refer to the non-standard as opposed to the conventional. The *active* voice is much more standard usage, and the alternation to one of the other two results in a less conventional use and is made to serve some specific purpose. Semantically, the system is *asymmetric* in the *privative* sense as the unmarked choices specify negative information with respect to the marked categories (namely, that it is non-passive/middle voice).

The point that was made for the agency marking applies also here. The semantically relevant aspectual choice is made between unmarked/marked options $B_{\mathrm{i}}/B_{\mathrm{i}}^{\mathrm{p}}$, $B_{\mathrm{i}}/B_{\mathrm{i}}^{\mathrm{m}}$ rather then between the two marked ones $B_{\mathrm{i}}^{\mathrm{p}}/B_{\mathrm{i}}^{\mathrm{m}}$.

Again, we can replicate our findings in the other voice dimensions (the simple templates and the causative templates) and conclude that, in this case, marked choices are morphologically marked by vocalization and that semantically they are used to mark the unusual versus the conventional.

A note about the middle templates: it is easy to see that the morphological correspondence between the middle templates (last line in table 5.2) and the active templates (first line in table 5.2) is weaker than the correspondence between the active and passive (first and second lines). This fact is morphologically manifested by the additional consonants *nun, taw* (n,t) in addition to the voice morphological contribution (the varying vocalization).

This morphological evidence, together with the historical debate about the origin and orientation of these forms (chapter 2) justifies a slightly different treatment of their semantical contribution. According to Doron [15] the middle voice morphemes modify the root rather than a fully constructed verb as is the case with the passive ones. Thus, they should receive a treatment which is similar to the agency morphemes in the active templates.

Recall that the active templates were examined relative to the simple template that approximates the meaning of the root. Thus, we examine alternations between the middle templates $B_{\mathrm{s}}^{\mathrm{m}}$ $B_{\mathrm{i}}^{\mathrm{m}}$ and the simple form B_{s}, in order to evaluate the contribution of the middle morpheme. Trivially, the marked choice between the middle pattern and the simple one is the former since it is morphologically and semantically marked with the middle morpheme.

'Grammaticality' marking

In the preceding sections we focused on existing alternations between templates that use the same root, bearing in mind that not all root-template combinations are grammatical. In this section we are concerned, to some extent, with the remaining ungrammatical combinations.

According to Smith [47] the grammaticality of aspectually marked choices depends on the language. Different situation types and viewpoints might have some default correlation. A marked aspectual choice that involves a non-typical combination of situation type and viewpoint may sound grammatically odd or even ungrammatical.

In Hebrew, a language with a very limited set of grammatical morphemes to denote tense (let alone aspect) it is not too uncommon to find odd, ungrammatical or new constructions.[20] This can be done by accident by speakers that learn the language (Hebrew as L2) or on purpose by proficient speakers in order to make subtle distinctions.

Such combinations are, for the most part, successfully parsed by hearers. Sometimes new combinations find their way into the langauge. 'Street language' and slang benefit extensively from this effective means of combining a simple meaning with certain 'dynamics' and is rich in word formations that involve nouns, adjectives, and other real world properties.

To illustrate some of this phenomena, consider the following examples. In (76) the intensive form is undoubtedly odd, however it is grammatical[21] and is used to denote a subtle distinction between making someone laugh (which ought to be a result of an activity), and causing someone to laugh (which might as well be punctual, accidental).

(76) a. $[c][x][k] + B_{\text{s}} = caxak$ (to laugh)
b. $[c][x][k] + B_{\text{i}} = ?cixek$ (to make someone laugh)
c. $[c][x][k] + B_{\text{c}} = hicxik$ (to cause someone to laugh)

Our Hebrew speaking readers might be more familiar with our next two examples. The 'childish' utterance in (77b) can be used (accidently by children or on purpose by adults to describe a *process* of getting wet, as opposed to 'get wet' that refers to (puts emphasis on) the *result state* of getting wet. The 'adultish' slang utterance in (78b) refers to hanging out in the 'hippest' street in Tel-Aviv during the seventies, 'Dizengof' street.[22]

[20] By 'odd' I mean a root-template combination that is rare in colloquial usage. By 'ungrammatical' I mean that the result of the root-template combination is not defined by the 'vocabulary' and/or its special meaning is not listed in the 'encyclopedia'.

[21] According to 'Even Shoshan Dictionary'.

[22] The term found its way into the language around the seventies (see Yonatan Gefen 'xomer tov'

(77) a. $[r][t][v] + B^{\mathrm{m}}_{\mathrm{s}} = nirtav$ (to get wet)

b. $[r][t][v] + B^{\mathrm{m}}_{\mathrm{i}} = hitratev$ (to become wet)

(78) a. $Dizengo\check{p}$ (a person/street name)

b. $[d][z][n][g][\check{p}] + B^{\mathrm{m}}_{\mathrm{i}} = hizdange\check{p}$ (walk about/hang out in Dezingof street)

These aspectual choices are made to mark subtle distinctions or deviations from the standard view of the situation and a particular stance taken by the speaker. Regardless of the fact that some utterances are more grammatical then others, they are all being used in colloquial speech and are successfully parsed by the listener.

Although in the current account we deal only with the grammatical, the application can be extended to deal with such 'ungrammatical' utterances, and we draw special attention to such phenomena in the empirical part of the study.

Summary

So far we have identified four levels of markedness in the Hebrew verbal systems. First, we isolated the single morphologically unmarked member, the simple template B_{s} with respect to all the others, which are marked with additional morphological material and modifying semantic features.

Secondly, in the *agency* dimension that is fixed on *asymmetrical subordinative* subsets, the *intensive/causative* alternations are marked 'consonantally' with respect to the simple form, and indicate the specific as opposed to the general. Lastly, the *voice* dimension that is fixed on *asymmetrical privative* subsets divides the option space between three contrasting values *active*, *passive* and *middle* and the alternations are marked by vocalization and are manifested in less conventional uses.

An evaluation of ungrammatical marked choices cannot be done within the basic account I develop, as here I am concerned only with the formally grammatical. However in the empirical part of the study we can find further support for the view that the templates indeed carry some aspectual meanings, since in light of the lack of other linguistic means template alternations are employed to endow situations with less-conventional properties.

5.3.3 Aspectual Pairing

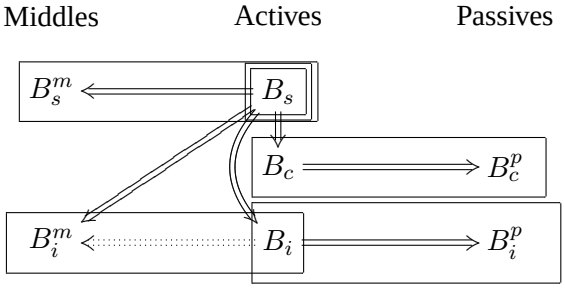
In order to evaluate the systematic contribution of templates we are going to to look at pair alternations rather than a seven-way classification. Not every pair is

p. 33). The street and the word are still extant however they are far less 'hip' and less used, and so the verb is, admittedly, no longer in use.

relevant to the discussion, but only ones that confine to certain marked/unmarked pairs that appear in the fixed domains we identified above.

The diagram below summarizes the aspectual alternations we are going to consider in the next chapter. The relevant alternations appear in bold arrows and the direction of the arrow shows the direction unmarked-to-marked.

Since we approximate the meaning of the simple verbs in our account with the unmodified meaning of the root, we can identify alternations with the root as alternations with the simple form of the verb, when such exist. If the simple verb form is ungrammatical, we take a noun/adjective simple morphological environment to approximate the unmodified meaning of the root. If such an environment does not exist and there is no meaningful alternation the contribution of the template is taken as opaque.



All the aspectual pairs we identified appear in the grid in table 5.2 on one (horizontal/vertical) dimension. A discussion of a diagonal pair, e.g., $B_{\mathrm{s}}/B_{\mathrm{i}}^{\mathrm{c}}$, should go through a middle term, which in the example is B_{i}. The aspectual choice then involves two levels, the choice between $B_{\mathrm{s}}/B_{\mathrm{i}}$ and the choice between $B_{\mathrm{i}}/B_{\mathrm{i}}^{\mathrm{c}}$.

A discussion of two symmetrically marked choices, e.g., $B_{\mathrm{i}}/B_{\mathrm{c}}$, should go through the middle term connecting them and evaluating the differences between the two aspectual choices with respect to their semantic 'least common denominator' (usually this is the basic meaning of the root).

One exception is the treatment of the middle templates, which we may consider a direct alternation with the B_{s} that conveys the basic meaning of the root.

Chapter 6

Modern Hebrew Verbal Templates

6.1 The Simple Template: Paal

The simple template, *Binyan Paal*, B_{s} in our notation, is morphologically and semantically the simplest. Morphologically, since it consists only of the root consonants and a basic vocalization (low vowels), and semantically since in this template the basic meaning of the root is assumed to remain unmodified.

Examples:

(79)
a. $[a][h][\check{b}] + B_{\mathrm{s}} = ah a\check{b}$ (love)
b. $[y][\check{s}][\check{b}] + B_{\mathrm{s}} = ya\check{s}a\check{b}$ (sit)
c. $[h][l][\check{k}] + B_{\mathrm{s}} = hala\check{k}$ (walk)
d. $[d][x][f] + B_{\mathrm{s}} = daxaf$ (push)
e. $[\check{s}][\check{b}][r] + B_{\mathrm{s}} = \check{s}a\check{b}ar$ (break)
f. $[a][\check{k}][l] + B_{\mathrm{s}} = a\check{k}al$ (eat)
g. $[n][g][\prime] + B_{\mathrm{s}} = naga$ (touch)

In our theory of markedness we identified it as the ultimately unmarked member in the entire set and the unmarked choice within any alternating pair that includes it. Also, we noted that the unmarked choice here denotes the general rather than the specific.

Indeed, we can find every kind of eventuality associated with verbs in the simple form. (80)–(85) list examples of verbs that are formed by fusing a root with the

simple template. These verbs typically denote[1] *states, strict* and *wide activities, achievements, accomplishments* and *semelfactives*.[2]

(80) *State:*
  a. $[y][d][']+B_{\mathrm{s}}=yada$ (know)
  b. $[a][h][\check{b}]+B_{\mathrm{s}}=ah\check{a}b$ (love)

(81) *Activity (strict):*
  a. $[y][\check{s}][\check{b}]+B_{\mathrm{s}}=ya\check{s}a\check{b}$ (sit)
  b. $[y][\check{s}][n]+B_{\mathrm{s}}=ya\check{s}an$ (sleep)

(82) *Activity (wide):*
  a. $[h][l][\check{k}]+B_{\mathrm{s}}=hal\check{a}k$ (walk)
  b. $[d][x][f]+B_{\mathrm{s}}=daxaf$ (push)
  c. $[m][\check{s}][\check{k}]+B_{\mathrm{s}}=ma\check{s}a\check{k}$ (pull)

(83) *Achievement:*
  a. $[n][p][l]+B_{\mathrm{s}}=nafal$ (fall)
  b. $[g][m][r]+B_{\mathrm{s}}=gamar$ (finish)
  c. $[\check{s}][\check{b}][r]+B_{\mathrm{s}}=\check{s}a\check{b}ar$ (break)

(84) *Accomplishment:*
  a. $[a][\check{k}][l]+B_{\mathrm{s}}=axal$ $(tapuax)$ (eat (an apple))
  b. $[k][r][a]+B_{\mathrm{s}}=kara$ $(sefer)$ (read (a book))

(85) *Semelfactive:*
  a. $[p][g][']+B_{\mathrm{s}}=paga$ (hit)

The criteria of the simple template are empty, and consist of no additional statements or integrity constraints. The lexical material of the verb is essentially the $PSCEN$ provided by the root, and the reference point R defined by the tense inflection (see chapter refch5:account).

Definition 33. Let V_{s} be a simple verb in Hebrew and let R be its consonantal root. So, a scenario for V_{s} is $RSCEN = PSCEN$ (which is, in turn, the default scenario $DSCEN$ of R).

Definition 34. Let V_{s} be a simple verb in Hebrew and let R be its consonantal root. The reference point R for the scenario of V_{s} is defined by its tense inflection relative to $RSCEN$ as elaborated in chapter refch5:account.

[1] In the sense that they typically head phrases/sentences that denote this kind of eventuality.

[2] note that strict/wide activities do *not* correspond to intransitive/transitive activities but to the existence of the changing fluent; this is similar to the notion of *unchanging activities* introduced by Creason [10].

In that case, the derivation of the meaning of a piece of a discourse is done by the EC computational machinery in the standard way (as presented in chapter 4). The derivation starts from the query presented by the integrity constraint and makes use of the axioms and additional lexical material provided by the scenario in order to derive the aspectual meaning of the verb.

6.2 The Intensive Template: Piel

6.2.1 Theoretical Discussion

The intensive template, *Binyan Piel*, B_{i} in our notation, is morphologically marked with a doubled middle consonant and semantically marked with the 'intensive' agency feature ι.

Examples:

(86)
a. $[s][p][r] + B_{\text{i}} = siper$ (tell, recount)
b. $[h][l][k] + B_{\text{i}} = hile\check{k}$ (walk around)
c. $[s][m][x] + B_{\text{i}} = simeax$ (make happy)
d. $[s][m][x] + B_{\text{i}} = xizek$ (make strong, strengthen)
e. $[\check{s}][\check{b}][r] + B_{\text{i}} = \check{s}iber$ (actively break, smash)
f. $[\check{s}][l][x] + B_{\text{i}} = \check{s}ileax$ (send off)
g. $[n][s][h] + B_{\text{i}} = nisa$ (try)
h. $[p][t][x] + B_{\text{i}} = piteax$ (develop)
i. $[']['][b][d] + B_{\text{i}} =' ibed$ (process)
j. $[s][y][m] + B_{\text{i}} = siyem$ (graduate)

Our point of departure for the discussion of the contribution of the intensive morpheme is the semantics Doron gives to the intensive functional head ι:

> "The agency head ι classifies the eventuality as an action." [15, p. 39]

Doron describes the notion of an *action* as follows:

> "Intensive verbs do not add an argument to simple verbs, but add entailments to the effect that the event denoted is an action. Accordingly, they are only predicated of entities which are capable of action. Yet the relevant notion of action is very weak." [15, p. 19]

Actors are therefore the agents of actions, and so they are required to be capable of action. However, they need not be sentient or volitional, and they are not necessarily animate.

> "There are inanimate entities in the universe that exert all kinds of force: [...] bodies exerting gravitation, magnets, [...] natural forces such as wind, fire, water, which have their own energy without possessing mental capabilities." [15, p. 19]

This conception of *action* is the basis of an abundance of $B_{\mathrm{s}}/B_{\mathrm{i}}$ alternations she presents, some of which I list here as (87)–(92).

(87) a. $[s][b][r] + B_{\mathrm{s}} = \check{s}a\check{b}ar$ (break)
b. $[s][b][r] + B_{\mathrm{i}} = \check{s}iber$ (actively break, smash, break with force)

(88) a. $[y][c][r] + B_{\mathrm{s}} = yacar$ (produce)
b. $[y][c][r] + B_{\mathrm{i}} = yicer$ (manufacture)

(89) a. $[p][t][r] + B_{\mathrm{s}} = patar$ (excuse)
b. $[p][t][r] + B_{\mathrm{i}} = piter$ (fire)

(90) a. $[q][\check{s}][r] + B_{\mathrm{s}} = qa\check{s}ar$ (tie)
b. $[g][\check{s}][r] + B_{\mathrm{i}} = qi\check{s}er$ (connect)

(91) a. $[\check{s}][l][x] + B_{\mathrm{s}} = \check{s}alax$ (send)
b. $[\check{s}][l][x] + B_{\mathrm{i}} = \check{s}ileax$ (send off)

(92) a. $[c][\check{p}][y] + B_{\mathrm{s}} = ca\check{p}a$ (witness)
b. $[c][\check{p}][y] + B_{\mathrm{i}} = cipa$ (expect)

However, one difficulty with this account is that the conception of *action* is very weak.

> "I cannot at this point formulate the lexical entailments which characterize a predicate of action. Some idea is given by Ross's (1972) and Dowty's (1979) explication of the meaning of DO." [15, p. 19]

Another difficulty with this account is that it is focused on the alternation of intensive templates with their simple counterpart. Indeed, she claims that if the Piel is a unique template in this root, it does not have any contribution and might be arbitrary. However, there exist Piel verbs that do not have a grammatical simple form counterpart but have other equi-root[3] counterpart(s), verbal or denominal.

In addition, there is some difficulty with the treatment given to denominal roots. In her syntactic account Doron allows roots to be inherently nominal and indicates that in denominal verbs it is the template that introduces the event [15, p. 33]. In her semantic account the intensive functional head ι does not introduce a new thematic relation but just adds a property to the event [15, p. 38]. However, if in denominal roots an underlying event does not exist, it is not clear what it is exactly that is being modified.

[3] I.e., with the same root

The solution she proposes is stipulating that there are *canonical actions* that involve nouns (*put/remove/make*) that underly the meaning of denominal intensive verbs with nominal roots. Adopted canonical examples are listed in (93)–(95).

(93) a. $[g][d][r]$ + noun environment = $gader$ (a fence)
b. $[g][d][r] + B_{\text{i}} = gider$ (put a fence)

(94) a. $[a][b][k]$ + noun environment = $a\check{b}ak$ (dust)
b. $[a][b][k] + B_{\text{i}} = ibek$ (remove dust)

(95) a. $[g][s][r]$ + noun environment = $ge\check{s}er$ (a bridge)
b. $[g][s][r] + B_{\text{i}} = gi\check{s}er$ (make a bridge)

This hypothesis is plausible, however I believe that it should be handled formally within the semantic account and not stipulated in addition to it.

We would also like to account for denominal verbs with adjectival equi-root counterparts, e.g., (96)–(97). In these cases, the canonical action defined by Doron is not immediately applied to the meaning of the root. Notwithstanding, there are certain characteristics shared by the resulting verbs, which can be described as, roughly, 'making the property hold'.

(96) a. $[m][l][a]$ + adjective environment = $male$ (full)
b. $[m][l][a] + B_{\text{i}} = mila$ (fill, fill up)

(97) a. $[q][c][r]$ + adjective environment = $qacar$ (short)
b. $[q][c][r] + B_{\text{i}} = qicer$ (shorten)

So, our aim in the proposed solution is to account for the contribution of the intensive agency functional head ι in a way that will allow us to:

1. formulate precisely the contribution of the semantic feature to the event structure
2. account for the meaning of verbs with denominal roots with noun or adjective equiroot counterparts.

I believe that the difficulty in defining precisely the entailments of an *action* in Doron's account stems from use of an underlying event argument à-la Davidson. Such an event argument takes an event as a whole, while the contribution of the template refer to specific parts within the internal event structure. Doron's analysis introduces two features that are clearly relevant to the internal event structure, namely

1. the existence of an actor, i.e., the agent of the action, and
2. the exertion of force.

Formalizing these notions in EC has a clear advantage as EC allows events to a complex elaborated internal structure, and specific part of the event can be, in turn, added or modified.

The proposed solution is that the intensive template requires for its application the presence of *dynamics*. If the eventuality associated with the root is *telic* the dynamics needs also to be oriented towards the inherent canonical goal, and terminated once it is achieved. If the root is *denominal*, the meaning of the root provides the goal towards which the dynamics is oriented.

6.2.2 Formal Account

In the formal account of the intensive verbs (as well as in the discussion of the other non-simple templates) I first treat verbs that *have* a simple verb counterpart and define the semantic contribution of the intensive feature relative to their preliminary eventuality. Then, I turn to the definition of the semantic contribution of the intensive template to denominal roots.In cases where neither exists I adopt Doron's view that the template may be accidental or arbitrary.[4]

In the applications I consider derivations of meanings of such verbs in small pieces of discourse (sentences). I focus on the past and present tenses as these are the inflections that are mainly examined in the empirical part of the study.

Atelic eventualities

Definition 35. Let V be an intensive verb and let V_{s} be its simple form associated with an *atelic* eventuality. The ι feature requires the presence of *dynamic* comprised of the following general statements with f_1', f_2', e' unknown parameters:

1. $\mathsf{HoldsAt}(f_2'(x), t) \rightarrow \mathsf{Trajectory}(f_1', t, f_2'(x'), d)$
2. $\mathsf{Initiates}(e', f_1', t)$
3. $\mathsf{Releases}(e', f_2', t)$

In words, the scenario of a verb in the intensive template must include (i) a trajectory in which one fluent exerts force that affects another fluent, (ii) a statement that allows an event to initiate the exerting force fluent, and (iii) a statement that release the other fluent, i.e., allowing it to change.

Note that in this account we get the two semantic features defined by Doron [15] 'for free': (i) the required *actor* is precisely the participant associated with f_1, (ii) the increased valence depends on the theme associated with f_2 (contrast for

[4] According to the principles of DM, the semantic contribution of a feature is relevant only when it is contrasted or blocks some other semantic feature.

instance examples (86b) vs. (86d)). Thus, a vast majority of the Piels, (although not all,[5]) are transitive.

Definition 36. Let V be an intensive verb and let V_{s} be its simple form associated with an *atelic* eventuality. The reference point R for the result scenario is defined by the following integrity constraints:

$$?\mathsf{HoldsAt}(f_1, R), R \gtreqless now \textit{ succeeds}$$

In this case, the meaning of the Piel corresponds to 'keeping oneself busy' doing something f_1 that is hinted by the meaning of its corresponding simple verb counterpart, and the application of tense makes reference to this extended fluent.

Atelic eventualities

Definition 37. Let V be an intensive verb and let V_{s} be its simple form associated with a *telic* eventuality. The ι feature requires the presence of dynamics that is oriented toward a goal, comprised of the following general statements, with f_1', f_2', e', e'' unknown parameters:

1. $\mathsf{HoldsAt}(f_2'(x), t) \rightarrow \mathsf{Trajectory}(f_1', t, f_2'(x'), d)$
2. $\mathsf{Initiates}(e', f_1', t)$
3. $\mathsf{Releases}(e', f_2', t)$
4. $\mathsf{HoldsAt}(f_2'(c), t) \wedge \mathsf{HoldsAt}(f_1', t) \rightarrow \mathsf{Happens}(e'', t)$
5. $\mathsf{Terminates}(e'', f_1', t)$
6. $\mathsf{Initiates}(e'', f_3', t)$

In words, a scenario of a verb in the intensive template for a telic eventuality must include a trajectory in which one fluent exerts force that affects another fluent, until a certain canonical goal is achieved. Here, we get the actor again 'for free' from f_1 and all $B_{\mathrm{s}}/B_{\mathrm{i}}$ alternation show increased transitivity. This turns out to be the case since f_2 in telic eventualities is related to some specific value that represents the canonical goal of the event, and thus it must represent an independent changing theme.

Definition 38. Let V be an intensive verb and let V_{s} be its simple form associated with a *telic* eventuality. A reference point R for the result scenario is defined by the following integrity constraint:

[5] Although Piel is commonly associated with increasing transitivity, it was evident in several other studies that such a generalization cannot be empirically maintained, e.g., [10].

$$?\mathsf{HoldsAt}(f_1, R), R \gtreqless now \textit{ succeeds}$$

In this case, the meaning of the Piel is roughly 'keeping oneself busy' with a process that is oriented towards achieving a certain goal. The dynamics is terminated once this goal is achieved. The goal is hinted by the meaning of its simple verb counterpart.

Denominal Roots

Definition 39. Let V be an intensive verb and let R be its denominal root. Let $P(x)$ be a predicate associated with the meaning of R and define a parameterized fluent $f_2(c)$ such that $P(f_2(c))$.
The ι feature introduces the same lexical material as introduced for telic eventualities, and adds the following integrity constraint:

IF $?\mathsf{HoldsAt}(f_2(c), t)$ *succeeds THEN* $?\mathsf{Happens}(e, t), \mathsf{Initiates}(e, f_3, t)$ *succeeds*

Definition 40. Let V be an intensive verb and let R be its denominal root and $RSCEN$ its result scenario associated with a *telic* eventuality. A reference point R for the result scenario is defined by the following integrity constraints:

$$?\mathsf{HoldsAt}(f_1, R), R \gtreqless now \textit{ succeeds}$$

Note that the integrity constraints define e as the canonical goal to be achieved in some critical value of f_2. In that case, the meaning of the Piel is 'keeping oneself busy' with a process in making a parameterized fluent reach a specific value of the property hinted by the root.

In the case of roots that denote nouns, the process involves putting/removing/making of an object. In case of adjectives, the process involves making a property hold for a specific value.[6] In both cases the denominal root provides the *incremental theme* that dictates the durativity and telicity of the process.[7]

[6]Note that even with degree adjective such as 97 ('shorten') the meaning of the Piel requires a specific value. Although the specific value of 'how short' is undefined, it should be read as reaching a 'sufficiently short' value. This stands in clear opposition to Hiphil, that need not refer to a specific target value. Compare with subsequent discussion in 6.3.

[7]Interestingly, in verbal roots the (a)telicity is determined by the eventuality $PSCEN$ and the durativity was endowed by the ι criteria. In denominal roots which do not have an underlying event structure, and the so-called *incremental theme* (f_2) provides the raw material for both the durativity/phases and telicity of the newly introduced event.

6.2.3 Applications

ACTIVITIES $\langle +, +, -, - \rangle$

We start with an almost trivial example, an eventuality which already contains the dynamics.

Examples:

(98) a. $[h][l][k] + B_{\mathrm{s}} = hala\check{k}$ (walk)
b. $[h][l][k] + B_{\mathrm{i}} = hile\check{k}$ (walk around)

(99) a. $[k][p][c] + B_{\mathrm{s}} = ka\check{p}ac$ (jump)
b. $[k][p][c] + B_{\mathrm{i}} = kipec$ (jump of joy, jump up and down in excitement)

(100) a. $[\check{s}][t] + B_{\mathrm{s}} = \check{s}at$ (sail)
b. $[\check{s}][t] + B_{\mathrm{i}} = \check{s}iyet$ (sail around)

(101) a. $[']['\check{p}] + B_{\mathrm{s}} = a\check{p}$ (fly)
b. $[']['\check{p}] + B_{\mathrm{i}} = o\check{p}e\check{p}$ (fly around)

The simple form of the verb denotes a wide activity (in the sense that there exists a changing fluent) and this corresponds to the following $PSCEN$ (preliminary scenario):

1. $\mathsf{HoldsAt}(f_2(x), t) \rightarrow \mathsf{Trajectory}(f_1, t, f_2(x'), d)$
2. $\mathsf{Initiates}(e, f_1, t)$
3. $\mathsf{Releases}(e, f_2, t)$

The intensive feature ι introduces the following criteria, where the unknown parameters are marked with " $'$ ":

1. $\mathsf{HoldsAt}(f_2'(x), t) \rightarrow \mathsf{Trajectory}(f_1', t, f_2'(x'), d)$
2. $\mathsf{Initiates}(e', f_1', t)$
3. $\mathsf{Releases}(e', f_2', t)$

Our first goal is to calculate $RSCEN$ in order to find the situation type of the result intensive verb. To this end, let us follow closely (parts of) the procedure of *addition* and *unification*.

1. Search in $PSCEN$ for a statement of the form
   (a) $\mathsf{HoldsAt}(f_2', t) \rightarrow \mathsf{Trajectory}(f_1', t, f_2', d)$
2. Having found
   (a) $\mathsf{HoldsAt}(f_2, t) \rightarrow \mathsf{Trajectory}(f_1, t, f_2, d)$

Unify f_1, f_2 with f_1', f_2' and union it into $PSCEN$

3. Update the remaining ι criteria with the instantiated fluents
   (a) $\mathsf{Initiates}(e', f_1, t)$
   (b) $\mathsf{Releases}(e', f_2, t)$
4. Search for a statement of the form in $PSCEN$
   (a) $\mathsf{Initiates}(e', f_1, t)$

   in $PSCEN$
5. Having found
   (a) $\mathsf{Initiates}(e, f_1, t)$

   Unify e' with e and union it with $PSCEN$
6. Update the ι criteria with the instantiated fluents
   (a) $\mathsf{Releases}(e, f_2, t)$
7. Union $\mathsf{Releases}(e, f_2, t)$ with the scenario.

Trivially, in resolving the scenario all the statements in the preliminary scenario are unified with the statements of the intensive feature criteria. Thus we end up with the same scenario:

1. $\mathsf{HoldsAt}(f_2, t) \rightarrow \mathsf{Trajectory}(f_1, t, f_2, d)$
2. $\mathsf{Initiates}(e, f_1, t)$
3. $\mathsf{Releases}(e, f_2, t)$

The contribution of the template here goes beyond the presence of the dynamics, and in fact is manifested via an application of hierarchical planning.

Suppose we want to derive the aspectual meaning of the following piece of discourse (with a verb inflected in the past tense):

(102) Dani hilex basadot
Dani walked$_{\text{intensive}}$ in the fields

The result scenario we are concerned with consists of the above three statements and the tense integrity constraint

$$?\mathsf{Happens}(f, R), R < now \textit{ succeeds}$$

Suppose we want to know whether the 'walking' event ended in the past, we need to wrap this event in a hierarchically planned event and to 'ask' the following

question, by means of a formal query:

$$?\mathsf{Happens}(e', R), R < now$$

Using the definition of hierarchical planning given in chapter 4 we need to resolve the following subgoals

$$?\mathsf{Happens}(start_f, s), \mathsf{Happens}(stop_f, r), \mathsf{HoldsAt}(f, R), s < R \leq r, R < now$$

$\mathsf{Happens}(start_f, s)$ is derived using statement 2, and $\mathsf{HoldsAt}(f, R)$ is derived using statements 1, 2, axiom 2 and the integrity constraint, and we use negation as failure for $\neg\mathsf{Clipped}$. The interesting part is the derivation of $\mathsf{Happens}(stop_f, r)$. This cannot be derived explicitly from the lexical material provided by ι but will be provided from context. However it should be noted that the intensive vern here is indeed felicitous with 'stop' events (104) but less felicitous with 'finish' events (103).

(103) a. dani halax habaita
Dani walked$_{\text{simple}}$ home
Dani walked home

b. ?dani hilex habaita
?Dani walked$_{\text{intensive}}$ home
?Dany walked intensively home

(104) a. dani hilex basadot (bemesheck shaot/ad
Dani walked$_{\text{intensive}}$ in-the-fields (for hours/until
shehitayef/vepitom ra'a arnav)
he-got-tired/and-suddenly saw rabbit)
Dani walked intensively in the fields (for hours/until he got tired/and suddenly saw a rabbit)

While the activity $halak\check{}$ (walk$_{\text{simple}}$) can be coerced to an accomplishment, $hilek\check{}$ (walk$_{\text{intensive}}$) is incompatible with an inherent terminal point. Rather, the query triggers a search for a 'stop' event in the context as in (104)(the $halak\check{}$ (walk) simple form is equally compatible with 'stop' and 'finish' events). This gives us further evidence for the durativity and 'ongoingness' of the intensive verb relative to its simple verb counterpart, although the scenario consists of the very same statements.

A note about the requirement for a 'theme' fluent f_2. Initially it seems that activity intensive verbs are not transitive. However, our application indeed required a corresponding incremental theme f_2. This is evident from the implausibility of (105). However, the adverbial modifier in (106) already makes it felicitous, which might mean that in such cases the incremental theme f_2 corresponds to, for instance, Dani's 'enjoyment'.

(105) a. *dani hilex
*Dani walked$_{\text{intensive}}$
*Dani walked intensively

(106) a. dani hilex lehana'ato
Dani walked$_{\text{intensive}}$ to-his-enjoyment
Dani walked for enjoyment

ACHIEVEMENTS $\langle -, -, +, + \rangle$

The next example is slightly more complicated: a telic eventuality that does not contain the dynamics to begin with.

Examples:

(107) a. $[s][b][r] + B_{\text{s}} = sabar$ (break)
b. $[s][b][r] + B_{\text{i}} = siber$ (break actively)

(108) a. $[s][l][x] + B_{\text{s}} = salax$ (send)
b. $[s][l][x] + B_{\text{i}} = sileax$ (send off)

(109) a. $[p][t][x] + B_{\text{s}} = patax$ (open)
b. $[p][t][x] + B_{\text{i}} = piteax$ (develop)

(110) a. $[p][g]['] + B_{\text{s}} = paga$ (hurt)
b. $[p][g]['] + B_{\text{i}} = pige'a$ (commit a terrorist attack)

The root in its simplest form denotes an achievement that corresponds to the following $PSCEN$:

1. $\mathsf{Initiates}(e, f_3, t)$

Since we are concerned with a telic eventuality, the intensive agency head ι introduces a criterion which includes a dynamic process that is oriented towards the goal specified in the preliminary scenario:

1. $\mathsf{HoldsAt}(f_2'(x), t) \rightarrow \mathsf{Trajectory}(f_1', t, f_2'(x'), d)$
2. $\mathsf{Initiates}(e, f_1', t)$
3. $\mathsf{Releases}(e, f_2', t)$
4. $\mathsf{HoldsAt}(f_2'(c), t) \wedge \mathsf{HoldsAt}(f_1', t) \rightarrow \mathsf{Happens}(e'', t)$
5. $\mathsf{Terminates}(e'', f_1', t)$
6. $\mathsf{Initiates}(e'', f_3', t)$

Again, we calculate $RSCEN$ by adding the criteria general statements to $PSCEN$.

1. Unify $\mathsf{Initiates}(e'', f_3', t)$ with $\mathsf{Initiates}(e, f_3, t)$, and update $e = e''$, $f_3 = f_3'$
2. Update unknown parameters in the criteria statements:
   (a) $\mathsf{HoldsAt}(f_2'(x), t) \rightarrow \mathsf{Trajectory}(f_1', t, f_2'(x'), d)$
   (b) $\mathsf{Initiates}(e, f_1', t)$
   (c) $\mathsf{Releases}(e, f_2', t)$
   (d) $\mathsf{HoldsAt}(f_2'(c), t) \wedge \mathsf{HoldsAt}(f_1', t) \rightarrow \mathsf{Happens}(e, t)$
   (e) $\mathsf{Terminates}(e, f_1', t)$

Now, we are left with unknown parameters for e', f_1', f_2' that need to be instantiated. In this case semantic memory comes into play. According to our basic account semantic memory holds information about regularities in the real world and the semantic features of the templates in particular.

Piel verbs denote an extended activity that is oriented towards a goal. A 'prototypical' description of a process of attaining a goal is precisely the notion of a 'plan'. Thus, f_1' is unified with some mechanism f_1 that can drive the execution of a plan forward[8] and f_2' with a parameterized fluent f_2 that indicates the progress towards the goal. The value yielded by the function $f_2(x)$ for a critical value c ($f_2(c)$) marks the attainment of the goal. Thus we end up with the following scenario that mirrors an accomplishment:

1. $\mathsf{Initiates}(e, f_1, t)$
2. $\mathsf{Releases}(e, f_2(x), t)$
3. $\mathsf{HoldsAt}(f_2(x), t) \rightarrow \mathsf{Trajectory}(f_1, t, f_2(x'), d)$
4. $\mathsf{HoldsAt}(f_1, t) \wedge \mathsf{HoldsAt}(f_2(c), t) \rightarrow \mathsf{Happens}(e', t)$
5. $\mathsf{Terminates}(e', f_2(c), t)$
6. $\mathsf{Initiates}(e', f_3, t)$

Let us illustrate by means of the minimal pair in (107). After unification of the 'break' lexical material with the contribution of the intensive template we get the following scenario:

1. $\mathsf{Initiates}(e, f_1, t)$
2. $\mathsf{Releases}(e, f_2(x), t)$
3. $\mathsf{HoldsAt}(f_2(x), t) \rightarrow \mathsf{Trajectory}(f_1, t, f_2(x'), d)$
4. $\mathsf{HoldsAt}(f_1, t) \wedge \mathsf{HoldsAt}(f_2(c), t) \rightarrow \mathsf{Happens}(break, t)$

[8]It can be an animate agent that strives to fulfill a goal or a physical process that progresses towards an inherent terminal point.

5. $\mathsf{Terminates}(break, f_2(c), t)$
6. $\mathsf{Initiates}(break, broken, t)$

The semantic memory (based on world knowledge) then provides us with a prototypical situation of a *process* of 'breaking' (rather than the change of state of *break*), i.e., exerting force. So, the scenario for break$_{\text{intensive}}$ is extended to include a gradually increasing level of force:

1. $\mathsf{Initiates}(e, breaking, t)$
2. $\mathsf{Releases}(e, force(x), t)$
3. $\mathsf{HoldsAt}(force(x), t) \rightarrow \mathsf{Trajectory}(breaking, t, force(x'), d)$
4. $\mathsf{HoldsAt}(breaking, t) \wedge \mathsf{HoldsAt}(force(c), t) \rightarrow \mathsf{Happens}(break, t)$
5. $\mathsf{Terminates}(break, force(c), t)$
6. $\mathsf{Initiates}(break, broken, t)$

Indeed, the English verb that most closely corresponds to 'break$_{\text{intensive}}$' is, according to [30], 'smash', which is defined as 'breaking with *force* into small pieces' (italics added).

In this case, the contribution of the template extends the time span of the achievement to include the preparatory phase that immediately precedes the achievement and causes it. In other cases, the lexical meaning of an achievement is coerced to an accomplishment per se, as in (109) and (110).

The meaning of the simple verb hints at the lexical meaning of the derived intensive verb, however, this often involves a shift in the lexical meaning that is less predictable. Nevertheless, we can still make successful predictions about the temporal schemata of the resulting verb.

The application of the reference point is, them, as follows;

(111) a. Dani šaḃar et hazḱuḱit
Dani broke$_{\text{simple}}$ ACC the-glass
Dani broke the glass

b. Dani šiber et hazḱuḱit
Dani broke$_{\text{intensive}}$ ACC the-glass
Dani smashed the glass

A derivation of the aspectual meaning of (111a) should start from the following query defined by our tense inflections semantics;

$$?\mathsf{Happens}(e, R) R < now \textit{ succeeds}$$

A derivation of the aspectual meaning of (111b) should start from the following query defined by our intensive feature semantics;

$$?\mathsf{Happens}(e', R)R < now \textit{ succeeds}$$

In the first sentence e is the canonical goal of breaking which happens in an instant, while in the second e' is a hierarchically planned event which accounts for an extended period of time in which the event took place. In the present tense, however, we get a default implication of an ongoing progression.

(112) a. Dani šoǒber et hazǩuǩit
Dani $\text{breaks}_{\text{intensive}}$ ACC the-glass
Dani is breaking the glass
b. Dani mešaber et hazǩuǩit
Dani $\text{breaks}_{\text{intensive}}$ ACC the-glass
Dani is smashing the glass

In the first sentence the meaning of 'break' needs to be extended with a preparatory phase to form a 'run-up achievement, and in the second the additional lexical material is *already* provided by the template and does not require further coercion triggered by this viewpoint.

ACCOMPLISHMENTS $\langle +, +, +, + \rangle$

In accomplishments the formalization of the simple verb coincides with the contribution of the intensive template, both in terms of the lexical material and the integrity constraint reference point. Thus, we see no change in the verb Aktionsart nor in the definition of the required viewpoint.

Examples:

(113) a. $[y][c][r] + B_{\text{s}} = yacar$ (produce)
b. $[y][c][r] + B_{\text{i}} = yicer$ (manufacture)
(114) a. $[s][p][x] + B_{\text{s}} = sapax$ (add,absorb)
b. $[s][p][x] + B_{\text{i}} = sipe'ax$ (annex)
(115) a. $[q][s][r] + B_{\text{s}} = qasar$ (tie)
b. $[q][s][r] + B_{\text{i}} = qiser$ (connect)

The intensive template indeed causes a shift in the lexical meaning that might stem from the kind of agency involved (volitional, intentional, etc). However, the system we are concerned with is not rich enough to express semantic features or entailments of different kinds of actors-agents, and we leave this issue for future research.

STRICT ACTIVITIES $\langle +, -, -, - \rangle$ / STATES $\langle -, -, -, + \rangle$

Interestingly, the Piel template is only compatible with a certain kind of state verb.[9]

Examples:

(116) a. $[y][s][b] + B_{\text{s}} = ya\check{s}a\check{b}$ (sit)
b. $[y][s][b] + B_{\text{i}} = yi\check{s}e\check{b}$ (settle (in a colony))

(117) a. $[y][s][n] + B_{\text{s}} = ya\check{s}an$ (sleep)
b. $[y][s][n] + B_{\text{i}} = yi\check{s}en$ (put to sleep)

(118) a. $[s][k][n] + B_{\text{s}} = \check{s}a\check{k}an$ (dwell)
b. $[y][s][n] + B_{\text{i}} = \check{s}iken$ (locate,relocate)

(119) a. $[s][t][k] + B_{\text{s}} = \check{s}atak$ (be silent)
b. $[s][t][k] + B_{\text{i}} = \check{s}itek$ (paralyze)

The interesting thing about these verbs in Hebrew is that they are ambiguous between *stative* and *inchoative* readings.[10] Formally, the $PSCEN$ for the stative reading is

1. $\mathsf{HoldsAt}(f, t)$

and for the inchoative reading it consists of an additional statement:

1. $\mathsf{Initiates}(e, f, t)$
2. $\mathsf{HoldsAt}(f, t)$

Generally it is the context which determines which is the correct interpretation (i.e., if the context provides an initiating event for the state than the second scenario is being picked, otherwise, the first scenario applies).

(120) a. Dani šatak$_{simple}$ bemešeǩ ša'ot
Dani silent$_{\text{simple}}$ for hours
Dani was silent for hours
b. Dani šatak$_{simple}$ miyad
Dani silent$_{\text{simple}}$ immediately
Dani became silent immediately

It has already been acknowledged by Doron [15, p. 28] that the Piel alternation of such verbs picks the inchoative reading. Thus, the preliminary scenario we are

[9] This case is the least straightforward to account for, however it is crucial as it is conceptually the closest case to the structure of denominal Piels which are a derived form of noun/adjectivial roots. Roughly, in both cases we derive an extended dynamic event from a 'stative' fluent.

[10] This is the case both for Biblical Hebrew [10] and modern Hebrew [15].

concerned with is the latter (which denotes 'getting into state' rather than 'being in a state') and in practice mirrors an achievement $\langle -, -, +, + \rangle$.

The contribution of the template has to be, therefore, compatible with telic eventualities, and the subsequent analysis is strictly identical with the one given to the achievements (which I shall not repeat here; the interested reader is invited to replicate it in the exact same manner).

Resulting present tense sentences manifest clearly the opposition between the stative and dynamic readings that are caused by the alternation of the simple and intensive form:

(121) Dani šotek aǩšav
Dani silent$_{\text{simple}}$ now
Dani is silent now

(122) Dani mešatek mišehu aǩšhav
Dani paralyze$_{\text{intensive}}$ somebody now
Dani is making someone helpless now

Two crucial observations can be made about the shift between simple stative/strict activity verbs and their intensive counterparts. The intensive templates accounts for an event with 'progressing phases', and consequently it is subject to the imperfective paradox like progressive verbs in English do. Also, it manifests an increased valence by adding another fluent to the one denoted by the original lexical material.

A NOTE ABOUT SEMELFACTIVES

Many of the typical semelfactive verbs in Hebrew have a doubled-2×2-consonant pattern in the root which results in a 4-consonant root. These roots are typically available *only* in the intensive form of the verb

(123) a. $[h][b][h][b] + B_{\text{i}} = hivhev$ (flicker)
b. $[m][c][m][c] + B_{\text{i}} = micmec$ (blink)
c. $[t][p][t][p] + B_{\text{i}} = tiptep$ (drip)

One way to explain this is that a 4-consonant root must be accommodated by an intensive template since the doubled middle morpheme allows accommodation of 4 consonants and can bear this root (also referred to as *Binyan Pilpel* [31]).

Yet I believe that the choice of this template for semelfactive verbs in Hebrew is also semantically motivated. The hypothesis is that semelfactive verbs are iconically marked by 'short' roots (i.e., bi-consonantal morphemes) that denote 'atomic' activities, and the doubling of the root plus the intensive template denotes an extended activity that involves repeating the 'atomic' meaning of the root.

Additional evidence for this view is given by the following verbs[11]:

(124) a. $[k][v][k][v] + B_{\text{i}} = kivkev$ (draw a dotted line)
b. $[']['][l][']['][l] + B_{\text{i}} = il'el$ (turn pages)
c. $[n][']['][n][']['] + B_{\text{i}} = nianea$ (shake, move repeatedly)
d. $[n][d][n][d] + B_{\text{i}} = nidned$ (move back and forth, in slang: nag)
e. $[m][l][m][l] + B_{\text{i}} = milmel$ (mutter)
f. $[g][m][g][m] + B_{\text{i}} = gimgem$ (stutter)

Thus, the semelfactive notion in Hebrew is, I believe, closer to Rothstein's account that views semelfactives as the minimal part of an activity (they can appear with the modifiers 'at 8pm', 'once', 'twice' or 'for 3 hours', 'all night', etc.), rather then other accounts of semelfactive verbs that view them as a separate class.

The treatment that should be given to semelfactives is thus to coerce them to *atelic* eventualities (cf. [52, 'Coercion' chapter, 3.3]) using the lexical material provided by the intensive template. f'_1 is then identified with the mechanism that outputs the atomic action and f'_2 with the repeated atomic occurrences. The reference point is given by reference to f_1 as done for other atelic eventualities in the intensive template.

DENOMINAL ROOTS

This is a relatively extreme case of coercion in which a value of a property that holds (and in fact can be evaluated) in an instant of time is coerced into a fully-fledged accomplishment. This is done in a rather natural way since the object or real world property is conceptually identified with what is known in the literature as the *incremental theme* (see [17, 33, 44, 52] etc.). This, as a result, contributes both the durativity and the telicity of the resulting event.[12]

Examples:

(125) a. $[\check{s}][m][n] + \text{noun} = \check{s}emen$ (oil)
b. $[\check{s}][m][n] + B_{\text{i}} = \check{s}imen$ (*put* oil)
(126) a. $[a][b][k] + \text{noun} = a\check{b}ak$ (dust)
b. $[a][b][k] + B_{\text{i}} = ibek$ (*remove* dust)
(127) a. $[g][d][r] + \text{noun} = gader$ (fence)
b. $[g][d][r] + B_{\text{i}} = gider$ (*make* a fence)

[11] example adopted from [31, p. 134–136]

[12] In fact, it is subject to the very same ambiguities that are dealt with in the literature with respect to the incremental theme. Contrast for example $ibek$ (dust) with 'wipe' in Levin and Rappaprt [41].

In the above canonical examples, the root in its simplest morphological form denotes a noun, or more specifically, an inanimate object. Let us take the property P as a predicate $P(x)$. Now we redefine the object x as $f(c)$ with c a critical (fixed) value of a parameterized fluent f that denotes the quantity/part of the object at hand.

This variable then has to be identified with lexical material provided by the contribution of the template. Thus, a noun like $gader$ (fence) can be interpreted as follows:

$$Fence(f(c))$$

Where f is a parameterized fluent that denotes the 'amount of fence' at hand, so to speak.

In case of an adjective, e.g., $male$ (full), this can be interpreted as follows:

$$Full(f(c))$$

where f is a measure that denotes 'how full' something is. The unification with lexical material provided by the context is essential. Take, for instance, the case of 'filling a bucket'. The parametrized fluent may be identified with a $height(x)$ fluent that marks the height of the water surface. In a different case, e.g., 'filling a room with people', it can be the occupied percentage of the room capacity.

In case of denominal roots, , the root contributes a fluent f_2 and a preliminary scenario that consist of the statement $\mathsf{Releases}(e, f_2, t)$. This allows f_2 to change after some e, a canonical start event.

However, we still have to decide what kind of eventuality (telic/atelic) is contributed by the template. Recall that f_2 was associated with a critical value $f_2(c)$. The specific object yielded by this function for the value c provides an inherent terminal point for the dynamics and thus we are concerned with a telic eventuality.

After unifying the parameterized fluent f_2 with the one provided by the intensive criteria, semantic memory provides instantiation of the rest of the fluents, with f_2 the event's *incremental theme* and $f_2(c)$ the desired value.[13]

Let us illustrate this by means of an (adjectival) example: Let us take the case of '*hu milla dli*' ('he filled a bucket') with the following root:

(128) a. $[m][l][a] + \text{adjective} = male$ (full)
b. $[m][l][a] + B_{\text{i}} = milla$ (filled up)

[13]In Hebrew, the connection between a desired result state f_3 and the values of the function f_2 is reflected morphologically. In practice that means that the instantiation of f_3 might not have to appeal to semantic memory but can be approximated via a predictable morphological alternation. This idea however needs to be further established and I leave it for further research.

The meaning of the root is taken to be:

$$Full(f(x))$$

Recall that the contribution of the intensive template is defined as follows:

1. $\mathsf{Initiates}(e', f_1', t)$
2. $\mathsf{Releases}(e', f_2'(x), t)$
3. $\mathsf{HoldsAt}(f_2'(x), t) \rightarrow \mathsf{Trajectory}(f_1', t, f_2'(x'), d)$
4. $\mathsf{HoldsAt}(f_1', t) \wedge \mathsf{HoldsAt}(f_2'(c), t) \rightarrow \mathsf{Happens}(e'', t)$
5. $\mathsf{Terminates}(e'', f_2'(c), t)$
6. $\mathsf{Initiates}(e'', f_3'', t)$

After unification of f_2 with appropriate lexical material (e.g., $height$ in case of filling a bucket), and c with the critical value (in our example, the height after which it overflows), we get the following updated scenario:

1. $\mathsf{Initiates}(e', f_1', t)$
2. $\mathsf{Releases}(e', height(x), t)$
3. $\mathsf{HoldsAt}(height(x), t) \rightarrow \mathsf{Trajectory}(f_1', t, height(x'), d)$
4. $\mathsf{HoldsAt}(f_1', t) \wedge \mathsf{HoldsAt}(height(c), t) \rightarrow \mathsf{Happens}(e'', t)$
5. $\mathsf{Terminates}(e'', fill, t)$
6. $\mathsf{Initiates}(e'', f_3'', t)$

Context (or when lacking context, semantic memory) provides the mechanism behind the 'filling' process (in case of 'filling a bucket with water', we can imagine a pipe connected to a water tap), and the state $filled$ that accommodates f_3:

1. $\mathsf{Initiates}(e, filling, t)$
2. $\mathsf{Releases}(e, height, t)$
3. $\mathsf{HoldsAt}(height(x), t) \rightarrow \mathsf{Trajectory}(filling, t, height(x'), d)$
4. $\mathsf{HoldsAt}(filling, t) \wedge \mathsf{HoldsAt}(height(c), t) \rightarrow \mathsf{Happens}(finished, t)$
5. $\mathsf{Terminates}(finished, filling, t)$
6. $\mathsf{Initiates}(finished, filled, t)$

Similarly, for the fence example we get

1. $\mathsf{Initiates}(e', f_1', t)$
2. $\mathsf{Releases}(e', fence(x), t)$

3. $\mathsf{HoldsAt}(fence(x), t) \rightarrow \mathsf{Trajectory}(f_1', t, fence(x'), d)$
4. $\mathsf{HoldsAt}(f_1', t) \wedge \mathsf{HoldsAt}(fence(c), t) \rightarrow \mathsf{Happens}(e'', t)$
5. $\mathsf{Terminates}(e'', f_1, t)$
6. $\mathsf{Initiates}(e'', f_3'', t)$

Semantic memory, or context, then contributes the missing parameters:

1. $\mathsf{Initiates}(e', build, t)$
2. $\mathsf{Releases}(e', fence(x), t)$
3. $\mathsf{HoldsAt}(fence(x), t) \rightarrow \mathsf{Trajectory}(build, t, fence(x'), d)$
4. $\mathsf{HoldsAt}(build, t) \wedge \mathsf{HoldsAt}(fence(c), t) \rightarrow \mathsf{Happens}(e'', t)$
5. $\mathsf{Terminates}(e'', build, t)$
6. $\mathsf{Initiates}(e'', fenced, t)$

(In both case, e' and e'' are the canonical events of 'start' and 'completion' of the derived accomplishment. In minimal models they boil down to the 'start' and 'finish' event type derivatives of f_1.

6.3 The Causative Template: Hiphil

6.3.1 Causatives

The term *causative* refers to a class of verbs that encode both a cause and an effect. Traditionally, this class referred in linguistics to verbs which are derived by a causative affix, and whose meaning can be rephrasable as 'cause to'/'cause to be' (e.g., the English *-ize* in *randomize*).

Traditionally generative semanticists distinguished several kinds of causative: (i) *lexical causatives*, in which a single verb denotes the cause and the effect, as in (129a), (ii) *morphological causatives*, in which the causative verb is related to a non-causative verb by morphological means, as in (129b), and (iii) *analytic/periphrastic causatives*, in which the cause and the effect are related at the phrasal level, usually with a general causative matrix verb plus a separate non-finite verb complement, as in (129c).

(129) a. kill, open, create
b. randomize
c. make leave, cause to return

The phenomena of *causation* has been extensively investigated in the philosophical literature in connection with entailments and truth conditions, and this study has often been connected with the study of conditionals and counterfactuals (e.g., philosophers like Lewis and Davidson). Problems that have been addressed with respect to causation in natural language semantics are, among others, *direction* (distinguishing *e cause c* from *c cause e*), *epiphenomena* (suppose that 'axe falls (c), its shadow moves (d) and the king loses his head (e)'; is it c, rather then d, that causes e?), *preemption* (when a cause c is preempted by an event d and thus the affect e doesn't take place, does c cause e?) and *causal selection* (which event, within a number of events and circumstances should be singled out as 'the cause'?).[14]

In the current study I am *not* concerned with what is entitled to be called 'true causation'. On the contrary, here I am concerned with what semantic content linguistic expressions that are traditionally referred to as *causative* actually contain. The *causative* constructions are used in ordinary language in a way that may be essentially different than what philosophers would call 'true causation' (cf. [18, p. 110]). In Hebrew, for instance, the verb $he'e\check{k}il$ (feed) is referred to as causative simply because it is derived from the root $[a][\check{k}][l]$ (eat) using the causative template although it is debatable whether the meaning of 'feed' is really 'cause to eat'.

Therefore, the reference to *causative* in the current study is limited in its scope and different in its applications. I am only concerned with *causation* to the extent that it helps to explain phenomena manifested by linguistic expressions that are referred to as *causative*. Specifically, I am only concerned with specific *causative constructions* in Hebrew, allowing the reader to make a comparison with causative constructions in other languages if she wishes so. Lastly, my semantic analysis of the *causative constructions* proceeds only insofar as they play a role in aspectual distinctions, as this is the ultimate goal of this study.

However, applying the notion of causativity to the theory of aspect is not straightforward and may be confusing at times. Thus, to avoid common pitfalls, I first review the relation between the notion of *causative* and the two notions central to our study: Aktionsart and complex events.

Causatives and Aktionsart

The first proposal that makes an explicit link between the causative and Vendlerian Aktionsart is Dowty's treatment of accomplishments. In his account Dowty [18, ch. 2] suggests that all accomplishments are construed as having the logical structure in (130), Thus having two events that are connected via a causal relation. To illustrate, in his account 'John killed Bill' and 'John painted a picture' get the following analyses [18, p. 91]:

[14] Dowty [18, p. 99–109] gives a survey of several problems and suggests a solution in terms possible worlds semantics.

(130) ϕ CAUSE ψ where
ϕ has (usually) the form of an ACTIVITY and
ψ has (usually) the form of a BECOME event

(131) [[John does something] CAUSE [BECOME ¬[Bill alive]]]

(132) [[John does something] CAUSE [BECOME [a picture exists]]

It was this analysis that encouraged many researchers to identify the notion of *accomplishments* with the notion of *causative*. However, Levin [35] argues against this and shows that neither can be reduced to the other. An argument along these lines is maintained in Rothstein [44].

Accomplishments indeed exhibit a 'cause' relation under their denotation, but they also exhibit more than that. They posses an intimate relation between a gradual change and the continuous cause via the notion of the 'incremental theme'. This notion is not a necessary condition for causatives per se (e.g., it is absent in other 'pure causatives' such as 'break'). On the other hand, the resulting change of state of an accomplishment is similar in essence to the resulting change of state denoted by an achievement. Thus, a cause relation is not a sufficient condition for an accomplishment either. Thus, put in Rothstein words,

> "to say that a causal element is an inherent part of an accomplishment seems either false or trivially true, and if trivially true, then it will be a part of the meaning of other non-accomplishment verbs too." [44, p. 104]

The identification of the causative with accomplishments is hard to maintain, firstly because the so-called cause and effect are tightly connected and hard to untangle, and secondly since it excludes other eventualities that involve cause and effect, such as achievements. Intuitively, both accomplishments and achievements involve the notion of cause, accomplishments via a gradual change and achievements via an instantaneous change. These two notions of change are precisely the ones that are formalized by the Event calculus, and formally correspond to the predicates Trajectory and Initiates respectively.

In this study I adopt the view that the term *causative constructions* cannot be identified with any specific kind of Aktionsart (achievement, accomplishment), neither can any kind of Aktionsart be reduced to causativeness.

Causatives and Complex Events

Following Davidson, semanticists have assumed that sentences in the language assert the existence of underlying events. In Neo-davidsonian theories the event argument is existentially quantified, and in the event calculus the event is constructed

in some fashion on top of the timeline (represented by the Reals). In any case, the classification to situation types (or *Aktionsart*) refers to those underlying events.

A fundamental question about causatives is how many events we can find under their denotation. Dowty's original proposal (130) gives the causative a 'bisentential analysis'. This analysis involves two underlying event arguments that are interrelated using the CAUSE connective.

However in our account, events might have an elaborate internal structure (e.g., achievements and accomplishments) which involve cause-effect relations and this by itself doesn't justify decomposition into two events.

The view that accomplishment verbs are 'bisentential' and denote two subevents had been rejected by many recent linguists [35, 44] however they continue to identify *true* causative verbs with 'complex events', i.e., events that involves two constituent subevents that are related via a *cause* relation.

An important difference Levin notes between the subevents in accomplishments and subevents in what she calls *true* causatives is that subevents of accomplishments are necessarily temporally dependent, whereas with other causative this need not be the case. In (133a) the activity and the process of realizing the goal unfold together, whereas in (133b) Terry's decision could have been made well before Sandy hears of it and be totally independent of it.

(133) a. Susan ran to the house
b. Terry shocked Sandy by deciding to run for office

Following this temporal independence observation, we suggest a view that causative constructions are ones that add a 'cause' and 'effect' relation, contingent on the fact that the 'cause' and 'effect' relation is *not* one that is defined by default in the elaborate internal structure of the eventuality at hand. Rather, it is added on top of the default internal relations, and therefore can be seen as conceptually 'independent'.

However, the manner in which external causes take effect is not different from the way default causes affect the internal temporal constituency, and thus the addition of an external cause may trigger a more complex event structure of the original event (the 'effect'), without necessarily requiring its decomposition.

As we shall see, the existing notions of cause and effect can be used to reconstruct the new complex event, and predict a shift in the verb's situation type. The current proposal stays neutral with respect to whether the external cause deserves the status of an independent event or not. In fact, it is the context that will determine this. By risk of incorporating details too early, I illustrate how a cause can be either a part of the event or of a different one.

(134) a. hatmuna hicxika et dina
The-picture laugh$_{\text{cause}}$ ACC Dina

The picture caused Dina to laugh

b. halecan hixik et dina
The-clown $\text{laugh}_{\text{cause}}$ ACC Dina
The clown caused Dina to laugh

c. ze šehalecan naṕal al haroš hixik et dina
That the-clown fell on the-head $\text{laugh}_{\text{cause}}$ Dina
The clown falling on his head caused Dina to laugh

Again, it is hard to say whether the 'cause' of Dina's laughing deserves the status of a separate event. In the first example, we are concerned with an instrument that causes Dina's laughing, in the last another event (the clown's falling, an achievement) is the cause of laughing, and the second case is ambiguous between the two readings.

Nevertheless, in the three examples the verb $hicxik$ ($\text{laugh}_{\text{cause}}$) carries a basic meaning that persists in all these contexts. This meaning is precisely what we are interested in formalizing.

The Causal Chain

A different link between causal relations and situation types that seems more productive in the discussion the aspectual distinctions was proposed by Smith [47]. The *causal chain* (originally attributed to Croft) was used by linguists to account for different phenomena related to the internal event structure (e.g., event components, thematic roles, etc). The scheme is, roughly, iconic from left to right in the sense that it represents temporal precedence.[15]

(135) CAUSE SUBJECT ACTION OBJECT RESULT

Smith uses the causal chain "to study the different lexical spans of verb constellations"[47, p. 33–36]. A *lexical span* means "how much of the causal chain it covers", and *situation types* (or *Aktionsarten*) have different characteristic spans. Thus she identifies the following situation types according to their mapping onto the causal chain:

(136) a. state .....RESULT
b. activity .....SUBJECT ACTION.....
c. achievement .....ACTION OBJECT RESULT
d. accomplishment SUBJECT ACTION OBJECT RESULT
e. semelfactive .....ACTION.....

[15] I leave out 'instrument' as it is not sequential and can be reduced to part of the action.

There are several interesting observations about this account in the context of the current study. First, the account fits the view that cause is a part of the event elaborated structure rather then requiring event decomposition.

Second, it identifies causal relations with temporal precedence. This observation is not as trivial as it sounds and it has been claimed by philosophers (e.g., Lewis) that temporal precedence need not be assumed in true causatives. Following Dowty [18], Rothstein [44] and others I assume that the cause precedes the effect and leave other kinds of exceptional causatives out of discussion.

Lastly, ignoring terminology, the underlying characteristic lexical span of various situation types is iconically (almost entirely) identical to the ones indicated by the tuples of the EC.

(137) a. state .....$\langle -, -, -, + \rangle$
b. activity .....$\langle +, +, -, - \rangle$
c. achievement .....$\langle -, -, +, + \rangle$
d. accomplishment $\langle +, +, +, + \rangle$
e. semelfactive .....$\langle -, -, +, - \rangle$

There is still, however, one fundamental problem with this account. According to Smith definitions (136) the CAUSE ingredient does not have its own contribution to the lexical span of different situations. The only reference to the CAUSE element is done with respect to accomplishments which contain the entire span. This brings back the problem of causative-accomplishment identification.

On a different note, as a by-product of the theory Smith presents a *causative classification* that emerges from the mapping from sentences onto parts of the causal chain. Thus, she distinguishes *Causative, Inchoative, Inceptive, Egressive* and *Resultative* sentences as events that focus on 'the entire chain', 'entry into a state', 'entry into an event', 'exit from an event' and 'the end of the chain' respectively.

I believe that in this account there is a confusion between 'cause' and 'CAUSE' that parallels the problems we discussed above. A 'cause' is a relation that refers to every two elements in the sequence (SUBJECT causes an ACTION, ACTION causes a RESULT, etc), and a CAUSE is an additional element (of the same type of SUBJECT, OBJECT, ACTION) that can be added to the chain on top of existing elements.

In order to remedy the problematic identification between causatives and accomplishments and to avoid the confusion between 'cause' and CAUSE, I modify the causal chain account and rephrase it according to our needs:

The causal chain is a list of elements that iconically stand in 'cause' and 'precedes' relation from left to right. The *lexical span* of the situation is defined by its mapping

onto the causal chain.[16]

(138) SUBJECT ACTION OBJECT RESULT

The causal chain can be altered with an additional element CAUSE, that precedes any of the other elements.

(139) (CAUSE) SUBJECT ACTION OBJECT RESULT

Since not all situations map onto the entire span of the list, the addition of the external element at the head of the chain puts focus on the beginning of the situation and give rise to the *causative*/*inceptive*/*inchoative* interpretation.

(140) (CAUSE) SUBJECT ACTION OBJECT RESULT

(141)
a. caused state .....CAUSE RESULT (*inchoative*)
b. caused activity ...CAUSE SUBJECT ACTION (*inceptive*)
c. caused Achiev. ...CAUSE ACTION OBJECT RESULT (*inceptive*)
d. caused Accomp...CAUSE SUBJECT ACTION OBJECT RESULT (*causative*)

In sum, the lexical chain provides us with a means to define more precisely the difference between 'cause' as a relation between components of the internal events structure and a CAUSE which is an additional element that is added and alters the situation viewpoint. The CAUSE stands in 'cause' and 'precede' relations to the first element in the lexical chain and it may give rise to a different interpretation to the one denoted by the verb's original Aktionsart.

Causative and Thematic Relation

Causatives are often mentioned with connection to agency. Following our claim that causatives are events with an added external cause, and as a direct implication of the possible temporal independency introduced by Levin, it is assumed that causes contribute a new participant in addition to those that already exist in the original situation.

Doron [15] formalizes this notion in her account of the Semitic templates and defines causative constructions as ones that contribute an additional agent participant in the sense of Dowty's proto-agent [17].

In this work we assume that the additional cause element introduces an additional agent-participant. However, we will not be concerned with the specific kind of agency involved and specific entailments (in the sense of Dowty's proto-agent list). This will be left open for future research.

[16] Formally, it shall correspond to the EC quadruples.

Summary

A cause is a relation within the internal structure of events. It characterizes features of the structures we have elaborated for different kinds of eventualities and can take different forms (instantaneous, gradual changes). The cause relation entails precedence (the cause always temporally precedes the effect).

Causatives as linguistic terms cannot be reduced to philosophical causation, and vice versa. Causatives might, but not necessarily do, entail an additional subsituation. This is in many cases dependent on context.

We define causatives as events/situations with an additional, external, component. The additional component stands in 'cause'/'precede' relation to the existing situation and its internal constituents. It brings about the occurrence of the same event, however the original event is looked at from a different viewpoint which might trigger a shift into a different situation type.

The various interpretations that are available under the causative reading are *inchoative, inceptive,* and *causative* all of which put emphasis on the bringing about/coming about of the new (static/dynamic) situation.

6.3.2 Causatives in Hebrew

Causative Constructions in Hebrew

Hebrew exhibits the three types of traditional causative: lexical, morphological, and analytic.

(142) a. Bill harag et Fred
Bill $\text{killed}_{\text{simple}}$ ACC Fred
Bill killed Fred

b. Bill hemit et Fred
Bill $\text{die}_{\text{cause}}$ ACC Fred
Bill caused Fred to die

c. Bill garam lefred lamut
Bill caused to-Fred to-die
Bill caused Fred to die

In (142a), a lexical item (the root $[h][r][g]$, kill) denotes both the cause and the effect. In (142b) a causative verb is derived from the simple verb met (die) and the morphological template Hiphil that contributes the causing event, and in (142c) the cause and effect events are denoted by the matrix verb 'cause' and the complement verb 'to-die' respectively.

In all three cases it is possible to argue that the construction denotes a complex event compound of two subevents: one of Bill's doing something that causes Fred to die, and the other in which Fred is dead. The events need not be temporally or spatially dependent, as Bill may shoot Fred, he may disconnect him from some medical machinery (that will cause him to die after a minute/hour/day), or, supposing Bill is a king and Fred is a prisoner, he may order his servants to deny Fred with food.

Neither the three expressions nor the three descriptions are strictly equivalent. I suggest that in all cases we are concerned with a complex event with two constituent subevents, however the temporal and spatial distance between the causing and caused events are iconically represented by the distance between the constituent lexemes/morphemes.

(142a) is most compatible[17] with shooting Fred, that requires Bill and Fred to be at the same time in the same place, and the two subsituations collapse into one. (142b) is compatible with disconnecting Fred from medical machinery, which requires Bill to be in the same place, but not necessarily in the same time, of Fred's death, and (142c) is compatible with Bill denying Fred's food, which does not require Bill to be anywhere near Fred, and moreover he need not know when (or even if) the actual dying event occurred.

In this study I am concerned only with causative constructions of the second type, in which verbs are derived from basic non-causative lexical items (roots) using the causative template. However, I will not try to draw a clear line between the three kinds of causative because I believe that these examples, rather then representing discrete categories, belong to a continuum.

In practice, the analysis I give is more appropriate to the second and third types in which the meaning is a result of the interaction between two elements in the grammar of the language (a basic lexical item and a syntactic form), in which one contributes a cause and the other the effect. However, I stay neutral with respect to whether the cause requires an 'independent' status with its own elaborated internal structure or not. What I am going to be concerned with is how the additional cause affects the structure of the original non-causative event that was denoted by the primitive lexical material (the root).

The lexical causatives *kill, break, open* are left out of the analysis as they are essentially different from the other two. In lexical causative (which Levin [35] calls 'true causative') both the cause and the effect are parts of the lexical meaning. In our formal framework we have classified them as achievements. It should be noted, however, that the proposed analysis of causative constructions doesn't interfere with our preliminary account since such lexical items are ungrammatical with the causative template, and this by itself provides an indication that the causative component, in this case, is superfluous.

[17] Based on Hebrew native speakers 'free associating', due to my informants.

(143) a. $[p][t][x] + B_{\mathrm{s}} = patax$ (open)
b. $[p][t][x] + B_{\mathrm{c}} = *hip\breve{t}iax$ (*cause-to-open)

(144) a. $[h][r][g] + B_{\mathrm{s}} = harag$ (kill)
b. $[p][t][x] + B_{\mathrm{c}} = *heherig$ (*cause-to-kill)

(145) a. $[\check{s}][\check{b}][r] + B_{\mathrm{s}} = \check{s}a\check{b}ar$ (break)
b. $[\check{s}][\check{b}][r] + B_{\mathrm{c}} = *hi\check{s}bir$ (*cause-to-break)

Morphological Causatives in Hebrew

It has been claimed before by Hebrew linguists that there are other morphological causative constructions in Hebrew in addition to the Hiphil. Creason [10] in his study of Aktionsart in Biblical Hebrew, defines *complex situations* as having the structure [$situation_1$ CAUSE $situation_2$], identifies them with the term *causative*, and defines both the intensive and the causative verbs as such.

The analysis of the intensive verbs as complex events, and as causative in particular, is hard to maintain, even in Creason's own account. To do so, he needs first to classify them into different categories (resultative, factitive, frequentative and others) in which the line between the two constituents substitutions is drawn in different manners, and second he has to acknowledge the fact that some intensive verbs simply denote non-complex situations (all the examples are adopted from [10, ch. 4].)

(146) *factitive* (bringing about a change of state)
a. $[y][b][s] + B_{\mathrm{i}} = yibes$ (dry)

(147) *resultative* (focus on the result of a simple verb)
a. $[r][p][a] + B_{\mathrm{i}} = ripe$ (cure)

(148) *frequentative* (non-complex repetitive/iterative sitautions)
a. $[h][l][k] + B_{\mathrm{i}} = hilek$ (walk intensively, walk around)

(149) *other* (non-complex sitautions)
a. $[r][d][p] + B_{\mathrm{i}} = ridef$ (chase)

It seems that the analysis of intensives as causatives is a result of a confusion between complex events and simple events with complex internal structure. We have shown in the previous sections that the intensive template has a semantic contribution to the temporal schemata of the event under denotation. Clearly, the contribution of the template may trigger a more elaborated event structure than the corresponding simple verb, but it need not require the addition of an external component we have defined as a 'CAUSE'.

This fact can be further motivated by the fact that the intensive template does not contribute an additional participant, which does not leave room for the temporal/spatial independence we discussed in (142).

6.3.3 The Causative Template Hiphil

The causative template, *Binyan Hiphil*, B_{c} in our notation, is morphologically marked with an additional consonant *heh* (h) prefixed to the root and semantically marked with the γ agency head.

Examples:

(150) a. $[']{}[c][b] + B_{\mathrm{c}} = he'eci\check{b}$ (cause-to be sad)
b. $[s][k][b] + B_{\mathrm{c}} = hiski\check{b}$ (cause-to lie down)
c. $[c][x][k] + B_{\mathrm{c}} = hicxik$ (cause-to laugh)
d. $[a][\check{k}][l] + B_{\mathrm{c}} = he'e\check{k}il$ (feed)
e. $[l][b][s] + B_{\mathrm{c}} = hilbi\check{s}$ (dress (someone))
f. $[x][\check{s}][k] + B_{\mathrm{c}} = hexe\check{s}i\check{k}$ (make-dark, darken)
g. $[x][l][\check{s}] + B_{\mathrm{c}} = hexeli\check{s}$ (make-weak, weaken)

Horowitz [31] offers a 'pseudo-algorithm' to calculate the meaning of Hiphil verbs:

> "If you come across a verb in the Hiphil pattern, extract the root and put before it the phrase 'to cause' or 'to make' and you will have the meaning of the verb." [31, p. 140]

This simplified algorithm should be successfully applied to minimal pairs such as the following (for more examples see [31, p. 142–147])

(151) a. $[s][k][b] + B_{\mathrm{s}} = sakav$ (lie down)
b. $[s][k][b] + B_{\mathrm{c}} = hiskiv$ (cause-to lie down)
(152) a. $[c][x][k] + B_{\mathrm{s}} = caxak$ (laugh)
b. $[c][x][k] + B_{\mathrm{c}} = hicxik$ (cause-to laugh)
(153) a. $[x][\check{s}][k] + noun = xo\check{s}e\check{k}$ (darkness)
b. $[x][\check{s}][k] + B_{\mathrm{c}} = hexe\check{s}i\check{k})$ (make-dark, darken)
(154) a. $[x][l][\check{s}] + adjective = xala\check{s}$ (weak)
b. $[x][l][\check{s}] + B_{\mathrm{c}} = hexeli\check{s}$ (make-weak, weaken)

It is less obvious how we derive the meaning of the following verbs, all of which are derived using the template 'Hiphil'.

(155) a. $hitxil$ (start)

b. $higia$ (arrive)
c. $hiksib$ (listen)
d. $he'emin$ (believe)

The upcoming discussion attempts to relieve the tension between the strict notion of 'cause' that is expected under such a description and the variety of available meanings of Hiphil verbs.

Our point of departure for the discussion of the semantic contribution of the causative templates is that the causative template contributes an external cause to a non-causative situation.

> "The agency head γ relates an eventuality to its cause [...] Unlike ι which does not introduce a new thematic relation but just a property of the event, γ introduces a new thematic relation: Cause."[15, p. 40]

Doron presents an account in which a new participant is added and related as a 'cause' to the eventuality denoted by a simple verb. Moreover, she posits that the thematic role introduced by γ, a cause, differs from the thematic role of the original agent, and thus γ's argument is always different to the subject of a simple verb. This, she believes, is the systematic contribution that is manifested in such pairs:

(156) a. $[p][x][d] + B_{\text{s}} = paxad$ (fear)
b. $[p][x][d] + B_{\text{c}} = hip\check{x}id$ (frighten)

(157) a. $[\check{s}][t][k] + B_{\text{s}} = \check{s}atak$ (be silent)
b. $[\check{s}][t][k] + B_{\text{c}} = hi\check{s}tik$ (make silent)

(158) a. $[h][l][k] + B_{\text{s}} = hala\check{k}$ (walk)
b. $[h][l][k] + B_{\text{c}} = holi\check{k}$ (walk someone/something)

(159) a. $[r][k][d] + B_{\text{s}} = rakad$ (dance)
b. $[r][k][d] + B_{\text{c}} = hirkid$ (cause-to dance)

(160) a. $[a][\check{k}][l] + B_{\text{s}} = a\check{k}al$ (eat)
b. $[a][\check{k}][l] + B_{\text{c}} = he'e\check{k}il$ (feed)

(161) a. $[l][\check{b}][\check{s}] + B_{\text{s}} = la\check{b}a\check{s}$ (dress)
b. $[l][\check{b}][\check{s}] + B_{\text{c}} = hilbi\check{s}$ (dress someone)

(162) a. $[k][\check{p}][a] + B_{\text{s}} = ka\check{p}a$ (freeze)
b. $[k][\check{p}][a] + B_{\text{c}} = hikpi$ (cause-to freeze)

Although Doron's account is centered around the thematic domain, she makes a crucial observation that is also relevant to the aspectual domain:

> "The causative morphology marks a change in the default attribution for causation" [15, p. 31]

The intuition behind this is simple. Take for instance the minimal pair in (161). In the simple sentence 'Dani labaš xulca' ('Dani put on a shirt') the agent of the 'dressing' event is the one putting his clothes on, and he is by default the cause of the 'dressing' event. In the causative verb alternation this is no longer the case. An additional participant, external to the original situation, is introduced and is now the cause of putting someone's clothes on, this 'someone' being the former agent participant.

It shall be seen that this observation applies also to the aspectual domain. Take as a starting point the elaborated event structure as formalized in EC (i.e., relations between *fluents* and *events*). The addition of an external cause introduces an *additional* relation between the newly introduced 'cause' and the *events/fluents* already existing in the original scenario.

Intuitively, this changes the overall scenario and the derivation of the aspectual description of the causative verb. In fact, we shall see that it also alters the point of view on the event as the focus is now put on the relation between this new component and the existing participants, and not on relations internal to the original situation type.

Similar to the discussion of the intensive template, we would like to account for denominal verbs that correspond to nouns (163)–(166) or adjectives (167)–(170). In this case, again, it is claimed that the event is introduced by the template, not by the root's meaning, however the question is then how we derive the preliminary temporal schemata of such verbs, and what kind of event is introduced by the causative template.

(163) a. $[a][z][n] + \text{noun} = ozen$ ear
b. $[a][z][n] + B_{\text{c}} = he'ezin$ listen

(164) a. $[l][š][n] + \text{noun} = lašon$ tongue
b. $[l][š][n] + B_{\text{c}} = hilšin$ slander

(165) a. $[z]['][a] + \text{noun} = ze'a$ sweat
b. $[z]['][a] + B_{\text{c}} = hezi'a$ sweat

(166) a. $[a][r] + \text{noun} = or$ light
b. $[a][r] + B_{\text{c}} = he'ir$ emit light

(167) a. $[a][r][\check{k}] + \text{adjective} = ar\check{o}k$ long
b. $[a][r][\check{k}] + B_{\text{c}} = he'eri\check{k}$ lengthen

(168) a. $[š][m][n] + \text{adjective} = šamen$ fat
b. $[š][m][n] + B_{\text{c}} = hišmin$ make fat

(169) a. $[x][z][k] + \text{adjective} = xazak$ strong
b. $[x][z][k] + B_{\text{c}} = hexezik$ hold/grasp strongly

(170) a. $[']['\check{s}][r] + \text{adjective} = a\check{s}ir$ rich
b. $[']['\check{s}][r] + B_{\text{c}} = he'e\check{s}ir$ enrich

So, our aim in the proposed solution is to account for the contribution of the causative agency functional head γ in a way that allows us:

1. to formulate precisely what is the 'external cause' and how it contributes to the event structure
2. to account for the meaning of verbs derived from denominal roots that correspond to nouns/adjectives

The proposed solution is that the causative template introduces an *immediately preceding* external cause for instantaneous events and a *parallel* extended external cause for extended events, and puts the emphasis on the beginning/development phases of the original event denoted by the equi-root simple verb.

The formalization of this solution relies on the revised *causal chain* model we presented and makes reference to *aspectual verbs*, ultimately viewing the Hiphil as a *super-lexical morpheme*. A discussion and incorporation of these notions to a fully-fledged formal solution follows in sections 6.3.3, 6.3.3 and 6.3.3 respectively.

The causal chain

According to Doron, the semantic template contributes a new participant. In our account, this additional participant adds another component (for the time being, it can be either a fluent or an event type) to the internal structure of the event. This additional component adds additional 'cause' relation(s) to the scenario.

The integration of the new participant can be defined algorithmically using the revised definition of the lexical chain in section 6.3.1:

1. identify the event structure of the simple lexical item in terms of the EC quadruples (formally, the $PSCEN$ of the root)
2. add a new component α to the left of the quadruple
3. relate α it to the first element in the original quadruple in a causal relation (for the time being, let us assume this is done via the Initiates predicate).

Thus, we get the following revised abbreviations for the different situation types

(171) a. caused state: $\langle\alpha\rangle$,$\langle -, -, -, f_3\rangle$ α *causes f3*
b. caused activity: $\langle\alpha\rangle$,$\langle f_1, f_2, -, -\rangle$ α *causes f1*
c. caused achievement: $\langle\alpha\rangle$,$\langle -, -, e, f_3\rangle$ α *causes e*
d. caused accomplishments: $\langle\alpha\rangle$,$\langle f_1, f_2, e, f_3\rangle$ α *causes f1*

Note that all α elements conceptually represent 'an external cause' but α can be of any kind. It can be a primitive event type, a fluent, several interrelated fluents (take for instance the dynamics introduced by the intensive template) or a hierarchically planned event.

In order to define the type of the additional element α, we assume that it occupies that first empty slot(s) that immediately precede (to the left) existing elements in the original quadruple. So, for instance, a 'caused state' can be represented as follows in (172). Examples of the various other interpretations of will follow.

(172) a. caused state: $\langle\alpha\rangle$,$\langle -, -, -, f_3\rangle \Rightarrow \langle -, -, e, f_3\rangle$

Aspectual verbs

In addition to the contribution of additional lexical material (a cause) the contribution of the Hiphil alters the viewpoint of the event in the sense that it mirrors the viewpoint of what we call *aspectual verbs*.

Aspectual verbs are verbs that focus on specific temporal stages of the event, e.g., 'start', 'begin', 'continue' and 'stop'. Their complement verbs refer to basic situation types, and the meaning of the aspectual verb focuses the attention on a specific part of the basic situation.

These verbs present parts of situations as events on their own right. This altered viewpoint might also change the interpretation of the default situation type of the original verb. Contrast, for instance, the *accomplishment* in (173a), the *achievement* in (173b), and the *activity* in (173c), all derived from the 'run' basic activity.

(173) a. John ran home
b. John stared to run home
c. John continued to run home

A cause brings about an entry into a new event or state. For instance, in (174a) Dani causes the light to *be* on. This can be done simply by switching it on. In (174b) Dani causes the light to *stay* on. This can be done, for instance, by pushing a push button that takes effect only as long as it's pushed.

(174) a. Dani hidlik et ha'or
Dani $\text{light}_{\text{cause}}$ ACC the-light
Dani put on the light
b. Dani Hiš'ir et ha'or daluk
Dani $\text{stay}_{\text{cause}}$ ACC the-light lit
Dani caused the light to stay on

Thus, Dani causes the light to stay on by retaining the pushing (ongoing) activity, and this put emphasis on the progression/development of the situation, rather than on its strict initiating event.

The appropriate reading of the different Hiphils is picked out depending on the original meaning of the root it is derived from. However, in all cases it puts emphasis on the beginning, progression, and/or the development of the situation.

Interestingly enough, the Hebrew aspectual that refer to the initiation and development of a situation are invariably derived from the Hiphil (without an alternating active template), which is correlated with the hypothesis that the Hiphil has this aspectual characteristic as an inherent feature.

(175) a. $[t][x][l] + B_{\text{s}} = *taxal$
b. $[t][x][l] + B_{\text{i}} = *tixel$
c. $[t][x][l] + B_{\text{c}} = hitxil$ (begin)
d. $[t][x][l] + \text{noun} = txilah, hatxala$ (beginning)

(176) a. $[m][s][k] + B_{\text{s}} = maša\check{k}$ (pull)
b. $[m][s][k] + B_{\text{s}} = *miše\check{k}$
c. $[m][s][k] + B_{\text{c}} = himši\check{k}$ (continue)
d. $[m][s][k] + \text{noun} = meše\check{k}$ (continuance)

Hiphil as a super-lexical morpheme

Some languages mark morphologically the meaning of aspectual verbs such as 'start', 'continue', 'stop', for instance, Russian and Navajo. Smith calls such affixes *super-lexical morphemes* because "they modulate the focus of the situation rather then determining the situation itself" [47, p. 76].

To exemplify what a *super-lexical* morpheme is we can follow the citation of the Russian example:

(177) a. $govorit'$ (speak)
b. $zagovorit'$ (begin to speak)

Forsyth [21] comments that the prefix za "leaves unaltered the basic meaning of the original verb but indicates how the action develops or proceeds".

I claim that this is precisely the contribution of the Hiphil to the aspectual meaning of the original verb. First, it indicates how or why it started, and second it gives essential meaning as to how or why it proceeds. Of course, it may carry additional lexical material or may alter the lexical meaning of the root, however it still allows us to make predictions about the aspectual viewpoint on the altered meaning of the verb.

The proposed solution is, therefore, that the causative template contributes an additional cause element in front of the *causal chain* elements that are represented in the original eventuality denoted by the root.

Also, the causative template alters the viewpoint of the situation to refer to the specific point in which the 'cause takes effect'. In this it resembles *aspectual verbs* as it focuses attention on a specific part of the situation and can be viewed as a *super-lexical morpheme*.

Crucially, the causative template does not allow reference to a causing event that is temporally excluded from the reference point. So, in the case of instantaneous events it requires an immediately preceding cause, and in the case of extended events it requires an immediately preceding cause plus a continuous stimulus for the event to keep holding. We shall show how the application of this condition enforces a parallel background event/state to hold as long as the original caused event is being referred to.

6.3.4 Formal Account

The causative criteria provide additional lexical material to account for the addition of an external cause to the eventuality denoted by the root. The kind of material that is required to define formally this external cause is dependent on the original situation, because in practice we fill in the immediately preceding empty slots in the original quadruple.

The causative criteria also provide an integrity constraint to alter the viewpoint on the situation to the phase in which the cause takes effect. In practice, if the reference point is defined for extended events/fluents, it shall force the cause to hold as long as the effect holds. Note that this is not a general 'causative' characteristic, but rather, a phenomena that stems from the particular viewpoint of the causative template.

The ultimate purpose of causative criteria is to alter the *default* attribution of causation in the preliminary scenario. Let us briefly review how it is done for the different kinds of eventualities we have in *EC*.

Again we start with verbal roots (i.e., ones that have a simple verb counterpart) and characterize the result eventuality with respect to the one denoted by the simple verb. Later we treat denominal roots, and comment about Hiphil verbs that seem to lack a causative component altogether.

STATES $\langle -, -, -, + \rangle$

States do not have a causal element in their preliminary scenario and are characterized by a fluent f_3 that holds at some time instant t. In this case the causative

template introduces an initiating cause, by means of an immediately preceding event.

Definition 41. Let V be a causative verb, and V_{s} its simple verb counterpart associated with a *state* eventuality and characterized by a fluent f_3. The feature γ requires the presence of a cause consisting of the following general statement:

1. $\mathsf{Initiates}(e, f_3, t)$

This definition ensures an update of the database with an explicit initiating event for every fluent object f_3, and the result scenario can be seen as an *inchoative* achievement $\langle -, -, +, + \rangle$. Note that the initiating event, however, can be of any kind and temporal extension (punctual, hierarchically planned, etc.)

Definition 42. Let V be a causative verb associated with an eventuality which is characterized by a fluent f_3 and additional lexical material in the sense of definition 41. The reference point of the feature γ is introduced by the following IC:

$$?\mathsf{HoldsAt}(f_3, R), \mathsf{Happens}(e, R'), R' = R - \epsilon, R \gtreqless now \textit{ succeeds}$$

The purpose of the integrity constraint is to make sure that both the cause (e) and the effect (f_3) holds at the reference point (modulu ϵ to allow the cause to take effect).

ACHIEVEMENTS $\langle -, -, +, + \rangle$

Achievements already have a causal element in their preliminary scenario (e, the canonical culminating point). The causative template in that case changes the default attribution of causation by contributing dynamics that fills in the immediately preceding slots f_1, f_2.

Definition 43. Let V be a causative verb and let V_s be its simple verb counterpart associated with an *achievement* eventuality, characterized by a canonical goal e and a result state f_3. The feature γ requires the presence of a run-up (preparatory) phase that is introduced by the following general statements:

1. $\mathsf{Initiates}(e', f_1, t)$
2. $\mathsf{Releases}(e', f_2, t)$
3. $\mathsf{HoldsAt}(f_2(x), t) \rightarrow \mathsf{Trajectory}(f_1, t, f_2(x'), d)$
4. $\mathsf{HoldsAt}(f_2(c), t) \wedge \mathsf{HoldsAt}(f_1, t) \rightarrow \mathsf{Happens}(e, t)$

where e is the canonical goal of the original event.

The dynamics added to the scenario precedes the resulting change of state and in fact makes the connection between the external cause and the resulting change of state. We shall see below how it can be applied both to instantaneous and continuous events that cause (or bring about) the achievement.

In both cases, the result scenario can be seen as a *run-up* achievement and can be abbreviated as $\langle +, +, +, + \rangle$, however we still need to make sure that the reference point refers to the phase in which the cause takes effect. This is done by means of an integrity constraint

Definition 44. Let V be a causative verb associated with eventuality which is characterized by a canonical goal e and a result state f_3 plus lexical material in the sense of definition 43. The past/present[18] tenses for the result scenario are introduced via the following integrity constraints:
For past:

$$?\mathsf{Happens}(e', R), R < now \textit{ succeeds}$$

and for present:

$$?\mathsf{HoldsAt}(f_1, R), R < now \textit{ succeeds}$$

where e' is a hierarchically planned event.

The purpose of this integrity constraint is to make sure that the element that makes the explicit connection between the cause and the effect holds at the reference point (in the past, the hierarchically planned event encompasses both the cause and the effect. In the present, the fluent f_1 drives the run-up phase forwards towards the canonical goal that is yet to be achieved).

ACTIVITIES/ACCOMPLISHMENTS $\langle +, +, \pm, \pm \rangle$

Activities occupy by default the first slots of the quadruple, thus naively we could think of adding an initiating event e' as the external cause event for fluent f_1 as we did for f_3 of *states*. However, activities in fact already induce the existence of an initiating event (in minimal models without any contextual information this event will be by definition their event type derivative $e' = e_f^+$).

Moreover, the causing element e might be a punctual event, whereas in our case the element that causes f_1 must be temporally extended. The point is crucial as we want both the cause and the effect to hold at any point of the activity fluent f_1 that is referred to by the Hiphil.

So, the lexical contribution of the template provides the dynamics that brings about the initiating event of the original activity fluent (this gives us, roughly, the meaning of the aspectual verb 'start'), and an integrity constraint that ensures that this

[18]The future tense is given by a much more complicated construction in the sense of the definition in [52, p. 125]. For the sake of simplicity and readability I leave it out of this account.

dynamics keeps holding as long as the original event does (this gives us, then, the meaning of the aspectual verb 'continue').

Definition 45. Let V be a causative verb, and V_{s} its simple verb counterpart associated with an *activity/accomplishment* eventuality, characterized by the fluents f_1, f_2. The feature γ requires the presence of a run-up phase that brings about the initiation of f_1 and is introduced by the following general statements:

1. $\mathsf{Initiates}(e', f_1', t)$
2. $\mathsf{Releases}(e', f_2', t)$
3. $\mathsf{HoldsAt}(f_2'(x), t) \rightarrow \mathsf{Trajectory}(f_1', t, f_2'(x'), d)$
4. $\mathsf{HoldsAt}(f_2'(c), t) \wedge \mathsf{HoldsAt}(f_1', t) \rightarrow \mathsf{Happens}(e, t)$

where e is the start event of the original activity.

Thus, the result scenario can be abbreviated as follows $\langle +, +, +, +, -, - \rangle$ where the tuple structure corresponds to $\langle f_1', f_2', f_1, f_2, -, - \rangle$.

Definition 46. Let V be a causative verb associated with an eventuality characterized by the fluents f_1, f_2 and additional lexical material in the sense of definition 45. The feature γ introduces the following integrity constraints:

$$?\mathsf{HoldsAt}(f_1, t), \neg\mathsf{HoldsAt}(f_1', t) \textit{ fails}$$

The practical implication is, then, that if the original activity holds at the reference point, then the causal activity needs to hold as well.

Tense for activities and accomplishments is introduced as usual by requiring the activity fluent f_1 to hold at the reference time.

The various result situations we get with can be represented using the extended tuple we introduced as $\langle f_1', f_2', f_1, f_2, e, f_3 \rangle$

1. state $\langle -, -, -, -, +, + \rangle$
2. activity $\langle +, +, +, +, -, - \rangle$
3. achievement $\langle -, -, +, +, +, + \rangle$
4. accomplishment $\langle +, +, +, +, +, + \rangle$

The criteria we introduced also result in altering viewpoints on the original situations.

In what follows we demonstrate in further detail the effect of the causative template criteria on various eventuality types and show how it interacts with the viewpoint defined by the tense of the original situations.

6.3.5 Applications

STATES $\langle -, -, -, + \rangle$

Examples:

(178) a. $[s][n][a] + B_{\text{s}} = sana$ (hate)
b. $[s][n][a] + B_{\text{c}} = hisni$ (cause to hate)

(179) a. $[d][a][g] + B_{\text{s}} = da'ag$ (be worried)
b. $[d][a][g] + B_{\text{c}} = hid'ig$ (cause to worry)

(180) a. $[p][x][d] + B_{\text{s}} = paxad$ (fear)
b. $[p][x][d] + B_{\text{c}} = hipxid$ (frighten)

State verbs introduce the following preliminary scenario:

1. $\mathsf{HoldsAt}(f_3, t)$

The causative criteria introduce the following general statement:

1. $\mathsf{Initiates}(e, f_3, t)$

In conjunction with the tense definition the causative criteria define the following reference point:

$$?\mathsf{HoldsAt}(f_3, R), \mathsf{Happens}(e, R'), R' = R - \epsilon, R \gtreqless now \textit{ succeeds}$$

Take for instance the following past, present and future utterances in (a), (b) and (c) respectively:

(181) a. hatsunami hid'ig et hatošaďim
The-tsunami worried$_{\text{cause}}$ ACC the-people
The tsunami caused the people to be worried
b. hatsunami mad'ig et hatošaďim
The-tsunami worry$_{\text{cause}}$ ACC the-people
The tsunami causes the people to be worried
c. hatsunami yad'ig et hatošaďim
The-tsunami will-worry$_{\text{cause}}$ ACC the-people
The tsunami will cause the people to be worried

The interpreted result scenario is then the following *inchoative* scenario and its eventuality structure mirrors an achievemnt.

1. $\mathsf{Initiates}(tsunami, worried, t)$
2. $\mathsf{HoldsAt}(worried, t)$

Moreover, the causative template enforces us to include both the cause (tsunami) and the effect (worry) in the reference point (and an ϵ time between the cause for the state and the state starting to hold).

$$?\mathsf{HoldsAt}(worry, R), \mathsf{Happens}(tsunami, R'), R' = R - \epsilon, R \gtreqless now \textit{ succeeds}$$

Note that even in the case of present tense $R = now$, the present moment is extended by ϵ to allow the cause to take effect. This is, however, cognitively plausible as it has been acknowledged by psychologists [52, part I] that *now* refers to an extended period of time that lasts about three seconds.

Crucially, the event called 'tsunami' here does not refer necessarily to the wave itself. For instance, one might utter the sentence in (181b) although the tsunami itself has already terminated. Here, the term 'tsunami' refers to an extended event that takes into account following consequences and side-effects (this interpretation of 'tsunami' is different to the one in, for instance 'the tsunami ruined many houses').

This is strengthened in the future utterance in (181c) which is naturally read as a pessimistic prophecy. It implies that the consequences and side effects of the tsunami will still hold at some reference point in the future.

Note that nothing prevents a situation that is initiated by an event (e.g., the tsunami) from holding after the initiating event is over (this will be the case in minimal models, by inertia). However, then the situation should be described using a different template (e.g., the simple verb that denotes 'I am worried'). When a speaker makes an aspectual choice of the Hiphil, she refers to the moment where the cause takes effect.

A note about the temporal extension of states and caused states: In Vendler's work [53] states are related to time instants in which they hold (rather then a unique and definite time period). Referring to a time instant in which a state holds via the causative construction enforces taking an initiating cause into account and providing an *inchoative* interpretation of this moment.

However, it has already been acknowledged (e.g., Dowty [18]) that states may be extended in time. In referring to an extended state a direct implication of the proposed formalism is that the caused event has to hold for each moment in which the effect holds, thus providing an extended caused event in the background of the state denoted by the preliminary scenario.

Thus, the following utterance is only felicitous if incorporating the extended 'tsunami' event in the background for two months:

(182) a. hatsunami mad'ig otanu kb̆ar xodšayim
The-tsunami $\text{worry}_{\text{cause}}$ ACC-us already two-months
The tsunami has been worrying us for two months now

Finally, when using the causative construction any kind of event can serve as a cause. In the following utterances e the initiating event is interpreted as a *state, activity, achievement* and *accomplishment* in (a), (b), (c), and (d) respectively.

(183) a. hamacaḃ hakaše hidi'g et ha'am
the-situation the-tough worried$_{\text{cause}}$ ACC the-people
The tough situation caused the people to be worried

b. šḃitat ha'oḃdim hidi'ga et ha'am
The-strike-of the-workers worried$_{\text{cause}}$ ACC the-people
The workers' strike caused the people to be worried

c. išhr haxok hidi'g et ha'am
approval of-the-law worried$_{\text{cause}}$ ACC the-people
The approval of the law caused the people to be worried

d. aliyat hamexirim hidiga et ha'am
increasing of-the-prices worried$_{\text{cause}}$ ACC the-people
The increasing of the prices caused the people to be worried

In the above sentences the causing elements are stated using a nominalized VP. In this work I am not dealing with nominalization (in general[19] or in Hebrew in particular[20]). However, it should be noted that the causing event can be expressed using a nominalized VP and be formalized using hierarchical planning as a single complex initiating event e'.

ACHIEVEMENTS $\langle -, -, +, + \rangle$

Achievement verbs get a slightly different treatment as they already contain a lexical causal element, and they denote a separate cause and effect. Thus, many achievement verbs are viewed as pure *lexical causatives* and lack the causative alternation altogether:

(184) a. $[s][b][r] + B_{\text{s}} = sabar$ (break)
b. $[s][b][r] + B_{\text{c}} = *hisbir$ (*cause to break)

(185) a. $[p][t][x] + B_{\text{s}} = patax$ (open)
b. $[p][t][x] + B_{\text{c}} = *hiptiax$ (*cause to open)

(186) a. $[h][r][g] + B_{\text{s}} = harag$ (kill)
b. $[h][r][g] + B_{\text{c}} = *heherig$ (*cause to kill)

However, achievement change-of-state verbs allow for the causative alternation. For example:

[19] More on nominalization in [52, ch. 12].

[20] See Berman [4] for the different kinds of nominalization in Hebrew.

(187) a. $[n][p][l] + B_{\text{s}} = nafal$ (fall)
b. $[n][p][l] + B_{\text{c}} = hepil$ (fell something)

(188) a. $[b][a][] + B_{\text{s}} = ba$ (come)
b. $[b][a][] + B_{\text{c}} = hevi$ (brought, cause to come)

(189) a. $[y][c][a] + B_{\text{s}} = yaca$ (go out, exit)
b. $[y][c][a] + B_{\text{c}} = hoci$ (cause to go out, take out)

In such verbs, the cause for the change of state remains unspecified. In these cases, the causative template specifies the cause for the change of state which is brought about. This cause can be either instantaneous or extended in time. In both cases the causative criteria contribute lexical material that relates the cause to the effect denoted by the preliminary scenario.

Take, for example, the minimal pair in (187). The simple verb *napal* (fall) denotes the following preliminary scenario, and the cause for the 'fall' event remains unspecified.

1. $\mathsf{Initiates}(fall, fallen, t)$

The causative alternation ***hipil*** (fell) then, incorporates a cause. However, this cause can be either a punctual event as in (190a) or an extended event as in (190b) (assuming the lumberjack had to cut for a while).

(190) a. habarq hepil et ha'ec
the-lightning fell ACC the-tree
The lightning felled the tree
b. xoteb-ha'ecim hepil et ha'ec
the-lumberjack fell ACC the-tree
The lumberjack felled the tree

Case 1: An instantaneous cause

First let us consider the utterance in (190a). The causative criteria introduce the following lexical material, with e', f_1', f_2' unknown parameters:

1. $\mathsf{Initiates}(e', f_1', t)$
2. $\mathsf{Releases}(e', f_2', t)$
3. $\mathsf{HoldsAt}(f_2'(x), t) \rightarrow \mathsf{Trajectory}(f_1', t, f_2'(x'), d)$
4. $\mathsf{HoldsAt}(f_2'(c), t) \wedge \mathsf{HoldsAt}(f_1', t) \rightarrow \mathsf{Happens}(fall, t)$

The event e' is then unified with the lightning, and f_1', f_2' remain to be instantiated. Again, semantic memory (and world knowledge) come into play. Typically, when lightning affects a tree it does not fall at the exact same moment, and even not

necessarily immediately after. Instead, the lightning damages the tree enough so that nature and gravity take their course.

In order to associate the lightning with the fall, we introduce a 'run-up' phase in which the cause gradually takes effect, and this is done via a dynamics.

1. $\mathsf{Initiates}(lightning, falling, t)$
2. $\mathsf{Releases}(lightning, run\_up, t)$
3. $\mathsf{HoldsAt}(run\_up(x), t) \rightarrow \mathsf{Trajectory}(falling, t, run\_up(x'), d)$
4. $\mathsf{HoldsAt}(run\_up(c), t) \wedge \mathsf{HoldsAt}(falling, t) \rightarrow \mathsf{Happens}(fall, t)$

Note that the run-up phase can be as short as we like (even as short as the ϵ we introduced in the previous section) as long as it allows the cause to take effect. However, it can also last longer.

Interestingly, one can utter *habark mehašabŭ'a še'abŭar hepil etmol et ha'ec* ('the lightning from last week felled the tree yesterday') and the criteria captures the explicit *causal* relation between the external cause and the effect despite their *temporal* independence.

Recall that the causative criteria (in combination with tense) introduce for the present tense the integrity constraint

$$?\mathsf{HoldsAt}(f_1, R), R = now \textit{ succeeds}$$

The purpose of the integrity constraint is to relate the cause (the $lightning$ that initiated $falling$) in the past and the effect (the $fall$) that will happen in the future to the reference point *now*. This is captured by referring to the interval $falling$ that connects the two.

Although the causative present tense utterance is not felicitous during the time between the lightning and the fall (191a), the entailment (191b) still holds. This is indeed captured by the causative integrity constraint that focuses the reference point on the run-up phase $?\mathsf{HoldsAt}(falling, R), R = now$ *succeeds*

(191) a. habarak mepil et ha'ec
the-lightning fells ACC the-tree
The lightning is felling the tree

b. ha'ex noŭpel
the-tree falls
The tree is falling

Case 2: A gradual change

Now let us consider (190b) repeated here for convenience:

(192) a. xoteb̆-ha'ecim hepil et ha'ec
the-lumberjack fell ACC the-tree
The lumberjack felled the tree

Here we are concerned with an extended cause event that brings about a gradual change of state. This gradual change (contributed by the context) easily accommodates the dynamics resulting in a structure that mirrors an accomplishment. In our example, the $falling$ is brought about by the lumberjack's exertion of force, i.e., $cutting$, and the contribution of the causative template is interpreted as follows:

1. $\mathsf{Initiates}(start, cutting, t)$
2. $\mathsf{Releases}(start, falling, t)$
3. $\mathsf{HoldsAt}(falling(x), t) \rightarrow \mathsf{Trajectory}(cutting, t, falling(x'), d)$
4. $\mathsf{HoldsAt}(falling(c), t) \wedge \mathsf{HoldsAt}(cutting, t) \rightarrow \mathsf{Happens}(fall, t)$

Interestingly, in that case the present tense utterance in (193a) is felicitous, as correctly captured by the integrity constraint for the run-up phase $?\mathsf{HoldsAt}(cutting, R), R = now$ *succeeds*

(193) a. xoteb̆-ha'ecim mepil et ha'ec
the-lumberjack fells ACC the-tree
The lumberjack is felling the tree

It can be concluded that in both cases the lexical material contributes a preceding cause and the resulting event structure mirrors the structure of an accomplishment and can be abbreviated as follows: $\langle +, +, +, + \rangle$

The reference point in both cases focuses on an intermediate extended fluent that connects the cause to the effect. However, the reference to this intermediate phase in the present tense is only felicitous if the 'run-up' phase is instantiated using additional lexical material (which is only possible in the case of a gradual change).

ACTIVITIES $\langle +, +, -, - \rangle$

Activities are more complicated to account for as their default description already occupies the first slots in the quadruple, and they already induce the existence of an initiating event in their preliminary scenario.

Examples:

(194) a. $[h][l][\check{k}] + B_{\mathrm{s}} = halaǩ$ (walk)
b. $[h][l][\check{k}] + B_{\mathrm{c}} = holiǩ$ (walk someone)

(195) a. $[d][h][r] + B_{\mathrm{s}} = dahar$ (gallop)

b. $[d][h][r] + B_{\text{c}} = hidhir$ (gallop something)

(196) a. $[r][k][d] + B_{\text{s}} = rakad$ (dance)

b. $[r][k][d] + B_{\text{c}} = hirkid$ (make dance)

(197) a. $[']['b][d] + B_{\text{s}} = a'bad$ (work)

b. $[']['b][d] + B_{\text{c}} = he'e'bid$ (employ)

To illustrate the effect of the causative template, let us take for instance the utterance in (198).

(198) a. ha-d.j. hirkid et Dani
The-d.j. danced$_{cause}$ ACC Dani
The dj caused Dani to dance

The simple verb *rakad* (danced) introduces the following preliminary scenario (let the fluent f_1 correspond to the activity 'dancing', and the changing fluent f_2 to Dani's physical changes, represented by e.g., his sweat/tiredness)

1. $\mathsf{Initiates}(start, f_{dance}, t)$
2. $\mathsf{Releases}(start, f_{sweat}, t)$
3. $\mathsf{HoldsAt}(f_{sweat}(x), t) \rightarrow \mathsf{Trajectory}(f_{dance}, t, f_{sweat}(x'), d)$

Then the causative criteria introduce the following statements that represent the preceding cause for Dani's dancing, the dj's efforts.

1. $\mathsf{Initiates}(e', f_{dj}, t)$
2. $\mathsf{Releases}(e', f_{music}, t)$
3. $\mathsf{HoldsAt}(f_{music}(x), t) \rightarrow \mathsf{Trajectory}(f_{dj}, t, f_{music}(x'), d)$
4. $\mathsf{HoldsAt}(f_{music}(c), t) \wedge \mathsf{HoldsAt}(f_{dj}, t) \rightarrow \mathsf{Happens}(start, t)$

The reference points in which f_1 holds are captured by the tense integrity constraint

$$?\mathsf{HoldsAt}(f_{dance}, R), R < now \textit{ succeeds}$$

And a derivation of the meaning of (196) needs to introduce the dj dynamics f_{dj}, f_{music} prior to Dani's dance. Note that here the (wide) activity of the dj brings about the start event of Dani's activity.

The causative criteria introduces the following integrity constraint:

$$?\mathsf{HoldsAt}(f_{dance}, t), \neg\mathsf{HoldsAt}(f_{dj}, t) \textit{ fails}$$

This means, that the entire time span in which f_{dance} holds is preconditioned on the continuation of the dj's activity f_{dj}. (Formally, for a time point t every derivation

in which f_{dance} holds and f_{dj} does not hold must fail finitely). Note that in this case the (wide) activity of the dj brings about the continuation of Dani's activity.

So, in the following present tense utterance:

(199) a. had.j. markid et Dani
The-d.j. dances$_{cause}$ ACC Dani
The dj causes Dani to dance

the tense is defined as follows (which should be interpreted as, roughly, 'Dani is dancing now')

$$?\mathsf{HoldsAt}(f_{dance}, R), R = now \textit{ succeeds}$$

And the causative template introduces the following integrity constraint (which holds in general, and in particular at the reference point $R = now$):

$$?\mathsf{HoldsAt}(f_{dance}, R), \neg\mathsf{HoldsAt}(f_{dj}, R) \textit{ fails}$$

In this case the dancing 'start' event already occurred in the past and Dani is already dancing. However, the utterance in (199) asserts that the cause for Dani's dancing, the dj, still holds. Formally, the integrity constraint enforces f_{dj} to hold in the present moment.

Again, the lexical material captured the initiation of the 'dancing' in the past, and the integrity constraint captures the continuation of the 'dancing' in the present.

The start/continue meanings are equivalent to what is picked out by the start/continue VP in (a)/(b).

(200) a. Dani hitxil laruc
Dani started$_{\text{cause}}$ to-run
Dani started to run
b. Dani himšiǩ laruc
Dani continued$_{\text{cause}}$ to-run
Dani continued to run

So in (a) the running does not start spontaneously, but Dani, its agent, starts it (via, for instance, a decision to start running). Although the running continues by inertia, it requires an additional stimuli to hold (in this case it can be Dani's physical state or state of mind). In practice, we focus here on a particular moment at time t. This moment can be seen as partitioning the running event into 'before' and 'after' and Dani's physical/mental condition can be viewed at every particular instant as allowing the 'rest of the running' to hold.

Note however, that the Hiphil doesn't entail anything about the extension of f_1' more than that it must parallel f_1 and precede it. In (199) it might be that f_{dj}

started to hold long before f_{dance} did (in case Dani had to warm up for a long time) and it might hold long after the f_{dance} ends (in case the party is not over). The crucial point here is that while Dani *starts* and *continues* to dance, the 'dancing' is preconditioned on the fact that f_{dj} holds. Indeed there may be other surrounding events (state of mind, physical tiredness) that might as well hold and affect the temporal extension of f_{dance}, however the causative template isolates f_{dj} as the one cause of the dancing event.

Similar to what we observed about states, the causative construction entails a 'cause' event in the background, of which the temporal extension is parallel and at least includes the 'caused' event.

Sometimes, it seems that the cause that is referred to by the Hiphil is punctual, as in the following sentence:

(201) a. Hyeriya hidhira et hasus (kilometrim)
The-gun-shot gallop$_{\text{cause}}$ ACC the-hourse (kilmeters)
The gunshot made the horse gallop (for miles)

Here we are concerned with a punctual initializing event, the gunshot. However, while the actual gunshot causes the initiation of the galloping, it is the effect of the gunshot (fear, distress, etc.) that causes its continuation. This is a similar case to the 'tsunami' (181b) in which the event is interpreted in an extended way.

ACCOMPLISHMENTS

Simple verb accomplishments, for the most part, do not have a causative alternation.

(202) a. $[b][n][h] + B_{\text{s}} = bana$ (build)
b. $[b][n][h] + B_{\text{c}} = *hibni$

(203) a. $[a][p][h] + B_{\text{s}} = a\check{p}a$ (bake)
b. $[a][p][h] + B_{\text{c}} = *he'e\check{p}i$

(204) a. $[y][c][r] + B_{\text{s}} = yacar$ (create)
b. $[a][p][h] + B_{\text{c}} = *hocir$

However, there are several accomplishment simple verbs that are compatible with the causative alternation. These are verbs that are in general ambiguous between activities and accomplishments.

Examples:

(205) a. $[a][k][l] + B_{\text{s}} = akal$ (eat)

b. $[a][k][l] + B_{\mathrm{c}} = he'ekil$ (feed)

(206) a. $[k][r][a] + B_{\mathrm{s}} = kara$ (read)

b. $[k][r][a] + B_{\mathrm{c}} = hikri$ (read out loud)

(207) a. $[k][t][b] + B_{\mathrm{s}} = katab$ (write)

b. $[k][t][b] + B_{\mathrm{c}} = hiktib$ (dictate)

(208) a. $[l][\check{b}][s] + B_{\mathrm{s}} = la\check{b}as$ (wear)

b. $[l][\check{b}][s] + B_{\mathrm{c}} = hilbis$ (dress someone)

The treatment we give to such verbs is similar to that of activities. We focus on the beginning of the causal chain, and require an external extended event to be a precondition for the initiation of the accomplishment and the continuous exertion of the force.

Recall that the tense definition for past introduces the following reference point:

$$?\mathsf{HoldsAt}(f_1, R), R < now \textit{ succeeds}$$

However, now by the contribution of the causative template we have the additional constraint

$$?\mathsf{HoldsAt}(f_1, t), \neg\mathsf{HoldsAt}(f_1', t) \textit{ fails}$$

which means that f_1' must hold at the same time as f_1.

With respect to the original accomplishment, the driving force f_1 is now conditioned by an external cause/stimulus f_1', and this stimulus has to last long enough if the original canonical goal is to be achieved. However, this is not necessarily the case. The stimulus/cause can last longer or shorter than the time required to achieve the canonical goal. In fact, this canonical goal needn't be achieved at all from the Hiphil point of view.

Take, for instance, the minimal pair in (209). The first sentence implies telicity because of the bounded direct object 'apple', however the second is read more naturally as an activity with an 'apple' its instrument. Note also that in Hebrew the 'apple' also must lose its accusative marker. This is due to the fact the Hebrew allows the accusative marking to occur only once [15].

(209) a. hayeled axal et hatapuax
The-child $\text{ate}_{\text{simple}}$ ACC the-apple
The child ate the apple

b. ima he'exila et hayeled betapuax
mom $\text{eat}_{\text{cause}}$ ACC the-child with-apple
Mom fed the child (with) an apple

There might be cases that seem to be telic, as in (210a). However, in this case we get the telicity only when looking from the mother's perspective. This can be thought of as having f_1' (the mother) a part of a separate hierarchically planned event in which the mother is represented as an activity fluent and the child's state of hunger as the event's 'incremental theme'.

(210) a. ima he'exila et hayeled
Mom $\text{eat}_{\text{cause}}$ ACC the-child
Mom fed the child

b. ima he'exila et hayeled lesova'a
Mom $\text{eat}_{\text{cause}}$ ACC the-child until-not-hungry
Mom fed the child until he wasn't hungry

In that case, the analysis is similar to the interpretation of (b) and it is achieved by a standard process of coercion from activities to resultative accomplishments (as described, for instance, in [44, ch. 3]).

The following triple shows similar phenomena. In the following (a) and (c) are telic with 'the shirt' and 'the child' the incremental theme of the event respectively, however in (b) an activity reading is implied, which might be a part of a higher level activity denoted by (c).

(211) a. hayeled labaš xulca
the-child put-on shirt
The child put on a shirt

b. ima hilbiša et hayeled bexulca
Mom $\text{dressed}_{\text{cause}}$ ACC the-child with-shirt
Mom dressed the child with a shirt

c. ima hilbiša et hayeled
Mom $\text{dressed}_{\text{cause}}$ ACC the-child
Mom dressed the child

Nevertheless, in all of the above cases the *original* scenario (i.e. the 'effect') maintains its accomplishment internal structure, because with respect to the child the canonical goal (denoted by the simple verb phrase) is achieved (putting on a shirt, eating an apple, etc.). The resulting tuple is therefore $\langle +, +, +, +, +, + \rangle$.

STRICT ACTIVITIES $\langle +, -, -, - \rangle$

Strict activities refer to a set of Hebrew verbs that are ambiguous between a state and an inchoative reading:

(212) a. $[y][š][b] + B_{\text{s}} = yašab$ (sit)

b. $[y][š][\check{b}] + B_{\mathrm{c}} = hošiǐb$ (cause to sit)

(213) a. $[a][m][d] + B_{\mathrm{s}} = amad$ (stand)

b. $[a][m][d] + B_{\mathrm{c}} = he'emid$ (cause to stand)

(214) a. $[š][t][k] + B_{\mathrm{s}} = šatak$ (be silent)

b. $[š][t][k] + B_{\mathrm{c}} = hištik$ (made silent)

I claim that the causative templates reserve this ambiguity but also shift it elsewhere (in fact, backwards). Formally, the two scenarios that are available for such verbs are a state:

1. $\mathsf{HoldsAt}(f_3, t)$

Or an inchoative achievement:

1. $\mathsf{Initiates}(e, f_3, t)$
2. $\mathsf{HoldsAt}(f_3, t)$

If the basic meaning is one of a state, then the causative template gives rise to an initiating event, and the result scenario mirrors the internal structure of an achievement.

If they are treated as inchoative achievements to begin with, the causative template is seen as invoking a preceding dynamics (as in the immediately preceding discussion on achievements), and the result mirrors the structure of an extended accomplishment.

The correct meaning is picked out by other factors (context, world knowledge, semantic memory). To illustrate, consider the following examples:

(215) a. haganenet hošiǐba et hayeled leyad hašulxan
The-kindergarden-teacher $\mathrm{sat}_{\mathrm{cause}}$ ACC the-child near the-table
The kindergarden teacher sat the child near the table

b. hašir he'emid et Dani al haraglayim
The-song $\mathrm{stand}_{\mathrm{cause}}$ ACC Dani on the-feet
The song made Dani stand on his feet

The first is more naturally associated with a process of making/influencing/convincing the child to sit next to the table, and the primitive lexical item 'sit' is *inchoative* with respect to the child (he is getting into a 'sitting' state). In the second example some particular song is the event that initiates the 'standing' event denoted by the primitive lexical morpheme, and it is most naturally read as the current *state* of the Dani.

Similar to the treatment we gave to denominal intensive verbs we start out from a predicate $P(f(c))$ that allows us to represent the meaning of the root as a parameterized fluent $f(x)$. This parameterized fluent corresponds to f_2 which is the *incremental theme* of the eventuality, and the preliminary eventuality consists of the statement

1. $\mathsf{Releases}(e, f_2(x), , t)$

and can be abbreviate as $\langle -, +, -, - \rangle$.

Following the principles we presented, the causative template adds an external cause that fills the immediately preceding slot, namely f_1. This is done via the following definition:

Definition 47. For denominal roots represented by a parameterized fluent f_2 the contribution of the causative template is introduced the following statements:

1. $\mathsf{Initiates}(e', f_1', t)$
2. $\mathsf{HoldsAt}(f_2(x) \rightarrow \mathsf{Trajectory}(f_1', t, f_2'(x'), t)$

Thus, the result scenario consist of the following statements:

1. $\mathsf{Releases}(e, f_2(x), , t)$
2. $\mathsf{Initiates}(e, f_1', t)$
3. $\mathsf{HoldsAt}(f_2(x) \rightarrow \mathsf{Trajectory}(f_1', t, f_2'(x'), t)$

where e', f_2' are unified with e, f_2 and f_1 is associated with an external agency and should be unified with additional lexical material contributed by the context. The result eventuality therefore can be seen as a *wide activity* and abbreviated as $\langle +, +, -, - \rangle$.

The reference point for the result scenario is then:

$$?\mathsf{HoldsAt}(f_1, R), R \gtreqless \mathit{now}\ \textit{succceeds}$$

The above construction gives rise to an abundance of emission verbs (identified by [15]) that take the form of denominal Hiphils.

(216) a. $[y][z][\prime] + \text{noun} = ze'a$ (sweat)
b. $[y][z][\prime] + B_{\text{c}} = hizi'a$ (to sweat)

(217) a. $[r][\prime][\check{s}] + \text{noun} = ra'a\check{s}$ (noise)
b. $[r][\prime][\check{s}] + B_{\text{c}} = hir'i\check{s}$ (to emit noise)

(218) a. $[r][q][\check{b}] + \text{noun} = reqe\check{b}$ (rot)

b. $[r][q][\check{b}] + B_{\mathrm{c}} = hirki\check{b}$ (to rot)

(219) a. $[a][r] + \mathrm{noun} = or$ (light)

b. $[a][r] + B_{\mathrm{c}} = he'ir$ (to emit light)

In other verbs, the 'emission' is understood in a more sophisticated (perhaps metaphoric) manner, however the event temporal schemata is still one of a wide activity (examples adopted from [31]):

(220) a. $[k][s][m] + \mathrm{noun} = kesem$ (magic)

b. $[z][m][n] + B_{\mathrm{c}} = hiksim$ (enchant)

(221) a. $[s][k][l] + \mathrm{noun} = se\check{k}el$ (brain)

b. $[s][k][l] + B_{\mathrm{c}} = hiskil$ (act wisely)

Finally, with adjectives the transitive activity is one of making the property hold to a greater and greater extent. Contrary to the Piel, the extension refers to a process that is not oriented towards a specific canonical goal $f_2(c)$. Thus, we are still concerned with a wide activity rather than an accomplishment, and the result is not subject to the imperfective paradox.[21]

(222) a. $[g][d][l] + \mathrm{adjective} = gadol$ (big)

b. $[g][d][l] + B_{\mathrm{c}} = higdil$ (make bigger, enlarge)

(223) a. $[a][r][\check{k}] + \mathrm{adjective} = ar\check{o}k$ (long)

b. $[a][r][\check{k}] + B_{\mathrm{c}} = he'eri\check{k}$ (make longer, lengthen)

(224) a. $[g][b][\check{h}] + \mathrm{adjective} = ga\check{b}oha$ (tall,high)

b. $[g][b][\check{h}] + B_{\mathrm{c}} = higbiha$ (raise, cause to be higher)

(225) a. $[\check{s}][m][n] + \mathrm{adjective} = \check{s}amen$ (fat)

b. $[\check{s}][m][n] + B_{\mathrm{c}} = hi\check{s}min$ (make fat)

A NOTE ABOUT HIPHIL STATES

So far we have shown how to derive Hiphil verbs with different time schemata (*wide activities*, *achievements* and *accomplishments*) all of which are intimately related to the notions of cause and change. However, there are Hebrew verbs in the Hiphil that at first glance do not seem compatible with that view.

[21] These verbs behave in some sense like what is known in the literature as *degree achievements* [18] and their treatment is more complicated and much more involved. The crucial point that is made here is that the two conditions required of a wide activity, (i) the presence of a dynamics, and (ii) no implication of completion, hold.

Common counterexamples to the position that the Hiphil template indeed carries a 'causative' meaning (and to the claim that the Semitic templates have systematic semantic contribution in general) are the Hebrew verbs $he'emin$ (believe) and $hirgi\check{s}$ (feel) (226). These verbs are taken as *states*, and as such, do not involve any 'cause' in their internal structure, let alone a 'change'.

(226) a. $[a][m][n] + B_{\mathrm{c}} = he'emin$ (believe)
b. $[r][g][\check{s}] + B_{\mathrm{c}} = hirgi\check{s}$ (feel)

I next present how the proposed analysis can bring new insight into the meaning of the Hebrew verb $he'emin$. The Hebrew verb $he'emin$ is derived from the root $[a][m][n]$ which in its simplest morphological environment produces the word $Amen$ (amen) (227).

(227) a. $[a][m][n] + \mathrm{noun} = amen$ (amen)
b. $[a][m][n] + B_{\mathrm{c}} = he'emin$ (believe)

From "How the Hebrew Language Grew" [31]:

> "In Hebrew the root AMN which means "confirm or support" has had a very rich development. All of the many words coming from AMN grew out of or can relate to the idea of "support or confirmation". To the basic meaning "confirm or support" is related the concept of true and faithful; it conveys the idea of being sure and certain in one's work, and possessed of strength." [31, p. 25–26]

I propose here that the meaning of the verb $he'emin$ is derived from the meaning of the word $Amen$, having the sense of 'may this prayer come true' [31, p. 26]. Thus, the Hebrew word for 'believing' can be seen as a (wide) activity that shall make one's prayers come true. Put differently, the verb $he'emin$ manifests the notion of 'cause' via the religious idea that believing (e.g.. in God) is a prior condition for your heart's desires coming true. This idea can also be extended to a non-religious domain in which (active) believing in general is indeed a prior condition for achieving your goals.

In (228) I summarize the proposed idea about the derivation of the meaning of the verb $he'emin$, and suggest that in fact it has the internal structure of a *wide activity* in which f_1 refers to (actively) believing and f_2 refers to the ever changing current state of affairs.

(228) a. $[a][m][n] + \mathrm{noun} = amen$ (may this prayer come true)
b. $[a][m][n] + B_{\mathrm{c}} = he'emin$ (cause prayers to come true) $\langle +, +, -, - \rangle$

A similar, although not identical, analysis, may be given to the Hebrew verb $hirgi\check{s}$ (feel). The meaning of the root $[r][g][\check{s}]$ corresponds to the noun $rege\check{s}$ which

means ‘a sense’, ‘an emotion’ or ‘a feeling’. Thus, the causative verb $hirgiš$ might correspond to actively surfacing emotions and hence the wide activity analysis can be seen as follows: f_1 is the active ‘feeling’ and f_2 is the changing ‘emotional state’.

(229) a. $[r][g][š] + \text{noun} = regeš$ (an emotion)
b. $[r][g][š] + B_{\text{c}} = hirgiš$ (feel)

6.4 The Passive Templates: Pual, Huphal

The passive templates, *Binyan Pual* and *Binyan Huphal*, $B^{\text{p}}_{\text{s}}, B^{\text{p}}_{\text{c}}$ in our notation are morphologically marked with the *u-a* vocalization and semantically marked with the passive voice head π.

In Hebrew, as opposed to other languages, voice alternations are morphologically realized by vocalization. Syntactically, in the formation of Hebrew verbs the Hebrew (active) pattern is fused with the root to form a verb, which then is combined with the functional head π to realize the *passive* voice (see also [1]).

Unlike the active templates, the passive verbs are derived from fully constructed verbs, not just the roots. This explains why the passive forms exist only when the corresponding active verbs exist (see also [15]).

In practice, the passive head π realized in the vowels *u-a* allows for two additional templates, the intensive-passive template and the causative-passive template.[22]

The intensive active/passive alternation $B_{\text{i}}/B^{\text{p}}_{\text{i}}$

(230) a. $[g][d][l] + B_{\text{i}} = gidel$ (grow)
b. $[g][d][l] + B^{\text{p}}_{\text{i}} = gudal$ (be grown)
(231) a. $[s][d][r] + B_{\text{i}} = sider$ (organize)
b. $[s][d][r] + B^{\text{p}}_{\text{i}} = sudar$ (be organized)

The causative active/passive alternation $B_{\text{c}}/B^{\text{p}}_{\text{c}}$

(232) a. $[g][d][l] + B_{\text{c}} = higdil$ (enlarge)
b. $[g][d][l] + B^{\text{p}}_{\text{c}} = hugdal$ (be enlarged)
(233) a. $[s][d][r] + B_{\text{c}} = hisdir$ (arrange)
b. $[s][d][r] + B^{\text{p}}_{\text{c}} = husdar$ (be arranged)

[22]There is some evidence in Biblical Hebrew for the simple-passive alternation that is characterized by the same vocalization, e.g., *lakax/lukax* [10].

While the syntactical role of the π functional head is quite clear (namely that it alters the assignment of grammatical functions such as subject, object, etc.) its semantic contribution is less obvious.

It is generally claimed that voice alternations are productive in changing the 'perspective' on events with respect to the participants in the situation.[23] When presenting a situation, one might present it from the point of view of any of the participants. In Berman and Slobin's developmental study it is claimed that:

> "With age, Hebrew speakers make increased use of productive systems of verb morphology to present non-agentive perspectives on events [...] rather than as prime activators of whatever happened."[3]

However, following Dowty [17] I adopt the view that such 'perspective dependent' features do not change the nature of the carrying event itself.

Creason [10] in his study of Aktionsart in Biblical Hebrew claims that the passive voice alternations refer to the same situations as the corresponding active verbs and do not trigger a change in their Aktionsart. He tests this hypothesis, rather successfully, on occurrences of voice alternation in the extant texts.

Doron [15] in her semantic account of voice and agency in Semitic templates claims that

> "Semantically, the function of π is to modify the external argument. [...] In addition, I would like to claim that the passive morpheme also modifies the thematic role of the external argument, by assigning it the thematic role of an *actor*." [10, p. 48]

Recall that the intensive template in Doron's account also modifies the external argument of the root by assigning it the role of an actor. Thus, the active and passive causative verbs indeed turn out to be semantically equivalent [15, p. 63].

As for the causative alternation, Doron claims that the agent in the situation is modified irrespective of the template, and thus while the active causative template is understood as having an implicit cause, the passive template is understood as having an implicit actor.

To support this she rejects the following active-passive alternations, for which she claims that the *actor* semantics is incompatible [15, p. 49–50]:

(234) a. $[k][']][s] + B_{\mathrm{c}} = hi\check{k}'is$ (annoy)
b. $[k][']][s] + B_{\mathrm{c}}^{\mathrm{p}} = *hu\check{k}'as$

(235) a. $[r][v][x] + B_{\mathrm{c}} = hirviax$ (gain)

[23] To distinguish it from the perfective/imperfective perspective on events discussed in part III, I shall refer to the perspective of different participants *in* a situation as the *internal* perspective and the perspective of the narrator on the situation as *external* perspective.

b. $[r][v][x] + B_{\text{c}}^{\text{p}} = *hurvax$

(236) a. $[']['][r][c] + B_{\text{c}} = he'eric$ (admire)

b. $[']['][r][c] + B_{\text{c}}^{\text{p}} = *hu'arac$

(237) a. $[q][v][h] + B_{\text{i}} = qiva$ (hope)

b. $[q][v][h] + B_{\text{i}}^{\text{p}} = *quva$

(238) a. $[c][p][h] + B_{\text{i}} = cipa$ (hope)

b. $[c][p][h] + B_{\text{i}}^{\text{p}} = *cupa$

However, the following utterances are acceptable (although admittedly rare) and were accepted by some Hebrew speaking informants:

(239) a. hu'chasti
I-mad$^{\text{passive}}_{\text{cause}}$
I was caused to be mad

b. Adam hu'arac al-yedey me'ot banot
Adam admired$^{\text{passive}}_{\text{cause}}$ by hundreds girls
Adam was admired by hundreds of girls

(240) a. ha'imut quva leyasher et hahadurim
The-confrontation hoped$^{\text{passive}}_{\text{intns}}$ to-straighten ACC the-matters
The confrontation was hoped to clear the air

b. ha'imut cupa leyasher et hahadurim
The-confrontation expected$^{\text{passive}}_{\text{intns}}$ to-straighten ACC the-matters
The confrontation was expected to clear the air

Moreover, the present participles derived from the passive templates with these roots are perfectly grammatical:

(241) a. hakesef hamurvax
The-money the-earned$^{\text{passive}}_{\text{cause}}$
The earned money

b. hazamar hamu'arac
The-singer the-admired$^{\text{passive}}_{\text{cause}}$
The admired singer

(242) a. hapitaron hamekuve
The-solution the-hoped$^{\text{passive}}_{\text{intns}}$
The hoped solution

b. hayom hamecupe
The-day the-expected$^{\text{passive}}_{\text{intns}}$
The expected day

Furthermore, the tests Doron [15] suggests to distinguish between an *actor* and a *cause* seem to have more to do with animacy and volitional involvement and less with the defined notion of action (in terms of 'an inanimate object that is capable of *action*'). So, 'rain' in (243b) is clearly incompatible here although it can be easily fit Doron's definition of an inanimate actor that is capable of exerting some sort of force:

(243) a. hadayrim hufnu leliskat ha'avoda al-yesey ba'alat
The-tanents turned$^{\text{passive}}_{\text{cause}}$ to-agency the-employment by owner
habayit/*ha'avtala
the-house/*the-unemployment
The tanents were turned to the employment agency by the landlady/*the unemployment

b. hayevul hugdal$^{\text{passive}}_{\text{cause}}$ al-yedey ha'agronomit/*eixut
The-crop increased by the-agronomist/*quality
hakaraka/*hageshem ha'intensivi
the-soil/*the-rain the-intensive
The crop was increased by the agronomist/*the quality of the soil/*the intensive rain

Therefore, it seems to me that the subtle distinctions to account for in the contribution of π (especially in the causative environment) have to do with the semantic properties of different kinds of agents, and in particular different kinds of actors, and not with the notion of *action* per-se.

Thus, in this case I adopt Creason's analysis and Dowty's view that the passive alternation does not change the verb's Aktionsart. An extended framework of classification that includes semantic features of different kinds of participants[24] might be able to account for additional distinctions, however I leave such possible extensions for further research.

6.5 The Middle Template: Niphal

6.5.1 Theoretical Discussion

The medio-passive template, *Binyan Niphal*, B^{m}_{s} in our notation, is morphologically marked with the consonantal prefix *nun* and *i-a* vocalization, and semantically marked with the middle voice feature μ. According to the template grid we presented in chapter 2, This middle voice alternation is related to the simple template.

Examples:

[24] That is, one that goes beyond the proto-agent and proto-patient course-grained distinction.

(244) a. $[y][d][\prime] + B^{\mathrm{m}}_{\mathrm{s}} = noda$ (be/become known)
b. $[\prime][m][d] + B^{\mathrm{m}}_{\mathrm{s}} = ne\prime emad$ (stand up)
c. $[a][\check{b}][d] + B^{\mathrm{m}}_{\mathrm{s}} = ne\prime ebad$ (get lost)
d. $[m][c][a] + B^{\mathrm{m}}_{\mathrm{s}} = nimca$ (be found)
e. $[\check{s}][\check{b}][r] + B^{\mathrm{m}}_{\mathrm{s}} = ni\check{s}bar$ (break)
f. $[b][n][h] + B^{\mathrm{m}}_{\mathrm{s}} = ni\check{b}na$ (be built)
g. $[\prime][s][h] + B^{\mathrm{m}}_{\mathrm{s}} = na\prime asa$ (be/get done)
h. $[g][m][r] + B^{\mathrm{m}}_{\mathrm{s}} = nigmar$ (finish (middle))

The application of the middle voice functional head μ is essentially different from the application of the passive voice head π. This is evident (i) morphologically, in the additional consonants prefixed to the root, and (ii) historically, in the changes in its status and debate about its role in the Hebrew template grid presented (see chapter 2).

It is an established fact that the Niphal presents the most diverse range of uses. Creason [10] lists, for example, the *reflexive, passive (adjectival/resultative)* and *middle* uses. In his detailed review of the Niphal, Creason [10] presents several ways in which this diversity has been dealt with by Hebrew grammarians.

One approach is the 'diachronic' approach, which proposes that the Niphal has a single *original* meaning, and all categories are historically *derived* from it. The other one is the 'synchronic' approach, which proposes that the Niphal has a single *abstract* meaning and all categories are different *implementations* of this basic meaning.

Creason reviews at least four PhD dissertations[25] that are mainly or exclusively concerned with the meaning of the Niphal. These works are mostly concerned with the following questions:

(245)
- Does the Niphal have a single meaning? (and if so, what is it?)
- Can the Niphal stand in direct opposition to patterns other than the Paal? (for instance, Piel or Hiphil?)
- What is the relation between the Niphal and other passive/reflexive patterns? (for instance, Pual, Huphal and Hitpael?)

Creason provides the following answers to the above questions, based on the results of various previous works.

- First, he concludes that the Niphal indeed has a single abstract meaning. He claims that (i) the Niphal refers to an event or the state resulting from an event, (ii) The Niphal presents the situation with respect to only a single participant and without regard to any other participant which may be involved,

[25] A full citations list is available at [10].

and (iii) Presence/absence of other participants as well as vollitionality of the single participant are determined by the context and by knowledge of the real world.

The first part is concerned with the aspectual domain, the second is concerned with the thematic domain, and the last with the various semantic interpretations of the Niphal. From an aspectual point of view, the Niphal's proposed meaning is that it refers to a resulting change of state of an event. From the thematic point of view, it is proposed that the Niphal presents the situation with respect to only a single participant.

The last point is crucial for the implementation of the proposed meaning. Since the Niphal does not completely specify the situation which it refers to (in terms of the other participants), the interpretation is a result of an interplay between a number of factors such as the semantic class of the simple verb, context, and world knowledge. This gives the large variety of situation types denoted above, sometimes even for one and same verb form.

- Second, Creason cites examples attested in the Bible of (supposedly rare) oppositions between the active templates Piel and Hiphil and the medio-passive template Niphal. So it seems that the Niphal *can* stand in direct opposition to active verbs other than the Paal. However, an interesting observation about these alternations is that in all cases the examples refer to *denominal* Niphals, Piels and Hiphils.
- Third, he claims that the Niphal is different from the passive voice patterns Pual and Huphal since it specifies only a single participant while the passive templates replicate the entire thematic structure of the corresponding active verb. Also, it differs from the middle/double status template Hitpael since it cannot denote double-status actions per se such as reciprocal or reflexive.[26]

Creason's account argues convincingly in favor of core elements I adopt in my proposed solution: (i) that the Niphal can be associated with a single meaning, (distinct from other passive and middle templates) and (ii) that it can stand in opposition to other patterns (as we shall see, these alternations are achieved via derivations from denominal roots). However, since Creason's account is focused on Biblical Hebrew and does not provide a formal semantic account,we are left with several important tasks at hand, namely:

1. to contrast Creason's analysis with an analysis of the modern Niphal.
2. to formalize precisely the abstract meaning of the Niphal.
3. to formalize the interplay between the meaning of the Niphal and other factors. (e.g., the situation type of the root it is derived from)
4. to formalize the derivation of denominative Niphals.

[26] In the next section we elaborate more on double status situations.

The departure point for the analysis of the modern Niphal is Doron's definition of the semantics of the functional head μ.

> "I propose that the middle morpheme is the realization of a voice head μ. The voice head modifies the root [...] in the following way: It voids the licensing of [the light verb] v. As a result the external argument is missing from the derivation. In addition, depending on the root, μ may assign the role of an Agent." [15, p. 58]

According to Doron (following [26]), whether or not a simple verb contains a light verb is a property of the root. Here, voiding v in fact deprives the root of its external argument. Depending on the root, μ may assign the role of an agent, however this role will be assigned to an already existing internal argument. This is precisely what gives rise to the reflexive reading.

This account reconfirms Creason's proposal for a single abstract meaning of the Niphal that gets different interpretations following the interplay with other factors. In this case the 'other factor' is the syntactic structure of the root, that in turn affects the thematic structure of the eventuality.

Moreover, it reiterates Creason's view that the Niphal is concerned with a *single* participant. This single participant coincides with the internal argument of the root. This participant is by default the receiving end of the action, however it may also be the agent under reflexive interpretation. Again, Doron's detailed analysis of the thematic domain calls for an extension that accounts for various aspectual phenomena.

The proposed solution is that the Niphal gives the viewpoint on the situation (denoted by the root) of the participant in the receiving end of the causal chain (see section 6.3.1). The meaning of the verb puts emphasis on the resulting change of state, which in turn gives rise to *egressive* and *resultative* interpretations (in case of dynamic events) and *inchoative* interpretation (in case of stative events).

Interestingly, the viewpoint presented by the Niphal complements the one proposed for the causative template Hiphil. While the causative templates puts emphasis on the beginning and development of the situation, the medio-passive template puts the emphasis on its resulting state.

Note that the proposed solution may also account for the fact that the causative templates do not have a middle form counterpart. The proposed explanation is that the middle viewpoint (egressive) that puts emphasis at the end of the causal chain is simply incompatible with the causative viewpoint (ingressive) that puts emphasis on the beginning of the causal chain.

6.5.2 Formal Account

Opposite to the causative template, the medio-passive template puts emphasis on the end of the casual chain, and it captures the *result state* of an *event*. Formally, both e (the canonical goal) and f_3 (the resulting state) have to be present in the lexical contribution of the μ feature.

Also, the μ feature puts emphasis on the *end* of the causal chain. Thus, an integrity constraint alters the viewpoint on the situation referred to by f_3. The integrity constraints introduced by the template interact with the default tense definitions, which in turn gives rise to *resultative, egressive* or *inchoative* readings.

STATES/ACHIEVEMENTS $\langle -, -, \pm, + \rangle$

Definition 48. Let V be a medio-passive verb and let V_{s} be its simple form counterpart, associated with a *state/achievement* eventuality. The μ feature requires the presence of a resulting change of state introduced by the following general statements, with e', f_3' unknown parameters:

1. $\mathsf{Initiates}(e', f_3', t)$
2. $\mathsf{HoldsAt}(f_3', t)$

If the preliminary scenario already has an Initiates statement (e.g. in case of an achievement), e and f_3 simply unify with those parameters. Otherwise (e.g., states), the unknown parameter (e) is unified with additional lexical material from the preliminary scenario, context, or world knowledge (recall Creason's account in section 6.5.1). In both cases the result eventuality has the structure of an achievement $\langle -, -, +, + \rangle$, and might also get an *inchoative* interpretation.

Definition 49. Let V be a medio-passive verb associated with a result scenario that mirrors an *achievement* eventuality. The μ introduces the following reference point for the result scenario:

$$?\mathsf{HoldsAt}(f_3, R), R \gtreqless now \textit{ succeeds}$$

Note that although in these cases the situation type denoted by the result scenario has the structure of an achievement, the viewpoint does *not* refer to the change of state as is typically the case for achievements, but is relocated at the end of the causal chain, the result state.

This altered viewpoint has various implications. This 'static' viewpoint proposes a semantics that complies with the adjectival use of such verbs. Also, at the time point after the reference R the result state f_3 still holds by inertia,[27] which in turn

[27] That is, in minimal models.

gives rise to an interpretation that resembles English present perfect, in which a past change of state has current relevancy.

ACTIVITIES/ACCOMPLSIHMENTS $\langle +, +, \pm, \pm \rangle$

Activities/Accomplishments are essentially *dynamic* events and thus the treatment they get is slightly more complicated. Here, we would like to assign dynamic (and not necessarily telic) events with a resulting change of state and a stative point of view.

Recall the treatment we gave to the causative template: we focused on a certain moment, and forced a *preceding cause* to hold. Here, we do the opposite. We focus on a certain moment and enforce a *result state* to hold.

Formally, the principle of assigning to *dynamic* events a *stative* viewpoint is as follows: we fix our point of view on the receiving end of the activity, namely f_2 and we 'freeze the situation' on a specific time instant t. Now, the resulting state f_{tmp} is an object that is yielded from the function $f_2(x)$ at time t.

Intuitively, this temporary result state is the state of the theme as if the event was clipped at this specific time point. We construct this event (type) at time t, and we look at it *as if* it were the goal to be reached.

Definition 50. Let V be a medio-passive verb and let V_{s} be its simple form counterpart, associated with an *activity/accomplishment* eventuality. The μ feature requires the presence of a resulting change of state introduced by the following general statements, with e', f'_1, f'_2, f'_3 unknown parameters:

1. $\mathsf{HoldsAt}(f'_2(x), t) \rightarrow \mathsf{Trajectory}(f'_1, t, f'_2(x'), d)$
2. $\mathsf{HoldsAt}(f'_2(x), t) \wedge \mathsf{HoldsAt}(f'_1, t) \rightarrow \mathsf{Happens}(e', t)$
3. $\mathsf{Initiates}(e', f'_3, t)$

When resolving f'_1, f'_2 unify with the parameters of the dynamics in the original scenario.

Similar to other constructions with the Niphal, the tense focuses on the result state, and not on the activity fluent as is the case with simple activities and accomplishments.

Definition 51. Let V be a medio-passive associated with a dynamics and additional lexical material in the sense of definition 50. The μ feature introduces tense via the following integrity constraint:

$$?\mathsf{HoldsAt}(f_3, R), R \gtreqless now \textit{ succeeds}$$

In order to assign a dynamic event with a stative viewpoint we need to introduce a temporary result state for it. This is done by means of statement (2) in the lexical material contribution of the μ feature.

Recall that for ordinary accomplishments we introduced a result state that is triggered by a particular value c of the function $f_2(x)$. Here, we do not fix the canonical goal on any particular value of f_2, rather, we obtain a canonical event triggering a temporary result state for any value x of the function f_2.

Intuitively, the state introduced for an ongoing *activity* is one of 'being done'. Think of, for instance, the public street sign 'work in progress'. Such a sign imposes a stative view on the 'working' dynamic activity.

When referring to accomplishments the canonical event might coincide with the canonical goal of the original scenario. However, it need not be the case. We can refer to an accomplishment that is still in progress and the canonical goal is yet to be achieved. In this case, the associated state is one of 'being in progress'. Think of, for instance, a web site sign 'Under construction'. Such a sign imposes a stative view on an accomplishment that is yet to be achieved.

Note that in all cases the derived canonical event marks the beginning of a halfopen fluent interval f_3 (that starts to hold immediately after), which by inertia holds until (or in parallel to) subsequent eventualities on the timeline.

A NOTE ABOUT VALENCE

One difference between the causative and the medio-passive is their valence change. By introducing a cause, the causative template imposes increasing valence on the situation. Here, focusing on the participant at the end of the causal chain provides us with a case of a decreasing valence.

For instance, the root $[']$[m][d] in the causative environment is transitive and in the context on the middle environment is intransitive as expected.

(246) a. hashir he'emid et Dani al haraglayim
The-song stand$_{\text{cause}}$ ACC Dani on-the-legs
The song made Dani stand on his legs

b. Dani ne'emad al haraglayim
Dani stand$^{\text{middle}}_{\text{simple}}$ on the-legs
Dani stood up on his legs

A NOTE ABOUT THE PRESENT PARTICIPLE

Although the medio-passive template imposes a stative view point on the situation, it does not entail that the situation is complete/completed and by no means denotes perfectivity.

In contrast to the medio-passive meaning, the 'perfective' viewpoint is given by a different nominal construction: the *benoni savil* (present participle), which is also morphologically derived roots, but belongs to the nominal domain.

The difference between this denominal form and the medio-passive verbal form is illustrated in the following alternation:

(247) a. hayeled ne'ecav
The-boy $\text{sad}^{\text{middle}}_{\text{simple}}$
The boy got sad

b. hayeled acuv
The-boy $\text{sad}_{\text{benoni}}$
The boy is sad

(248) a. haxalon nišbar
The-window $\text{broke}^{\text{middle}}_{\text{simple}}$
The window broke

b. haxalon šhab̆ur
The-window $\text{broken}_{\text{benoni}}$
The window is broken

The *benoni*, then, refers only to the result state, while the verbal form of the Niphal provides a stative reading that still maintains a causing event in the elaborate internal structure.[28]

6.5.3 Applications

ACHIEVEMENTS $\langle -, -, +, + \rangle$

As noted in section 6.3.3, achievement verbs already include a causal element and therefore some of these simple verbs are incompatible with the causative alternation. These are precisely these verbs that are the most productive (and in fact, commonly used) with the medio-passive construction.

(249) a. $[\check{s}][\check{b}][r] + B_{\text{s}} = \check{s}a\check{b}ar$ (break)
b. $[\check{s}][\check{b}][r] + B_{\text{s}} = ni\check{s}bar$(be/get broken)

[28]More about the difference between the Niphal and the benoni in [14].

(250) a. $[p][t][x] + B_{\mathrm{s}} = patax$ (open)
b. $[p][t][x] + B^{\mathrm{m}}_{\mathrm{s}} = niptax$ (open, (be) opened)

(251) a. $[h][r][g] + B_{\mathrm{s}} = harag$ (kill)
b. $[h][r][g] + B^{\mathrm{m}}_{\mathrm{s}} = neherag$ (get killed)

(252) a. $[g][r][m] + B_{\mathrm{s}} = garam$ (cause)
b. $[g][r][m] + B^{\mathrm{m}}_{\mathrm{s}} = nigram$ (be caused)

Such verbs introduce the following $PSCEN$:

1. $\mathsf{Initiates}(e, f_3, t)$

Which unifies with the μ feature's criteria in the following manner:

1. $\mathsf{Initiates}(e, f_3, t)$
2. $\mathsf{HoldsAt}(f_3, t)$

The causal element is built into such roots although the cause element might remain underspecified. For the application of the μ feature this does not matter as it focuses on the effect rather then the cause. The reference point introduces the following integrity constraint, that puts the emphasis on the resulting state rather than the canonical event.

$$?\mathsf{HoldsAt}(f_3, R), R \gtreqless now \text{ succeeds}$$

In the alternation between the B_{s} and $B^{\mathrm{m}}_{\mathrm{s}}$ in past constructions, the viewpoint switches from the caused participant to the one that experiences the result state.

(253) a. Dani patax et hadelet
Dani $\text{opened}_{\text{simple}}$ ACC the-door
Dani opened the door

b. hadelet niptexa al-yedey Dani
The-door $\text{opened}^{\text{middle}}_{\text{simple}}$ by Dani
The door was opened by Dani

c. hadelet niptexa bacohorayim
The-door $\text{opened}^{\text{middle}}_{\text{simple}}$ at-the-noon
The door opened at noon

The viewpoint associated with such utterances provides us with interpretation that resembles the English present perfect, in the sense that the result state is still relevant for eventualities yet to come (meaning, in minimal models it is implied that the door is still open in subsequent moments).

Interestingly, the masculine-singular inflection strengthens this side-effect as there is a homonymy between the past-masculine-singular and present-masculine-singular forms. This ambiguity provides us with an interpretation that the event *might* have

happened in the past (the event time need *not* be common knowledge between the speaker and the hearer) however the result state still holds now.

(254) a. haxalon nisgar
The window.m closed/closes.m$^{\text{middle}}_{\text{simple}}$
The window has closed

STATES $\langle -, -, -, + \rangle$

Examples:

(255) a. $[a][h][\check{b}] + B_{\text{s}} = ah\check{ab}$ (love)
b. $[a][h][\check{b}] + B^{\text{m}}_{\text{s}} = ne'eh\check{ab}$ (be loved)

(256) a. $[y][d][\prime] + B_{\text{s}} = yada$ (know)
b. $[y][d][\prime] + B^{\text{m}}_{\text{s}} = noda$ (be known)

The aspectual meaning of stative roots is characterize by the following preliminary scenario:

1. $\mathsf{HoldsAt}(f_3, t)$

This, in turn, unifies with the μ feature criteria to provide the following result scenario, with e' an unknown parameter.

1. $\mathsf{HoldsAt}(f_3, t)$
2. $\mathsf{Initiates}(e', f_3, t)$

This lexical material enforces us to update the database with the occurrence of an event that initiates the state, which by the μ feature criteria then gives rise to an *inchoative* reading.

The reference point introduced coincides with the one introduced by the tense for ordinary states:

$$?\mathsf{HoldsAt}(f_3, R), R \gtreqless now \textit{ succeeds}$$

This means that the event had to occur *prior* to the reference point, meaning, the cause 'had time' to take effect, and the result state already started holding.

Note that similarly to the case of the causative template, the causing event may be, due to context, an hierarchically planned event.

(257) a. hasipur noda biglal hakata$\check{b}$a ba'iton
The-story known$^{\text{middle}}_{\text{simple}}$ because the-article in-the-newspaper
The story became known due to a newspaper article

b. hasipur noda biglalpirsum hakataba ba'itonai
The-story known$^{\text{middle}}_{\text{simple}}$ because publishing the-article

in-the-newspaper

The story became known due to the publishing of the newspaper article

c. hasipur noda biglal hoda'ato shel haxašud
The-story known$^{\text{middle}}_{\text{simple}}$ because the-confession-his of the-suspect

The story became known due to the confession of the suspect

Again, the nominalized phrases describe extended events with varied internal structure that correspond formally to the occurrence of e.

STRICT ACTIVITIES $\langle +, -, -, - \rangle$

Examples:

(258) a. $[a][m][d] + B_{\text{s}} = amad$ (stand)
b. $[a][s][h] + B^{\text{m}}_{\text{s}} = ne'emad$ (stand up)

(259) a. $[\check{s}][\check{k}][\check{b}] + B_{\text{s}} = \check{s}a\check{k}a\check{b}$ (lie)
b. $[\check{s}][\check{k}][\check{b}] + B^{\text{m}}_{\text{s}} = ni\check{s}ka\check{b}$ (lie down)

As noted before these verbs are ambiguous between stative readings and inchoative readings. Interestingly, this ambiguity disappears once alternating to the medio-passive template, which has only the inchoative reading.

To achieve this formally, one can either start out with a state $PSCEN$ and follow the formal procedure we offered for states above (coercing them to inchoative with the addition of a preceding cause event), or present them as inchoative to begin with, with an altered point of view that focuses on the result state.

(260) a. hu amad (pitom/kol hayom)
He stood$_{\text{simple}}$ (suddenly/all the-day)
He stood up suddenly
He stood all day

b. hu ne'emad (pitomkol hayom)
he stood$^{\text{middle}}_{\text{simple}}$ (suddenlyall the-day)
He stood up suddenlyall day

ACTIVITIES $\langle +, +, -, - \rangle$

Examples:

(261) a. $[']{}[z][r] + B_{\text{s}} =' azar$ (help)
b. $[']{}[z][r] + B_{\text{s}}^{\text{m}} = ne'ezar$ (get help)

(262) a. $[n][s][a] + B_{\text{s}} = nasa$ (lift)
b. $[n][s][a] + B_{\text{s}}^{\text{m}} = nisa$ (be lifted)

(263) a. $[\check{s}][m][r] + B_{\text{s}} = \check{s}amar$ (keep, watch)
b. $[\check{s}][m][r] + B_{\text{s}}^{\text{m}} = ni\check{s}mar$ (be kept, watch oneself)

(264) a. $[']{}[s][h] + B_{\text{s}} =' asa$ (do)
b. $[']{}[s][h] + B_{\text{s}}^{\text{m}} = na'asa$ (be/get done)

This meaning can be captured by the canonical example of the Hebrew root $[']{}[s][h]$ (do) as illusatrated in the following alternation:

(265) a. X asa Y
X $\text{did}_{\text{simple}}$ Y
X did Y

(266) a. Y na'asa al yedey X
Y $\text{did}_{\text{simple}}^{\text{middle}}$ by X
Y has been done by X
b. Y na'asa heyteb̆
Y $\text{did}_{\text{simple}}^{\text{middle}}$ well
Y has been done well

Such roots refer to dynamic events that introduce the following $PSCEN$:

1. $\mathsf{Initiates}(start, doing, t)$
2. $\mathsf{Releases}(start, progress, t)$
3. $\mathsf{HoldsAt}(progress(x), t) \rightarrow \mathsf{Trajectory}(doing, t, progress(x'), t')$

The terminating event and the result state are by no means a part of the root's lexical material. The medio-passive template introduces the following general statements that in turn unify with parameters of the preliminary scenario:

1. $\mathsf{HoldsAt}(progress(x), t) \rightarrow \mathsf{Trajectory}(doing, t, progress(x'), t')$
2. $\mathsf{HoldsAt}(progress(x), t) \wedge \mathsf{HoldsAt}(doing, t) \rightarrow \mathsf{Happens}(e', t))$
3. $\mathsf{Initiates}(e', f_3', t)$

In order to derive the meaning of (266a) we start out a derivation from the integrity constraint introduced by μ feature:

$$?\mathsf{HoldsAt}(f_3, R), R \gtreqless now$$

By axiom 3 we need to find an initiating event for the result state f_3. By statements (3) and (2) in the μ feature criteria this state is initiated by an event which is brought about by a trajectory (statement 1). Crucially, statement (2) provides an initiating event for every value of the $progress$ function. So, for each moment in which the fluent activity $doing$ holds, it is possible to derive a temporary result state of 'having been done'.

(266b) derives a state of something 'having been done well', from an event of 'doing something well'. The fact that there is a state in which something is (or has been) done well, must trivially be conditioned on the fact that such 'doing' proceeded for a certain amount of time.

Crucially, this meaning cannot be canceled. Nothing can change the fact that a certain thing has been done well, if the database is updated with such an event that indeed took place (this is contingent on the lexical material introduced in the preliminary scenario).

A note about f_1 in such constructions: it may be the case that f_1 remains unspecified. However, this does not entail that such an f_1 does not exist. f_1 is contributed by the preliminary scenario of the root and is unified with lexical material in the context or by semantic memory. Under certain interpretations f_1 is taken to have the same argument as f_2, which provides a reflexive interpretation, as in (b).

(267) a. haxatul nišmar al-yedey be'alav
the-cat watch$^{\text{middle}}_{\text{simple}}$ by owners-his
the cat was watched by its owners

b. haxatul nišmar al napšo
the-cat watch$^{\text{middle}}_{\text{simple}}$ on himself
the cat watched out for himself

ACCOMPLISHMENTS $\langle +, +, +, + \rangle$

As with achievements, simple verbs that are incompatible with the causative alternation are felicitous with the medio-passive alternation.

Examples:

(268) a. $[b][n][a] + B_{\text{s}} = bana$ (build)
b. $[b][n][a] + B^{\text{m}}_{\text{s}} = ni\check{b}na$ (be built)

(269) a. $[']['][r][\check{k}] + B_{\text{s}} =' ara\check{k}$ (arrange)
b. $[']['][r][\check{k}] + B^{\text{m}}_{\text{s}} = ne'era\check{k}$ (be arranged)

(270) a. $[y][c][r] + B_{\text{s}} = yacar$ (create)
b. $[y][c][r] + B^{\text{m}}_{\text{s}} = nocar$ (be created)

The treatment of accomplishments is similar to the one we gave to activities. Let us take for instance, the meaning of the following phrase

(271) a. habayit niv̆na
The-house $\text{built}^{\text{middle}}_{\text{simple}}$
The house was (being) built

The lexical material provides us with the following $PSCEN$

1. $\mathsf{Initiates}(e, building, t)$
2. $\mathsf{Releases}(e, house, t)$
3. $\mathsf{HoldsAt}(house(x), t) \rightarrow \mathsf{Trajectory}(building, t, house(x'), t')$
4. $\mathsf{HoldsAt}(house(c), t) \wedge \mathsf{HoldsAt}(building, t) \rightarrow \mathsf{Happens}(finish, t)$
5. $\mathsf{Terminates}(finish, building, t)$
6. $\mathsf{Initiates}(finish, built, t)$

The μ criteria provides the following statements with e', f'_1, f'_2, f'_3 as unknown parameters

1. $\mathsf{HoldsAt}(f_1(x), t) \rightarrow \mathsf{Trajectory}(f_1, t, f_2(x'), t')$
2. $\mathsf{HoldsAt}(f_2(x), t) \wedge \mathsf{HoldsAt}(f_1, t) \rightarrow \mathsf{Happens}(e, t)$
3. $\mathsf{Initiates}(e, f_3, t)$

f'_1, f'_2 can be unified with $building$ and $house$ using the trajectory, and if the canonical goal has been accomplished then e' and f'_3 can be standardly unified with $finish$ and $built$ respectively. In that case the phrase in (271) indeed refers to the result state of a house that has been completed.

However, recall that the tense integrity constraint allows us to utter (271) in the present, in the future, and also in the past in case of an uncompleted house:

$$?\mathsf{HoldsAt}(f_3, t), R < now \textit{ succeeds}$$

Statement (2) in the μ feature criteria alows us to derive a state in which the house is 'being built', conditioned on the fact that the dynamics 'building' has taken place for a while.

This, in turn, cancels the phenomenon we termed 'the imperfective paradox'. To illustrate, in the following minimal pair, (272) does not entail anything about the existence of a fully baked cake, whereas (273) defines precisely the state of the cake at the present moment, of 'having been baked for a while'. In minimal models the cake will be fully baked in both (272) and (273). However the state captured in (273) is entailed even in non-minimal models (e.g., where there is a power outage) and cannot be canceled.

(272) a. ima ofta uga
Mom baked$_{\text{simple}}$ cake
Mom baked/was baking a cake

(273) ha'uga ne'efet
The-cake baked$^{\text{middle}}_{\text{simple}}$
The cake has baked

This brings up the question of identifying the notion of 'result states' with the notion of 'telicity'. Yitzchaki in her Master's thesis [55] claims that while many languages take these notions to coincide, Hebrew morphology (e.g., via the present participle alternations) reopens this issue, and suggests that maybe (for Hebrew, or in general) these notions are distinct.

The above discussion provides supporting evidence for this view since an ongoing event can be looked at from a stative point of view, imposing a temporary result state on the present moment, however this by no means implies telicity since the temporary result state is not the one inherent in the meaning of the accomplishment root.

DENOMINAL ROOTS

As recognized by both Doron and Creason, the Niphal is also available with denominal roots. This alternation is available with middle templates (as opposed to the passive templates) since the functional head μ attaches to the root rather then to a fully constructed verb. (Interestingly, many of these denominal verbs are also compatible with the Hiphil alternation)

Nouns

(274) a. $[l][x][c] + \text{noun} = laxac$ (stress)
b. $[l][x][c] + B_{\text{s}}^{\text{m}} = nilxac$ (get stressed)
c. $[l][x][c] + B_{\text{c}} = hilxic$ (stress)

(275) a. $[b][h][l] + \text{noun} = behala$ (fear)
b. $[b][h][l] + B_{\text{s}}^{\text{m}} = ni\check{b}hal$ (get frightened)
c. $[b][h][l] + B_{\text{c}} = hi\check{b}hil$ (frighten)

(276) a. $[p][r][d] + \text{noun} = pered$ (a part)
b. $[p][r][d] + B_{\text{s}}^{\text{m}} = ni\check{p}rad$ (separate, depart)
c. $[p][r][d] + B_{\text{c}} = hi\check{p}rid$ (separate)

adjectives

(277) a. $[r][t][b] + \text{adjective} = ratu\check{b}$ (wet)

b. $[r][t][b] + B^{\mathrm{m}}_{\mathrm{s}} = nirta\check{b}$ (get wet)

(278) a. $[k][r][b] + \text{adjective} = karo\check{b}$ (close)

b. $[k][r][b] + B^{\mathrm{m}}_{\mathrm{s}} = nikra\check{b}$ (get close(r))

(279) a. $[x][l][\check{s}] + \text{adjective} = xala\check{s}$ (low)

b. $[k][r][b] + B^{\mathrm{m}}_{\mathrm{s}} = nexlas$ (get low(er))

The proposed solution in that case is, again, to take the noun/adjective as a predicate $P(f(c))$ that corresponds to a specific value of some parameterized fluent (which in turn corresponds to the quadruple $\langle -, +, -, - \rangle$). This value provides the raw material for the canonical event and the resulting change of state. Thus, the meaning of such verbs is that the fluent object yielded by $f_2(c)$ has started to hold.

In the case of denominal roots the μ feature introduces the same lexical material and integrity constraints as for activities and accomplishments that consist of a dynamics. f_2 then unifies with f_2' in the μ criteria and the parameters are unified with contextual lexical material or semantic memory. (Again, recall Creaon's account, and the interplay between those factors.)

NIPHALS AND HIPHILS

The fact that the middle functional head interacts with the root gives rise to alternating middle and causative templates, with the absence of a corresponding simple verb (examples adopted from Doron [15, p. 13]). These are, for instance, locative verbs and experiencer verbs.

Locative verbs

(280) a. $[\check{s}][']][n] + B^{\mathrm{m}}_{\mathrm{s}} = ni\check{s}'an$ (lean)

b. $[\check{s}][']][n] + B_{\mathrm{c}} = hi\check{s}'in$ (lean)

(281) a. $[\check{s}][a][r] + B^{\mathrm{m}}_{\mathrm{s}} = ni\check{s}'ar$ (stay)

b. $[\check{s}][a][r] + B_{\mathrm{c}} = hi\check{s}'ir$ (remain)

(282) a. $[\check{p}][r][d] + B^{\mathrm{m}}_{\mathrm{s}} = ni\check{p}rad$ (separate) (from)

b. $[\check{p}][r][d] + B_{\mathrm{c}} = hi\check{p}rid$ (separate) (others)

Experiencer verbs

(283) a. $[l][x][c] + B^{\mathrm{m}}_{\mathrm{s}} = nilxac$ (be stressed)

b. $[l][x][c] + B_{\mathrm{c}} = hilxic$ (stress)

(284) a. $[b][h][l] + B^{\mathrm{m}}_{\mathrm{s}} = ni\check{b}hal$ (get frightened)

b. $[b][h][l] + B_{\mathrm{c}} = hi\check{b}hil$ (frighten)

(285) a. $[z][h][r] + B^{\mathrm{m}}_{\mathrm{s}} = nizhar$ (beware)

b. $[z][h][r] + B_{\mathrm{c}} = hizhir$ (warn)

We already noted that while the causative template provides us with increased valence, the medio-passive template often shows a valence decrease.

[15] presents the typological generalization that there is a universal ranking of predicates $\ldots, P_i, \ldots, P_j, \ldots$ according to increasing 'spontaneity of events'. Under this view, *causatives* and *middles* are the result of a single alternation, characterized by an increasing 'valence' (middle(intrans)-simple(trans) vs. simple(intrans)-causative(trans)), for which the order is never reversed.

So in the case of Hebrew, event spontaneity and valence can be ranked as follows: $B_{\mathrm{middle}} < B_{\mathrm{simple}} < B_{\mathrm{cause}}$, and crucially, this is never reversed for any pair in the languages.

Interestingly, this ranking can be replicated using the causal chain. The order of the elements is in fact the reverse of the mapping of equi-root eventualities derived from the different templates onto the causal chain: $B_{\mathrm{cause}} < B_{\mathrm{simple}} < B_{\mathrm{middle}}$.

This, again, reiterates the close connection between the thematic domain and the aspectual domain. In this case, it is also possible to connect aspectual phenomena (mapping to the causal chain) to syntactic phenomena, transitivity and changing valence.

Adjectival Niphals

The aspectual account at hand is compatible with the use of Niphal verbs as adjectives (see also [14]). These adjectival uses of the Niphal refer to the result state as a property that holds for the modified noun.

(286) a. isha ne'ehevet
beloved woman

b. ba'al nivgad
betrayed husband

c. yeladim nirgashim
excited children

6.6 The Middle Template: Hitpael

6.6.1 Theoretical Discussion

Creason [10] in his study of verb patterns in Biblical Hebrew shows that the Hitpael denotes a wide range of what he calls *double status* situations. A *double status*

situation is one in which (a set of) real world objects has two roles in the situation (while in the corresponding 'active' situations each of the two (sets of) objects has only one of the two roles). The different meanings he identifies are *reflexive, reciprocal* and *inchoative*.

The difference between *reflexive* and *reciprocal* situations is that the former refers to a single situation in which a single object serves as both participants, and the latter refers to *sets* of situations in which a *set* of objects serves as both participants. In the former, the single object acts upon or with respect to itself. In the latter each individual in the set acts upon or with respect to another object in the set. The *inchoative* refers to a slightly different situation in which a participant undergoes a change of state (which may occur either as the result of an internal process or of an action taken by some other participant).

Simons [46], in her account of the derivation and function of the modern Hitpael template, identifies precisely these three subcategories amongst the Hitpael verbs as demonstrated in (287), (288) and (289) respectively.

(287) inchoative

a. $[a][h][\check{b}] + B_{\text{i}}^{\text{m}} = hitahe\check{b}$ (fall in love)
b. $[y][\check{s}][\check{b}] + B_{\text{i}}^{\text{m}} = hity\check{s}e\check{b}$ (sit down)
c. $[m][l][a] + B_{\text{i}}^{\text{m}} = hitmale$ (become full)
d. $[z][k][n] + B_{\text{i}}^{\text{m}} = hizdaken$ (become old)

(288) reflexive

a. $[r][x][c] + B_{\text{i}}^{\text{m}} = hitraxec$ (wash oneself)
b. $[l][\check{b}][\check{s}] + B_{\text{i}}^{\text{m}} = hitlabe\check{s}$ (dress oneself)
c. $[p][\check{s}][t] + B_{\text{i}}^{\text{m}} = hitpa\check{s}et$ (undress oneself)
d. $[r][x][c] + B_{\text{i}}^{\text{m}} = hitkaleax$ (take a shower)

(289) reciprocal

a. $[r][a][h] + B_{\text{i}}^{\text{m}} = hitrae$ (see (in a social sense))
b. $[x][b][q] + B_{\text{i}}^{\text{m}} = hitxabeq$ (hug)
c. $[n][\check{s}][q] + B_{\text{i}}^{\text{m}} = hitna\check{s}eq$ (kiss)
d. $[p][y][s] + B_{\text{i}}^{\text{m}} = hitpayes$ (make up, make peace)

Her final claim is, however, that:

> "the Hitpael is not a reflexiviser, nor a creator of inchoatives, and the range of verbs types emerge in the hitpael is not due to any ambiguity of the hitpael itself. Rather, the hitpael is associated with a very general property of intransitivity. However, intransitivity is produced in different ways from different lexical structures, with differing results; it is the different properties of these lexical structures which are responsible for the range of meaning produced." [46, p. 23]

The crucial step for the resolution of this puzzle was made by Doron in formalizing the contribution of the functional head μ and explaining how it might get a reflexive interpretation by assigning an agent role to the internal argument of the root.

Note however, that $B^{\mathrm{m}}_{\mathrm{s}}$ (Niphal) and $B^{\mathrm{m}}_{\mathrm{i}}$ (Hitpael) derived from the same root and the middle functional head μ are by no means identical. Take for instance the following alternations:

(290) a. $[p][t][x] + B_{\mathrm{s}} = patax$ (open (active))
b. $[p][t][x] + B_{\mathrm{i}} = piteax$ (develop (active))
c. $[p][t][x] + B^{\mathrm{m}}_{\mathrm{s}} = niptax$ (open (middle))
d. $[p][t][x] + B^{\mathrm{m}}_{\mathrm{i}} = hitpateax$ (develop (middle))

(291) a. $[l][b][s] + B_{\mathrm{s}} = labas$ (put on)
b. $[l][b][s] + B_{\mathrm{i}} = *libes$
c. $[p][t][x] + B^{\mathrm{m}}_{\mathrm{s}} = nilbas$ (be put on)
d. $[p][t][x] + B^{\mathrm{m}}_{\mathrm{i}} = hitlabes$ (dress up (oneself))

(292) a. $[s][m][r] + B_{\mathrm{s}} = samar$ (keep, watch)
b. $[s][m][r] + B_{\mathrm{i}} = simer$ (preserve)
c. $[s][m][r] + B^{\mathrm{m}}_{\mathrm{s}} = nišmar$ (be careful)
d. $[s][m][r] + B^{\mathrm{m}}_{\mathrm{i}} = histamer$ (be preserved)

Evidently, the Hitpael verbs differ from their Niphal counterparts (in the same root) both in terms of their lexical meaning and their temporal schemata. While the Niphal verbs manifest focus on a resulting change of state and can be evaluated at an instant, the Hitpael verbs are intuitively more dynamic and require a longer period of time in order to evaluate their 'happening'.

The reason for this difference is the presence of an additional functional head realized by the Hitpael template. Recall that the Hitpael $B^{\mathrm{m}}_{\mathrm{i}}$ is the middle voice alternation of the intensive verb Piel B_{i}, both of which realize the semantic feature of the functional head ι.

In the case of Hitpael $B^{\mathrm{m}}_{\mathrm{i}}$ the middle voice head μ doesn't modify the root, but it modifies the root already modified by ι. Thus, the aspectual meaning of the Hitpael incorporates elements contributed by both the *intensive* agency and the *middle* voice semantic feature.

This combination is indeed aspectually significant. The ι feature contributes an extended dynamics with an actor exerting force and a gradually changing theme and the μ feature contributes a canonical goal and a result state. Therefore, the result verbs are extended just enough to cover the entire span of the lexical chain.

The proposed solution is then, that the Hitpael presents complete situations, extended in time, with a fully elaborated internal structure that mirrors the structure of an *accomplishment*.

However, two important distinctions must be made. First, although the situation is viewed as *complete* in its representation it need not be taken as *completed*. Indeed, present tense verbs show the same behavior as other intensive verbs by producing in particular contexts the imperfective paradox.

Second, although we view the situation as *complete*, it need not mean that it is viewed as *perfective*. On the contrary, we have defined in chapter 4 *perfectivity* as 'lack of internal structure'. Since the Hitpael construction puts in focus the elaborate internal structure of events, this cannot be the case.

The essence of this proposal is that Hitpael verbs encompass all possible elements of a situation (e.g., the elements denoted by the lexical chain, or the EC quadruples) and wrap them up into a single eventuality. This view can be motivated on various grounds based on the different categories we have identified:

1. From the *inchoative* point of view, the meaning of the Hitpael refers to en extended process of getting into a state, not only an instantaneous change. Note for instance the difference between the following pair: while the first can be modified using a punctual time adverbial (e.g., 'at noon'), the second is more natural with an extended period of time.

   (293) a. $[y][d][']+B_{\mathrm{s}}^{\mathrm{m}}=noda$ (become known)
   b. $[y][d][']+B_{\mathrm{i}}^{\mathrm{m}}=hitvade'a$ (get to know (a person or a subject))

   Further evidence for the extended temporality of inchoative Hitpael is given by the aspectual verb $halak\check{}$ (lit. walk, go). The 'go' aspectual verb in this context reiterates the progressive aspect of the situation (this repetition can be equated with the phrase 'more and more' in English).

   (294) a. hazerem halax vehitgaber
   the stream go-and-become $\mathrm{strong}_{\mathrm{int}}^{\mathrm{mid}}$
   The stream became stronger and stronger
   b. hatalmid halax vehistaper
   the pupil go-and-become $\mathrm{improve}_{\mathrm{int}}^{\mathrm{mid}}$
   The pupil became better and better

2. From the *reflexive* point of view, the fact that the external argument of the verb (formally, the participant denoted by f_1) identifies with the theme (formally, the participant denoted by f_2) and provides a 'built-in' *incremental theme* that accounts both for the durativeness of the eventuality and its telicity.

   (295) a. $[l][b][s]+B_{\mathrm{s}}=labas$ wear/put on (something)
   b. $[l][b][s]+B_{\mathrm{i}}^{\mathrm{m}}=hitlabes$ dress (oneself) up

3. From the *reciprocal* point of view, the unfolding of different sets of participants (and possibly the existence of multiple events)[29] under the verb denotation motivates the suggestion that Hitpael verbs conceptually wraps up complex situations to a single complete 'whole'.

   (296) a. hem nishku/xibku/ haechad et hasheni
   They kissed$_{\text{intensive}}$/hugged$_{\text{intensive}}$ one another
   b. hem hithashku/hitxabku
   They kissed$^{\text{middle}}_{\text{intensive}}$/hugged$^{\text{middle}}_{\text{intensive}}$

The hypothesis is further motivated by the canonical Hitpael form $hitraxe\check{s}$ (happen). It can be shown that almost every time adverbial is compatible with this construction, however in any case it is seen as a single, complete situation.

(297) a. *haerua hitraxesh* besha'a 2/kol hayom/bashana she'avara/bishlavim/tox daka
   the-event happened at 2 pm/all day/last year/in stages/in a minute

Formally, the composition of the aspectual schemata denoted by this pattern relies on the results of previous discussions. We get the 'complete' meaning of the Hiphil from the integration of the two functional heads (i) the intensive feature ι that introduces the dynamics and (ii) the μ feature that introduces a canonical goal and a resulting state.

6.6.2 Formal Account

The middle intensive template, *Binyan Hitpael*, B^{m}_{i} in our notation is marked both consonantally with a doubled middle morpheme and with the vocalization *a-e*. Moreover, it is the only form in Hebrew that carries a *t* prefixed to the root, as other so called *t-forms* in different Semitic languages

Semantically, the meaning of the Hitpael is composed from two different components that modify the basic meaning of the root: (i) the lexical material introduced by the ι feature (similar to the Piel), and (ii) the lexical material introduced by the μ feature (similar to the Niphal). The reference point of the result scenario is essentially the one defined standardly for Hebrew accomplishments (chapter 5).

Formally,

1. The intensive agency head ι introduces a dynamics which is telic/atelic based on the meaning of the root, in the sense of the definitions in section 6.2.
2. The middle agency head μ introduces a canonical event and result state in the sense of the definitions in section 6.5.

[29] See [6] for further discussion of this option.

3. The tense for Hitpael verbs is given by the general definition of tense for accomplishments, in the sense of the definitions in chapter 5.

Thus it follows that

STATES/STRICT ACTIVITIES get the interpretation of extended inchoatives in which a gradual process of getting into the state takes place.

WIDE ACTIVITIES get the interpretation of extended activities, that can be looked at from a stative point of view of 'being done'.(Note that in this case the fully specified quadruple does not necessarily imply telicity, similar to phenomena we identified in the analysis of the Niphal)

ACHIEVEMENTS get the interpretation of run-up achievements or strict accomplishments.

ACCOMPLISHMENTS remain accomplishments. However, they may get a different reflexive/reciprocal interpretation with respect to the corresponding simple verb. This however, is confined solely to the thematic domain.

6.6.3 Applications

SOME CANONICAL EXAMPLES

The following canonical examples present the simple/intensive/middle intensive alternation.

(298) *state*
- a. $[a][h][b] + B_{\text{s}} = ah\breve{a}$ (love)
- b. $[a][h][b] + B_{\text{i}}^{\text{m}} = hitahev$ (fall in love)

(299) *strict activity*
- a. $[y][s][b] + B_{\text{s}} = yasa\check{b}$ (sit)
- b. $[y][s][b] + B_{\text{i}} = yise\check{b}$ (settle)
- c. $[y][s][b] + B_{\text{i}}^{\text{m}} = hitahe\check{b}$ (sit down, settle down)

(300) *wide activity*
- a. $[h][l][\check{k}] + B_{\text{s}} = hala\check{k}$ (walk)
- b. $[h][l][\check{k}] + B_{\text{s}} = hile\check{k}$ (walk intensively)
- c. $[h][l][\check{k}] + B_{\text{i}}^{\text{m}} = hithale\check{k}$ (walk about)

(301) *achievement*
- a. $[p][t][x] + B_{\text{s}} = patax$ (open)
- b. $[p][t][x] + B_{\text{s}} = pitex$ (develop (active only))
- c. $[p][t][x] + B_{\text{i}}^{\text{m}} = hitpateax$ (develop (middle only))

(302) *accomplishment*

a. $[k][\check{s}][r] + B_{\mathrm{s}} = kašar$ (tie)

b. $[k][\check{s}][r] + B_{\mathrm{i}} = kišer$ (connect)

c. $[k][\check{s}][r] + B_{\mathrm{i}}^{\mathrm{m}} = hitkašer$ (make a phone call)

The interested reader is invited to formalize the joint contribution of the two features using the machinery presented in the previous sections. The application, in this case, is strictly technical.

A Note about Denominal Hitpaels

To summarize this section and the entire discussion, I argue that the fact that the Hitpael template carries the entire temporal span of a complex eventuality makes it a very efficient means to derive new verbs, which takes the 'burden' of introducing an elaborated event structure off of the lexical material. Put differently, the Hitpael templates provides an underlying event structure 'for free'.

As a result we observe a vast majority of Hitpael verbs that are derived from nouns, adjectives, foreign borrowed words, slang terms, and even acronyms. The various ways in which the Hitpael is used in day-to-day language to derive denominal verbs is (only partially) demonstrated by the below list.

(303) *nouns*

a. *hitpašer* compromise (derived from *pšara* (compromise)

b. *hitxaret* regret (derived from *xarata*, regret)

c. *hitxaten* get married (derived from *xatan*, groom)

d. *hitxaběr* make friends (derived from *xaver*, friend)

e. *hicta'er* fill with grief (derived from *ca'ar*, grief)

f. *hištaker* get drunk (derived from *sekǎr*, alcoholic drink)

(304) *adjectives*

a. *hitxazek* become strong(er) (derived from *xazak* strong)

b. *hityapa* make oneself pretty (derived from *yafe* pretty)

c. *hitxamem* become warm(er) (derived from *xam* warm)

d. *hitxakem* act wisely (derived from *xakǎm* wise)

e. *hit'ašer* become rich (derived from *'ošer,'ašir* richness, rich)

f. *hit'aceb̆* become sad (derived from *acub̆* sad)

(305) *slang and others*

a. *hitbaes* get depressed (derived from *basa*, slang for a 'down' mood)

b. *hištarlel* act recklessly (derived from slang for reckless)

c. *hitxac'ken* get pimpled (derived from *xac'kun* slang for a 'pimple')

d. *hitfalek* happen by accident (derived from *flik*, a nonchalant hit)
e. *hitfanen* do something fun (derived from the English word ‘fun’)
f. *histaxbek* make friends (derived from the Arabic word *saxbak*, a friend)
g. *hištapčer* improve ones appearance (derived from the army acronym *s.p.c.r* for *sipur-cura* improve-appearance)
h. *hitagalce’ax* clean and shave oneself (derived from the army acronym *g.l.c.x* for *giluax-cixcu’ax* shave-clean)
i. *hitkalebˇ* live on a low budget (derived from *kelebˇ*, dog)
j. *hitxarfen* go nuts (derived from *xoref*, winter)

Chapter 7

Summary and Conclusions

7.1 Outlook

Tables 7.1 and 7.2 summarize the *situation types* we identified under the denotation of verbs in various templates with relation to the basic aspectual meaning of the root they are derived from.

Table 7.3 summarizes the *viewpoints* on the situation we identified for various templates with respect to the lexical material provided by their result scenario (the lexical material of the root plus the contribution of the template).

Iconically, the '|' can be seen here as the 'temporal spot' of the participant whose viewpoint is represented by the template. The '|-' indicates the direction which is in focus. The 'causer' in the causative template, for instance, initiates the situation and looks 'forward' upon its development. The 'affected/receiver' patient in the medio-passive template, on the other hand, realizes a result state looking 'backwards' on the change of state that causes it. In the double status action a single participant is represented on both ends, looking 'inside' at the process that takes it from one point to another, encompassing the entire causal chain.

Root	*state*	*[strict] activity*	*[wide] activity*	*achieve [ment]*	*accomplish [ment]*
Paal	state	activity	activity	achieve	accomplish
Piel	accomplish	accomplish	activity	accomplish	accomplish
Hiphil	accomplish	inceptive	inceptive	accomplish	accomplish
Niphal	achieve	resultative	resultative	achieve	accomplish
Hitpael	accomplish	accomplish	accomplish	accomplish	accomplish

Table 7.1: Situation type per template for verbal roots

Root	*noun*	*adjective*
Piel	accomplish	accomplish
Hiphil	wide activity	wide activity
Niphal	achieve	achieve
Hitpael	accomplish	accomplish

Table 7.2: Situation type per template for denominal roots

Eventuality	|———————|
Piel	———————
Hiphil	|———————
Niphal	———————|
Hitpael	|———————|

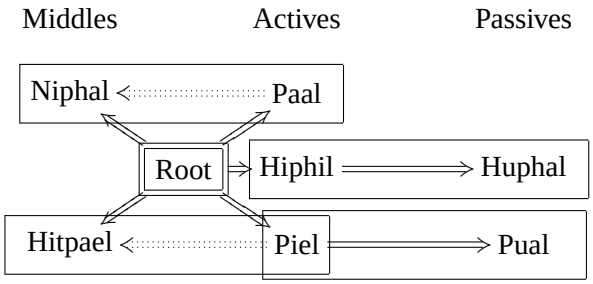
Table 7.3: Viewpoint per template

Table 7.4 shows canonical examples of Hebrew verbs in the various templates that represent the particular parts of situations that the templates focus on.

The picture that emerges from the preceding discussion is that the morphological templates in the Hebrew verbal system are (among other things) aspectual operators. These templates (with the exception of the two passive templates, see diagram below) modify the basic situation denoted by the primitive lexical material — the root — in two dimensions. They specify additional lexical material that has to be introduced to the scenario, and they introduce constraints that alter the default viewpoint on the situation. This allows for various different interpretations of the same basic lexical material.

Hiphil	|-*hitxil*—*himšiǩ*—*hiṗsik*—*hišlim*–
	|-start—continue—stop——complete–
Niphal	–*nigram*—*naasa*—*nigmar*-|
	–caused——done——finished-|
Piel	–*piteax*———*siyem*–
	–develop———graduate–
Hitpael	|-*hitraxeš*-|
	|–happen–|

Table 7.4: Canonical viewpoints of the Hebrew verbal patterns



As a result, different aspectual classes are associated with the same root based on the morphological environment they appear in. This is a rather interesting implementation of the phenomena called shift/coercion that is found throughout the literature with respect to Vendlerian traditional classification. It has been shown in the literature how coercion is triggered by different grammatical environments of the verb (e.g., progressive achievements in English). Similarly, the morpho-syntactic environment of the Hebrew root has the similar effect (which is almost identical in a computational sense) of coercing a basic situation to a different situation type (e.g., intensive achievements in Hebrew).

According to the principles of distributed morphology, the morphological templates are morphemes which are manipulated by the syntax in the creation of verbs. Having established that this grammatical process may affect the aspectual meaning of verbs in a predictable way, I believe that, contra the traditional view, we can plausibly argue to have found traces of grammatical aspect in Modern Hebrew.

This observation was made possible only by incorporating logical and computational machinery that allows us to abstract away from idiosyncratic verb meanings and focus our attention on a strictly aspectual analysis of the temporal and causal relations in the situation.

The Event Calculus has proven productive in systematically analyzing the temporal schemata of the templates and subtle distinctions in the internal organization of components/participants in the situation, and the application of the computational machinery allowed us to make successful predictions with respect to various root-template combinations.

In short, we have seen that the verbal templates incorporate the aspectual notions of event phases via a *dynamics* (Piel and Hitpael), and allow alternation between *inchoative/inceptive/ingression* and *egressive/resultative* viewpoints (Hiphil and Niphal respectively).

The marked aspectual categories, namely each one of the non-simple forms, are associated with a rather specific and elaborated internal structure and therefore are more naturally associated with ‘imperfective’ readings. In addition, some of the templates make explicit the connection with background information (e.g., the connection to a background cause provided by the Hiphil and the connection to a

subsequently inert state provided by the Niphal). Simple verb forms, however, are confined to the unmodified meaning of the root and are more naturally related with a perfective interpretation (as they do not 'zoom in' on the internal structure of the situation, and do not focus on specific event parts of the event. Essentially, those situations can be treated as 'lacking structure').

Note, however, that the verbal templates do *not* account for *telicity*. In the cases we have treated, telicity was maintained with respect to the lexical material denoted by the root. As usual, this can be altered due to additional lexical material in the verb environment (recall the *incremental theme*). However, we managed to show that some coercion phenomena from *atelic* to *telic* situations is deprived when appealing to the lexical material and reference point of a specific pattern (e.g., the intensive activities of Piel), which means that the templates also impose constraints on the meaning of the resulting verb. When such constraints cannot be met, the result of fusing a certain roots with a certain template is ungrammatical (recall the causative achievements).

In this work we followed closely Doron's account [15] of agency and voice in the Semitic templates, which focuses mainly on the thematic domain. Nevertheless, we were able to show that her observations and distinctions are also relevant to explaining aspectual phenomena. This in itself provides strong evidence for the intimate connection between the aspectual dimension and thematic relations in the eventuality structure.

We acknowledged in chapter 3 that traditional treatments of thematic roles in situations are not adequate, and that a proper treatment of these roles cannot be complete without incorporating elements of the event structure into the account. The Semitic templates, traditionally associated with phenomena of the thematic domain (voice and agency, transitivity alternations) provided us with an example in the opposite direction: a formal treatment of the event structure cannot be complete without incorporating the classification of participants into the account.

Creason [10] in his study of Aktionsart in Biblical Hebrew took the first step in this direction by incorporating ontological and thematic participant classification in his *Aktionsart* discussion. However, the treatment given by Creason is informal, and centered around a closed set of examples. This cannot provide the desired general account or the means for successful predictions.

I suggest that extending the Event Calculus framework to account for the semantic content of the roles participants play in situations allows one to make precise predictions of subtle distinctions between different mini-theories denoted by different scenarios. By so doing, we can make it more adequate for dealing with aspectual phenomena in languages other than English, in which semantic operators focus on the kind of participants involved (e.g., Persian [37]) rather than on strictly aspectual notions such as perfectivity (e.g., Russian [21]), progressive (e.g., English [52]) ingressive (e.g., Polish [34]) and incohative (e.g., French, [38]).

Finally, I hope to have established that the traditional view that Modern Hebrew lacks grammatical aspect altogether deserves to be reconsidered. Moreover, I hope to have established that there is enough evidence to account for the *two* basic ingredients for aspectual systems proposed by Smith [47] (*situation types* and *viewpoints*) in Modern Hebrew. By this it is hoped to encourage and facilitate the development of a theoretical framework for Modern Hebrew aspect, towards incorporating other syntactic, semantic, and pragmatic concerns into the account.

7.2 Further Research

There is much more to be explored in Modern Hebrew aspect (and theories of aspect in general) with respect to syntactic, semantic, and pragmatic factors. Below I give a preliminary list of suggestions for further research in this field.

First, within the theory we have just proposed, it should be interesting to extend the preliminary account of tense semantics (as presented in chapter 5) to explain additional phenomena. To start with, as of yet we have not tried to apply the proposed semantics of root/template combinations to future tense verbs. This 'gap' is not accidental. Hebrew present/future tense alternations manifest different shades of meaning (similar to the distinctions between 'will' and 'be going to' in English). Hence, investigation and formalization of the future tense in Hebrew may shed some more light on the distinct nature of the future tense, linguistically [7] and cognitively [52].

(306) a. ani tasa maxar le'amsterdam
I-fly$_{\text{present}}$ tomorrow to-Amsterdam
I fly tomorrow to Amsterdam

b. ani atus maxar le'amsterdam
I-fly$_{\text{future}}$ tomorrow to-Amsterdam
I will fly tomorrow to Amsterdam

Second, since Modern Hebrew has a limited three-way tense system, mature speakers alternate purposefully between tenses in the same clause or between adjacent clauses. This 'sequence of tenses' might have the affects of backgrounding, foregrounding, and relativizing the tense operator. A possible extension of this account is to formalize the semantics of tense alternation (possibly in the neighborhood of time adverbials such as *'ka'ašer', 'kš'* (when) and the relativiser *'š'* (that)). The purpose of such an investigation would be to formalize and theoretically support the observation in [3] that sequences of tenses provide additional means for Hebrew speakers to denote meaningful aspectual distinctions.

(307) a. higati kšavadta
I-arrive$_{\text{past}}$ when-you-work$_{\text{past}}$

I arrived when you were working

Third, in addition to the three tenses we presented, there exist two additional inflections in Modern Hebrew, the imperative and the infinitive. The imperative is mainly used in direct communication and the infinitive might be used in a nominalized phrase or as a verb complement. An interesting question is whether or not these particular forms are employed to serve aspectual function, again, in light of the limited set of grammatical means that Hebrew provides to denote aspect.

(308) a. kum!
wake-up$_{\text{imperative}}$!
wake up!

b. kaše lakum baboker
difficult to-wake-up in-the-morning
It is difficult to wake up in the morning

c. hayeled lo roce lakum
the-child not want to-wake-up
The child does not want to wake up

In addition, some present tense inflections in the simple form have different *netiyot* (forms) that seem to be related to different aspectual classes, for instance *Pael* (*yašen* (sleep), *ra'ev*(hungry)) for states and *Poel* for dynamic events (*holeǩ* (walk), *šoǒber* (break), *bone* (build)).

This hints at the special status that stative verbs have in Semitic morphology. Further evidence can be found in the present participle denominal construction that provides the result state of an eventuality via a morphological alternation. The close connection between this construction and various aspectual distinctions was explored in detail in [14], however it is an open question how these results can be systematically related to the proposed account.

On a wider scope, this study raised and reiterated two fundamental questions with respect to aspectual phenomena in general, first the connection between eventuality semantic classes and participant thematic roles (first attributed to [17]), and second, the debateable identification between result states and telicity (also raised by [55]).

The current study provides further evidence both for the bi-directional relation between events and their participant's semantic properties as well as the distinction between a 'result state' and an 'inherent terminal point'. These two fundamental issues deserve to be further investigated, preferably in a cross-linguistic arena.

Finally, one crucial direction for further research is the evaluation of the proposed theory from a cognitive point of view and the relation to language acquisition and developments processes. Such an investigation is precisely the purpose of the next part of this study.

Part III

A Quest for a Lost Monkey

Chapter 8

Introduction

8.1 Background

Throughout the theoretical part of the study we emphasized the intimate connection between our cognitive experience of time and our ability to express various temporal relations via linguistic forms. In chapter 1 we described the bidirectional relation between language and cognition in the temporal domain, and this bidirectional relation was reflected in at least two important ways.

One way is the aspectual choices that users make when expressing aspectual meanings (following Smith [47]). This choice is used to make distinctions that are cognitive rather than language dependent. The other way is our choice of formalism that reflects a presupposed human capacity of planning, which is, according to our main hypothesis, the medium through which we construct our conscious experience of time. In this part we are going to explore this bidirectional relation from a developmental point of view.

This part of the work is inspired by a cross-linguistic developmental study of "relating events[1] in narratives" [3], in which analyses of child and adult language, based on the ways they provide words to a wordless picture book, were used to gain a better understanding of the linguistic, cognitive and communicative abilities that underlie the human ability to talk about time. The reference point for the investigation of the 'different ways' children and adults have for 'relating events' was a series of pictures that represent events and describe dynamic interaction over time between animated beings in a physical setting.

According to [3], 'talking about events' is comprised of two components: the way a narrator puts into words a conception of events (i.e., the capacity to describe a

[1] From this point onwards I use the term 'event' in its informal sense (which correspond to the EC formal term 'eventuality').

situation) and the ways in which events are related to one another (i.e., the linguistic means that are used to connect different events and package them in a coherent discourse).

Theoretically, these two components correspond to the two components in our formal proposal. The choice of a *situation type* is related to the way a speaker describes a situation via his choice of basic lexical material and possible grammatical coercion. Less trivially, the choice of the *viewpoint* is intimately related to the grammatical environment that focuses attention on specific parts or participants of the described event, and and draw attention to background information or specific causal relations.

According to Berman and Slobin [3], three factors contribute to an 'identifiable use of linguistic means' to describe and relates events to one another: (i) different ages, (ii) different languages, and (iii) different ways of talking about the same picture (the narrators's 'perspective' on the situation).

Interestingly, the motivation for this cross developmental study stemmed directly from the apparent opposition between English and Hebrew in terms of their linguistic devices to express temporal relations.

> "We began with [...] the study of the development of temporal expressions in two quite different languages, English and Hebrew. We chose these two languages because one, English, has an elaborated set of verb markings for tense and aspect while the other, Hebrew, does no more then mark the verb for three basic tenses — past, present and future — with no grammaticalization of aspect. We wondered whether Hebrew-speaking children would attempt to compensate for the sparse grammatical marking of temporality in their language by the use of **lexical** expressions for notions that are grammaticalized in English." [3, emphasis in original]

The underlying assumption (attributed to Slobin) is that children seek linguistic means for expressing emerging concepts — in this case, supposedly universal concepts of temporality.

This assumption was studied in detail in 'child language' literature, and various approaches have been proposed. Against the traditional 'obligatory context' approach, in which some context *requires* the use of certain linguistics means (which are not dependent on the topic of the situation or the character of interaction) this study adopts the 'conceptualization' approach, first due to Wiest [54].

> "When a situation is conceptualized from an external perspective, properties such as 'complete', 'punctual' 'resultative' are salient, and when conceptualized from an internal perspective properties such as 'ongoing' ('continuative'), 'durative', and 'incomplete' are prominent."[54].

The 'conceptualization' approach focuses on the expressive *options* that a speaker

could take in describing or relating events. Under this view, the child has to learn more than whether a particular objectively defined situation requires the use of a certain grammatical morpheme, but also how to conceptualize situations and convey the way in which they were conceptualized.

A good example is the relation between story *grounding* and temporality. Essential sequenced events in a storyline, *foreground*, tend to be dynamic, punctual and completive, contrasting with *background* information which is frequently descriptive and often refers to physical or inner states and durative situations. It has already been established that if a language marks its verb for perfective aspect such forms tend to occur in foreground clauses; and if it marks its verbs for imperfective aspect such forms tend to occur in background clauses.

One language for which this observation was established is Biblical Hebrew (BH), whose literary style has grown to become as a de facto standard for literature, at least in its several descendents (see chapter 2 for further details).

> "BH uses *WAY-(yikyol)* to mark verbs in the clauses of the story line. I have shown that this form cannot appear in the background material, that is, outside of the story line. In written French narratives the simple past (*passe simple* carries the story line. In Russian, every verb has either P(erfective) or IMP(erfective) form. The verbs in sequential clauses are in P form, while the verbs in the rest of the text are usually IMP [...] (Note that BH is much more rigid in this respect; its foreground form may not appear in the background material under any circumstances)."[29]

To illustrate, contrast the following biblical examples with the root $[a][h][b]$ (love) (example adopted from [29]).

(309) a. wayye'ehav ya'aqov 'et rahel
love+WAY Jacob ACC-Rachel
'Jacob had fallen in love with Rachel'

b. weisrael 'ahav 'et yosef mikol banaw
and-israel love+QAT ACC-Joseph from-all sons-his
'Now Israel loved Joseph more then any other of his sons'

Here, the same basic situation of 'loving' is described from different viewpoints: one is imperfective and the other is perfective, based on the role it plays in the story. The crucial point here is that foreground and background are not given by the pictures, but are constructed by the narrator. Thus, there is indeed more to story telling than identifying an objective 'triggering context' in the description of the situation involved.

The developmental view of this study focuses therefore on the various ways *form* and *function* interact. *Form* refers to any kind of linguistic devices (semantic, gram-

matical) in the languages and *function* refers to the purposes those forms are meant to serve. The developmental history of a form usually shows an expanding range of its functional uses as it is employed to describe newly emerging concepts.

> "They [children past the age of three] already 'know' many of the morphemes under study, but do not yet know everything about the uses of these morphemes. And, in the following several years, they are learning not only new uses for the forms they know, but also acquiring new forms — in our study, both tense/aspect forms and interclausal connectives." [3]

In the original study [3], adults and children, native speakers of five different languages (English, German, Spanish, Turkish and Hebrew) were divided into three different age groups (pre-schoolers above three years old, schoolchildren and adults) and were asked to tell the story depicted by the pictures of the wordless story book (*Frog, Where Are You?*). The analysis of the linguistic forms they used in their (monologic) discourse was used to evaluate five functional categories: temporality, event conflation, perspective, connectivity, and narrative style.

In a preliminary study I conducted (described in detail in [50]) I focused on the investigation of linguistic forms in Modern Hebrew, and on three specific functional categories: temporality, perspectives and connectivity. The results of this preliminary study provided me with evidence that mature Hebrew speakers indeed employ additional lexical material (such as adverbial words and subordinate clauses, repetition, pragmatic use of aspectual verbs, etc.)

However, what I considered most striking about my findings was the marked deviation from standard verb usage to a less conventional template alternation in the same root. Thus, adult proficient speakers used *hithalek̆* (walked about), *hit'oṕeṕ* (fly about) instead of *'aṕ*, *ne'ecab̆* (got sad) instead of *haya acub̆*, etc. Consequently I have identified some correlation between the morphological template of the verb and aspectual properties of the described event.

The main motivation and the intuitions that guided the current study came directly from these findings. In this part I am going to complete the task, and by conducting a more concentrated empirical investigation of the use of tense inflection and verbal templates in Hebrew, I show the role they play in making aspectual distinctions as formally described in the first part of the study.

8.2 Goals

The ultimate goal of this part of the study is to provide preliminary empirical evidence for the proposed theory being *cognitively plausible* and *linguistically adequate*.

The technical way in which this is done is similar (although not identical) to the method used in [3] and [50]. The investigation focuses on one specific language and specific linguistic forms (the morphological templates and tense inflections), and the task is modified to facilitate the investigation of the functions these forms are employed to serve in real language use.

The structure and main procedure of the experimental setup is examined in detail in section 9. For the time being it suffices to say we analyze pieces of discourse uttered by children and adults from the ages 3 to 30 based on a wordless story book, in order to examine the form/function correlation of the inflected verb forms they use.

Firstly, we want to find evidence for the use of the morphological templates (the *Binyanim*) in aspectual contexts that have been described in the previous section. Secondly, we want to examine how the interaction of the verbal templates with the grammatical tenses affects default temporal/aspectual distinctions that are depicted by the tense inflectional morphemes. Lastly, we want to compare and contrast the verbs (verb phrases) that are used in different contexts or by different narrators to describe situations that are conceptually of the same type.

This form/function correlation is also looked at from a cognitive perspective. From a developmental point of view, concepts that emerge later are predicted to manifest themselves in the linguistic forms later in age, and linguistic forms that were seen to be more computationally involved can only be acquired after the relevant cognitive capacity has emerged.

With relation to the theoretical part of the study, the goal of this part is to evaluate how the *aspectual choice* of (i) verbs, (ii) verbal templates, and (iii) tense inflections picked out by the narrator differ with (i) age, (ii) situation type (Aktionsart), and (iii) the perspective taken on the situation (grounding and perfectivity). Such information is hoped to shed some light on the specific role morphological templates play in encoding aspectual distinctions and elucidate the range of functions they are employed to serve throughout the developmental history of these forms.

Chapter 9

Experimental Setup

9.1 Method

The method we use in our empirical investigation is the analysis of connected discourse produced by native Hebrew speakers in the narration of a story based on pictures from a wordless story book named 'Monkie' [45].

The body of the data set consists of interviews in which the subjects were asked to tell the monkey story three times; once as they went through the pictures, and twice on two different occasions that refer to two different reference points. One reference point is within the course of events in the story plot and the other is external to it and immediately follows it.

The use of the story book as a reference point for the stories allows us to define the inherent (aspectual) meaning in the various situations depicted by the pictures of the book (complete/incomplete, punctual/durative, telic/atelic), and in turn to evaluate the aspectual choices that different speakers make with respect to it.

Moreover, our investigation has an important subjective component that refers to the grounding of events in the story plot. We examine which events are used as foreground/background by different narrators and assess the linguistic forms that are used to convey the corresponding aspectual notions of (im)perfectivity.

Our analysis focuses strictly on the verb forms that are used to describe particular pictures. To some extent we analyze adjacent clauses insofar as they refer to single identifiable events (in this context, the criterion for individuating events is the partition of the story plot into pictures).

The verb forms that are used throughout the interviews are analyzed with respect to (i) the kind of situation they are meant to describe, (ii) the relation of the situation to other preceding/following/higher level events in the story, and (iii) the description of the same situation by the same narrator in a different contexts.

At times, adopting the viewpoint of one of the protagonists plays a role in conveying the aspectual message. Such phenomena elucidate the role thematic roles have in interpreting the internal structure of a situation and affect the formal *viewpoint* that is ascribed to it.

In the sequel we elaborate upon each of the components in the experimental setup; the material in section 9.2, the task in 9.3, the subjects in section 9.4 and the dataset in section 9.5, and show how they were designed to serve the specific goals of this study.

9.2 Material

The reference point for the analyzed discourses is a bound storybook with pictures adapted from the original 'Monkie' [45] picture book.

In [50] I used the original version of 'Monkie' to conduct a similar experiment, however this material proved to be problematic for the implementation of the task at hand. The post mortem analysis of the experimental execution yielded the following conclusions.

First, each page in the story book consisted of a number of pictures that were related (in some fashion) to a higher-level event. This kind of layout was inappropriate for our task for several reasons: For the younger interviewees the presence of additional pictures provided an out-of-focus distraction and interfered with the description of the picture at hand. For the older interviewees, this layout provided a way to make 'shortcuts' by wrapping up multiple pictures in a single utterance bypassing the main distinctions the experiment was designed to account for. For all interviewees the cognitive task at hand (narrating a piece of discourse based on several pictures) was more complex and much more involved than was originally intended.

Moreover, the actual book was inherently inadequate for the use of Hebrew speaking narrators, as the organization of the pictures (together with the paging) was ordered from *left to right*. This is opposite to the standard Hebrew writing system which is invariably from *right to left*.

In addition to the apparent difficulty of reading a book from the subjectively 'opposite' direction, this problem is in fact of a more general kind. Consider for instance picture [[2]] in the story plot in the appendix that shows the mother, the boy and the monkey riding a bicycle. In the original book, the riding direction coincides with the direction of the text (left to write), as do all other dynamic movements described in the pictures of the book (consistently, the elements that refer to the 'next' situation exist on the right of the picture while the ones relevant to previous situations remain on the left).

This can be related to the temporal-spatial hypothesis that both spatial and temporal domains are intimately related from a cognitive point of view. In our case, this problem required 'translating' the direction of the pictures to the one that by default is related to 'progression'.

In addition, it turns out from the texts as well as from some prosodic information in the preliminary interviews that some pictures in the original 'Monkie' book were unhelpful in driving the narrative forwards. On the contrary, a few pictures caused the narrator unnecessary complications and detached them from the story line (by stipulating further occurrences that were not intended). In light of the above conclusion a new version of the 'Monkie' story was designed. The new, truncated story book was designed based on pre-test interviews with adults that testified to the significance of each of the pictures for the flow of their story.

The result is a bound wordless storybook based on the pictures of [45] which is shorter, with one picture per page, all reprinted in a 'flipped' orientation, and bound from right to left. It is this version of the storybook that provided the raw material out of which Hebrew-speaking children and adults constructed a connected narrative (at this point the reader is advised to turn to appendix A to review the sequence of selected pictures that form our story plot, as these pictures will be extensively referred to in subsequent discussion[1]).

9.3 Task

The task presented to the interviewees is a four-part task, each of which parts refer to the storybook described in the previous section.

In **part I** the interviewee was asked to tell the story depicted by the pictures while walking through the pictures (crucially, without knowing what happens next).

In **part II** (picture [[23]]) the interviewee was interrupted by a doll 'assistant' that 'wanted to know' what happened so far in the story.

In **part III** the interviewee was asked to continue telling the story from the point it was interrupted, and

In **part IV** (picture [[46]], following the complete resolution of the story) the assistant's 'friend' (another doll), was brought in and 'asked' the interviewee to retell the whole story.

The purpose of the (complementary) **parts I+III** was to capture specific verb forms (derivational morphology and tense inflections) that were chosen to describe aspectual properties inherent in different kinds of situations. The purpose of **part II** and

[1] for coherence of the current document, I included the pictures in their original 'left to right' orientation

part IV was to examine the narration of events in retrospect, from a different viewpoints.

The crucial difference between **parts II** and **IV** is that in the former the interruption point is located roughly in the middle of the story plot, when some of the situations have already been completed and others are still ongoing. The second uses as reference point the last picture in the book that marks the story resolution. At this point, all the events have been completed and the story has been resolved. This conceptual difference was expected to affect the kind of forms that are used to describe situations from different points of view.

The above task had to be slightly modified for interviewees of different ages with different constraints or needs. For the younger interviewees (ages 3–4), **parts II** and **IV** presented a unreasonable overload on the working memory and thus were omitted altogether. Adults were asked to perform the exact same task as children (including the aid of the various doll 'assistants') however the interview was concluded with presenting experimental goals and an open discussion of their aspectual choices and the linguistic means that they used.

The use of assistant dolls shouldn't be taken just as a matter of 'cuteness'. In [3] it is noted that

> "Younger children take fewer expressive options because (a) cognitively, they cannot conceive of the full range of encodable perspectives (b) communicatively, they cannot fully assess the listener's view point; and (c) linguistically, they do not command the full range of formal devices."

In the context of the current study we are not interested in investigating the development of communication skills however we cannot overlook the fact that younger children cannot fully assess, let alone pretend to have, a knowledge gap between them and the experimenter. The use of different figures for the different repetitive stories is meant to overcome problems in engaging in the task of 'retelling' a story to someone whose knowledge state is similar to their own [2]. For older ages, this prevents taking 'shortcuts' that are based on taking for granted that the hearer (the experimenter) and the speaker (the interviewee) already have a *common knowledge* of the story.

Of course, the use of assistant dolls proved helpful also in (i) convincing children (and adults) of different ages to engage in all the four, admittedly exhausting, parts of the task, and (ii) minimizing the communication with the experimenter throughout the interview. The second point was crucial since any communication with the experimenter may affect and influence their tense conventions and default aspectual choices.

[2] Recall the *false belief task* [25].

9.4 Subjects

All in all I have conducted 42 interviews with children and adults between the ages of 3 and 30 (male/female ratio roughly 50%/50%). All the interviewees are native Hebrew speakers that grew up in Israel to native Hebrew speaking parents.[3]

All the interviewees belong roughly to the same socio-economic group, and all the parents of the children as well as the adult interviewees have academic background in the level of at least undergraduate studies. Geographically, all interviewees came from roughly the same area of the urban enter of Israel (mostly Tel-Aviv and Gush dan, Modi'in and Reut).[4]

9.5 Data

Not all of the 42 interviews that have been conducted could be used to form the body of the dataset to be analyzed. Some interviews had to be eliminated for various reasons;

- lack of cooperation (total or partial) during the interview
- engaging in a different task than the intended one (e.g., telling an imaginary story that is not related to the content of the pictures)
- unreasonable length of the stories (too long or too short)
- and, unfortunately, technical reasons (e.g., bad audio-recording quality)

The resulting data set consists of 22 interviews, 4 adults and 18 children (with male/female ratio of 8/10 within the children). The texts (henceforth, 'the interviews') were divided into ten age groups that were classified into four different age categories:

- pre-schoolers (kindergarden) 3-4;4-5;5-6;6-7 (6)
- early school children (elementary school) 7-8;8-9;9-11 (6)
- adolescents (junior high) 11-13;13-15 (6)
- adults (mostly graphic design graduated students) 26-28 (4)

Table 9.1 lists relevant information about the selected interviewees together with the coding conventions that were used to refer to each of the interviews. The selected interviews were transcribed in Modern Hebrew (unvocalized) scripts, using the transcription conventions described in table 9.2.

[3]Interestingly, all interviewees belong to a generation that is referred to as the first generation of children to native Hebrew speaking parents.

[4]Not the author but the town.

	(C)hild/(A)dult (M)ale/(F)emale Years;Months	**Age**	**Gender**
Pre schoolers	CF3;6	3;6	female
	CF3;10	3;10	female
	CF4	4	female
	CF4;6	4;6	female
	CM5;3	5;3	male
	CF5;6	5;6	female
	CF6;6	6;6	female
	CF6;7	6;7	female
Early schoolers	CM7;6	7;6	male
	CF7;6	7;6	female
	CF8	8	female
	CM8;9	8;9	male
	CM9	9	male
	CM10	10	male
Mid schoolers	CF11	11	female
	CM12;6	12;6	male
	CM13;6	13;6	male
	CF14;7	14;7	female
Graduated Students	AF26a	26	female
	AF26b	26	female
	AF26c	26	female
	AF28	28	female

Table 9.1: Interviewees Information

Text	Description	Meaning
text	normal text	subject utterances
text	**bold**	experimenter utterances
(text)	normal text	meta-task information
	in brackets	instructions, clarifications, opinions
xxx	three exes	unintelligible utterance
[[n]]	number in double square brackets	focus on picture number n

Table 9.2: Transcription Conventions

Code	Description	Meaning
Default	no indication	steady intonation
,	comma	partially falling intonation
.	period	fully falling intonation
...	three dots	a short pause e.g. wondering, rephrasing
	empty line	a longer pause e.g. thinking, moving between pictures
!	exclamation mark	excited delivery
?	question mark	end of question type utterance
“ ”	quote	change of voice e.g. taking a protagonist perspective

Table 9.3: Conventions for Transcription of Prosodic Information

In the transcribed texts prosodic information was partially included, only to complement the content of the linguistic material provided by the utterance (the picture in focus, making references using demonstratives, adopting a protagonist viewpoint, etc.). The transcription conventions for prosodic information are summarized in table 9.3.

Chapter 10

Analysis and Results

10.1 Method

Our method for analyzing the transcribed interviews is as follows. First we review all four parts of each transcribed interview and map the verbal forms to the pictures they are meant to describe.

To keep our analysis straight to the point and avoid divergence of the discussion towards irrelevant peculiarities we leave out of the analysis all clauses that do not contain strictly verbal inflected forms.

And so, the following forms are completely excluded from the analysis:

1. Strictly nominal clauses (no verbal/copular element)
2. *yeš/eyn* (have/not have) sentences
3. *efšar/cariǩ* (modal) sentences
4. *ze/zo/ele* (demonstratives without or instead of copular elements) sentences
5. Personal comments of the interviewee ('I don't understand', 'I forgot', 'I don't know what to do' etc.)

The following clauses are partially excluded from analysis (counted, partially analyzed):

1. Future and imperative clauses
2. Non-finite verb forms (*curat ha-maqor*)
3. Subordinate clauses (*mišpat murkaḃ*)
4. Passive forms (*Pual/Huphal*)
5. Present participles (*benoni saḃil*)

6. Nominalized verb forms

It is important to stress that leaving such forms out of the analysis does not mean that they are aspectually irrelevant. On the contrary, some of these peculiar Semitic/Hebrew forms may contribute additional aspectual information. In fact, the very same data set could be used for the analysis of the syntactic, semantic and pragmatic uses of these 'other' forms however it has to be done in a separate study.

Then, we analyze the data in two dimensions:

1. Quantitative analysis
2. Qualitative analysis

10.1.1 Quantitative Analysis

For each part of each interview we create a templates/tense grid and count all the verbal forms that fill up the different slots.

For example, the table below shows the verb forms grid created for PART I (stated in the top left cell) of the transcribed interview CM4 — child, male, four years old (stated in the title).

CM4

PART I	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	4(1)	1	15(2)		1	21(67.7%)
Piel	1		1			2(6.45%)
Hiphil	1(1)		5			6(19.3%)
Niphal					2	2(6.45%)
Hitpael						0(0%)
Total	6(19.35%)	1(3.22%)	21(67.7%)	0(0%)	3(9.67%)	31

The **vertical** dimension refers to the patterns we consider as having aspectual contribution; *Paal* (B_{simple}), *Piel* ($B_{\text{intensive}}$), *Hiphil* (B_{cause}), *Niphal* ($B^{\text{middle}}_{\text{simple}}$), *Hitpael* ($B^{\text{middle}}_{\text{intensive}}$). Note that *Pual* ($B^{\text{passive}}_{\text{intensive}}$) and *Huphal* ($B^{\text{passive}}_{\text{cause}}$) are missing as we concluded that they are semantically equivalent to their active forms. In practice the very few verbal occurrences of these forms were added to their active counterparts count.

The **horizontal** dimension refers to possible tense values, that include the *past* tense forms, forms that are *ambiguous* between past and present (this is often the case with Niphal singular masculine inflections such as $ne'ebad$ (lost), or double Paal singular double consonant roots ba (come) rac (run), etc.), *present* forms, *future* and *imperatives* (which were mostly used in the same context, namely direct speech between protagonists), and the *infinitive*.

For each interview five grids were created: one for each part, and one for the conclusive result of the 'walk through' story (PART I+III). All tables are available in the appendix. The data was then used to identify trends of verbal form usage in terms of tense (dominant tense and tense alternation) and patterns (simple/non-simple verbs used).

It should be noted that the statistical tables were not used as a representative sample of the entire population and mean/deviation measures were *not* taken. The reason for that is that these interviews do not form a homogenous sample. On the contrary, each interview marks a specific, different, point in the language development process.

The main idea was to identify the developmental trends of this specific set and show how it fits the theory. This is intended to to provide *preliminary* evidence for the use of such forms (and the aspectual choice between them), and to show how the developmental history of these forms *might* look like.

In order to establish the development trends statistically, each age group (from the total of ten) should consist of a much larger set of interviews on which a statistical analysis *per age group* can be conducted. The proposed method of analysis, however, can be applied as is to larger sets of interviews.

10.1.2 Qualitative Analysis

Following the constraints on our statistical method of analysis, a qualitative analysis in the context of this study is more important and much more illustrative.

In this part we review each discourse[1] and compare the different verb forms (inflected patterns) that were used by different narrators, or by the same narrator in different contexts (different parts of the study), to describe one and the same episode in the story book.

Such an analysis also puts emphasis on the individual differences between interviewees, as it is clear that there are different ways in which one could tell a story.

We start by estimating the developmental phase of interviewees in each age group, using general assumptions and predictions, and we compare it with the analysis of planning components that have been included in the narrative (for a complete discussion of planning components in the 'Monkie' story plot turn to [50, ch. 4]).

Then, we review utterances-per-picture that demonstrate typical uses in the specific discourse, and elucidate the functions that such forms were meant to serve. Lastly, we compare our findings for specific age groups with those of neighboring age groups and point out significant contrasts, similarities and progression.

[1] To avoid repetitions, I included in this work the analysis of no more than 13 interviews that form a representative sample of the trends and typical uses I identified in the texts.

10.2 Predictions

Our main predictions for both part of the analysis are:

1. We expect an increased use of non-simple verb forms with age
2. We expect more non-simple verbs in the 'telling' part (parts I+III), as most events are still ongoing and have a clear connection to background information (an 'imperfective' use)
3. We expect more simple verbs in the 'retelling' part (part IV) as the story is recapitulated from a retrospective point of view in which all events are seen as 'complete' and 'completed' (a 'perfective' use)
4. We expect a combination of 'perfective' and 'imperfective' uses of verbs in the 'pause' (part II) since some episodes are complete, completed (i.e., their mini-plan has come to resolution) while other are still ongoing, and may serve as settings or background for the events yet to come.
5. We expect voluntary alternations between equi-root patterns increased with age.

Throughout the analysis, it should be noted that for Hebrew-speaking children the *obligatory* inflections are confined to tense and are acquired and mastered early on (at about age 3 [3]). Also, the language manifests some inherent choices with respect to the morphological templates (e.g., some roots have a *common, typical* use in a single specific template).

Employing additional information to convey aspectual meanings (what is referred to in chapter 3 as 'aspectual choice') is thus *voluntary* in Hebrew, and therefore I expect such choices to appear rather late in the language acquisition process. From a cross-linguistic point of view, I would expect alternation between templates in the same root to appear later than alternation between simple/progressive/perfective inflections for languages with obligatory grammatical marking for such notions.

10.3 Analysis

10.3.1 Quantitative Analysis

Appendix B.1 contains all statistical tables for verb-form usage, for each part of the interviews.

Table 10.1 summarizes the length of the various stories (note that 'STORY I' refers to parts I+III of the experiment and STORY II refers to part IV) and the percentage of inflected past/present verb forms that were used in any of the stories.

Hebrew narrators anchor their story either in the past or the present (as it stands, it is a matter of individual preference). However, regardless of the tense the speaker has used to anchor her story, the vast majority of the interviews show a significant increase in the use of past tense forms and decrease in the use of present tense forms in the part of 'retelling' the story (part IV) (recall that in our semantic account of Modern Hebrew tenses (chapter 2) the past tense has default implications of 'completion' and present tense has a default implications of 'progression').

Table 10.2 summarizes the percentage of simple verbs that were used in the various parts of the interview. Clearly, there is a general trend of decrease in the simple verb forms (and a complementary increase in verbs in non-simple patterns) with age.

This trend is in line with our hypothesis that the non-simple verbs manifest marked aspectual choices that pinpoint specific features of the internal event structure. Expressing such concepts in the narrative requires the speaker first to acquire these concepts (cause relations, result states, etc.), and second, to conceptualize the story episode in such a way that these concepts are aspectually relevant.

Moreover, we have shown (by means of computational derivations) that 'computing' aspectual meanings of non-simple templates is more demanding and may present an overload for the working memory at early ages, which is also consistent with our expectation that non-simple verbs appear at a later age.

Finally, it seems that the option space of Hebrew simple verbs (with the exception of a few unique root-template combinations) provides sufficient lexical material for a basic, sequential narration of the story (event by event). As we expected, the *voluntary* choice/decision to deviate from simple verbs appears later. This may correspond to the emergence of new concepts and exploration of newly acquired means for incorporating such concepts in speech.

10.3.2 Qualitative Analysis

In this section I analyze the use of verbs, tense and templates throughout the different parts of the experiment by individuals in different age groups. For each interview I perform a cross-analysis of the same picture in the different parts of the interview and a brief comparison with neighboring age groups.

Age group 3–4

GENERAL

- The task for children in this age group is reduced and consists of a single narration of the entire story while walking through the pictures. These nar-

	STORY I	(past/present)	STORY II	(past/present)
CF3;6	48	(27%/52%)		
CF3;10	96	(93%/3.125%)		
CM4	33	(18.16%/66.66)		
CF4;6	62	(17.74%/61.29%)		
CM5;3	80	(36.25%/45%)	16	(68.75%)
CF5;6	115	(68.7%/4.3%)	61	(77%/3.2%)
CF6;6	137	(70%/9.5%)	28	(53.5%/4.16%)
CF6;7	123	(71.5%/10.5%)	33	(84.8%/3.9%)
CM7;6	198	(66.66%/13.13%)	75	(65.3%/2.7%)
CF7;6	110	(78.1%/7.2%)	62	(87.1%/0%)
CF8	98	(78.6%/8.16%)	39	(89.7%/0%)
CM8;9	61	(14.7%/70.49%)	38	(68.42%/2.6%)
CM9	60	(88.33%/0%)	30	(90%/0%)
CM10	81	(81.48%/2.46%)	31	(70.9%/6.4%)
CF11	141	(69.5%/1.4%)	69	(62.3%/1.44%)
CM12;6	75	(85.33%/0%)	20	(95.2%)
CM13;6	114	(83.33%/5.26%)	76	(76%/11%)
CF14;7	84	(77.38%/9.5%)	44	(72.72%/0%)
AF26a	117	(71.19%/9.4%)	53	(84.9%/3.77%)
AF26b	125	(40.8%/32.8%)	97	(86.59%/1.03%)
AF26c	157	(75.15%/5.09%)	99	(86.86%/2.02%)
AF28	183	(75.4%/4.63%)	151	(77.4%/5.59%)

Table 10.1: Verb Forms Usage — Tense Inflections

	PART I	PART II	PART III	STORY I	STORY II
CF3;6	87.5%		87.5%	87.5%	
CF3;10	86%		84.4%	85.4%	
CM4	80%		57.14%	66.66%	
CF4	85.36%		65.43%	76.76%	
CF4;6	58.06%		72.9%	62.9%	
CM5;3	87.5%	100%	7%9	82.5%	93.5%
CF5;6	83.6%	73%	73.4%	76.5%	85%
CF6;6	72.2%	92.3%	70%	71.5%	86.7%
CF6;7	82.4%	75%	84.3%	82.1%	87%
CM7;6	74.5%	69.4%	70.2%	71.2%	74.6%
CF7;6	77.2 %	80.9%	70%	74.5%	79%
CF8	80 %	87.5%	76%	78.5%	79.4%
CM8;9	53.12 %	62.5%	50%	54.09%	68.42%
CM9	60 %	71.4%	92.8%	75%	76.6%
CM10	74 %	81.81%	67.74%	71.6%	90.3%
CF11	48 %	58%	45.16%	46.8%	55.07%
CM12;6	71.05 %	66.66%	62.31%	66.66%	71.42%
CM13;6	57.33 %	58.8%	61.5%	58.77%	61.84%
CF14;7	57.14 %	69.56%	74.28%	64.28%	72.72%
AF26a	70.14 %	58.33%	56%	64.1%	58.49%
AF26b	37.68 %	55%	60.71%	48%	65.9%
AF26c	50.6 %	66.66%	70.27%	59.87%	75.75%
AF28	60.82 %	60.34%	66.27%	63.38%	62.9%

Table 10.2: Verb Forms Usage — Morphological Patterns

ratives were generally characterized by a 'picture description' mode (see [3] for explanation and further evidence for this mode of narrative by the younger children).

- The narratives of these children were not entirely voluntary. They required some prompting from the experimenter or an accompanying adult (e.g., a parent). Ultimately, they were relatively short. The experimenter comments were limited to the required minimum and maintained a neutral mode (i.e., not carrying any tense/aspect information).
- Children at the ages of 3–4 have already mastered the use of verb inflections for the three grammatical tenses past, present and future. According to the simplest hypothesis [54] tense morphology is used by children to represent relationships between event time (ET) and speech time (ST) (the deictic center *now*).
- Deviations from the tense in which the story is anchored (if there is any anchor) are common, and may be seen as arbitrary or accidental as they are not meant to serve any specific purpose (see additional evidence in [3]).
- An alternative hypothesis for early stages of languages development is the *'defective time hypothesis'*:

  > "[. . .] the initial tense morphology does not perform its normal deictic function. Instead of coding deictic relationships, the past tense form codes the aspectual relationship of completion and the future tense form codes intentions [. . .] the child lacks an abstract conception of time. Hence, the morphological contrast between past and non-past represents the distinction between resultative and continuative aspect." [54, p. 359–361]

- The dimensions of the defective tense hypothesis are *semantic* (only telic verbs will be inflected in the past tense), *syntactic* (tense distinctions will be redundant and only accompany aspectual distinctions) and *temporal* (only reference to immediate time situations are expected).

CF3;6

- The narrative is relatively short (48 verb forms) and is anchored mainly in the present (most of the forms are ambiguous between past and present however the text is naturally read as if they are referring to the present moment).
- The narrative does not faithfully represent the story plot and it is hard to identify an underlying goal/plan structure in use (by means of inclusion of relevant planning components). For instance, the picture in which the boy is crying for the lost monkey is described as follows:

1. ‘hu **ocem** eynayim ve**koev** lo ha’ayin’[[8]]
   ‘He **closes**$_{\text{simple}}$ eyes and-**hurts**$_{\text{simple}}$ to-him the-eye’[[8]]
   ‘He **closes** his eyes and his eye **hurts** him’[[8]]

- The past tense is used to refer to events that have already terminated in the past. For instance, in the following phrases the protagonist she refers to does not appear in the picture, but is assumed to ‘have been there’.

1. ‘hu **hitxabe**’[[8]]
   ‘He **hid**$^{\text{middle}}_{\text{intensive}}$’[[8]]
   ‘He **hid himself**’[[8]]
2. ‘arye !... **axla** oto’[[29]]
   ‘lion !... she–**ate**$_{\text{simple}}$ him’[[29]]
   ‘A lion !... she **ate** him’[[29]]

- The narrative is characterized mainly by the use of Paal verbs (87.5%).
- All the non-simple verb forms that are used in the story are ones that do not have an active simple verb counterpart. Thus, their ‘choice’ is in some sense obligatory. Still, they reflect the formal features we discussed.

1. ‘hu **hitxabe**’[[8]]
   ‘He **hid**$^{\text{middle}}_{\text{intensive}}$’[[8]]
   ‘He **hid himself**’[[8]]
2. hem **meǩinim** oǩel’[[13]]
   ‘They **prepare**$_{\text{cause}}$ food’[[13]]
   ‘They **are preparing** food’[[13]]

The middle-intensive template is used to describe an episode in which the monkey supposedly hid himself which results in his disappearance that takes effect in the present moment. The causative template is used with respect to a picture that represents an ongoing activity and makes an explicit connection to the protagonists in the background (the mice).

- There is an interesting use of an (ambiguous) medio-passive verb in two consequential sentences, in two different tense contexts.

1. ‘hu **holeǩ** habayta ve**niǩnas**’[[35]]
   ‘He **goes**$_{\text{simple}}$ home and-**enter**$^{\text{middle}}_{\text{simple}}$’[[35]]
   ‘he **goes** home and **gets in**’[[35]]
2. ‘Hu **niǩnas** ve**ra’a** ...’[[36]]
   ‘He **entered**$^{\text{middle}}_{\text{simple}}$ and-**saw**$_{\text{simple}}$ ...’[[36]]
   ‘He **got in** and **saw** ...’[[36]]

Both of the 'enter$^{\text{middle}}_{\text{simple}}$' verb forms refer to the same situation — the doctor's entering into the house. However, the former appears in a present context whereas the latter appears in past context. This may be a reflection of the defective tense hypothesis. We see here that the continuative activity which is referred to in the first clause (walking, entering) is referred to with the present tense, and the other, which consists of a completive situation (the result state of the entering) in the second clause is referred to in the past tense.

CF3;10

- This narrative is already longer (96 verb forms) than the previous one and is anchored rather consistently in the past.
- The narrative corresponds more closely to the story plot than the previous one and there is evidence for inclusion of underlying goal/plan structure components in the narrative. For example, the following clauses describe the episode in the picture with reference to other episodes in the story line.

  1. 'hu **nasa** leb̆ad vehu **haya** acub̆'[[5]]
     'He **rode**$_{\text{simple}}$ alone and-he **was**$_{\text{simple}}$ sad'[[5]]
     'He **rode** alone and he **was** sad'[[5]]
  2. 'hem **hayu** babayit, habuba niš'ara kan'[[10]]
     'They **were**$_{\text{simple}}$ in-the-house, the-doll **stayed**$^{\text{middle}}_{\text{simple}}$ here'[[10]]
     'They **were** at home and the doll **stayed** here'[[10]]

- The narrative is characterized mainly by use of Paal verbs (85%).
- We see a straightforward use of Hiphil verbs that do not have an optional active verb alternation:

  1. 'ish... **hoci** ta'dag'[[34]]
     'man... **exit**$_{\text{cause}}$ ACC-the-fish'[[34]]
     'A man... **took out** the fish'[[34]]

  Meaning, the man took out the monkey.[2] The simple verb alternation (namely that the money went out by itself) cannot be used in this context. However there are other optional simple forms (e.g., *tap̆as* (caught$_{\text{simple}}$)). In any case, all Hiphil verbs refer to pictures that represent an activity oriented towards an achievement but that is still ongoing (in other terminology, run-up/progressive achievements).

[2] This is not a typo, the monkey is referred to here as a fish. Following a little help from a parent — 'it looks a bit like a monkey, our fish, doesn't it?' — the subsequent narrative was fixed accordingly.

1. ‘herim oto lema’la’[[3]]
   ‘**rise**$_{\text{cause}}$ him up’[[3]]
   ‘He **raised** him up’[[3]]
2. ‘**heb̆i’u** mitriya’[[9]]
   ‘they-**come**$_{\text{cause}}$ umbrella’[[9]]
   ‘They **brought** an umbrella’[[9]]

- Use of Piel verbs refer to ongoing activities:

1. ‘**mecayrim**’[[39]]
   ‘they-**draw**$_{\text{intensive}}$’[[39]]
   They are drawing
2. ‘**yibesh** lakof’[[39]]
   ‘**dried**$_{\text{intensive}}$ to-the-monkey’[[39]]
   ‘He **dried** to[3] the monkey’[[39]]

Although these Piel forms do not have an active verb alternations, (the intensive is their default and unique template) the use of these forms is done in a rather awkward manner. In the first clause inflected forms appeared isolated in the clause, and this present tense utterance is surrounded exclusively by neighboring past tense verbs. The second appears in an ungrammatical context (wrong case marking). This awkward use of intensive verbs might indicate two things: (i) that this form was acquired ‘more recently’, or (ii) that it was employed in a ‘new’ context (although this function has not yet been completely mastered).

- The Niphal medio-passive template is used precisely to mark the result state of an achievement which takes effect in the present moment (regardless of the fact that the actual achievement is located in the past). There is an additional, awkward use of the Niphal with the copular element (in 3) to mark a change of position that will affect the rest of the story (losing the monkey).

1. ‘habuba **niš’ara** kan’[[10]]
   ‘the-doll **stayed**$^{\text{middle}}_{\text{simple}}$ here$^{\text{middle}}_{\text{simple}}$’[[10]]
   ‘The doll **stayed** here’[[10]]
2. ‘zot ayin še**nikre’a**’[[33]]
   ‘this eye that-**torn**$^{\text{middle}}_{\text{simple}}$’[[33]]
   ‘This is an eye that **got torn/ripped**’[[33]]
3. ‘vehakof **nihiya** me’axorey’ [[26]
   ‘and-the-monkey **be**$^{\text{middle}}_{\text{simple}}$ behind’[[26]]
   ‘And the monkey **got (left)** behind’[[26]]

[3]The preposition used here is ungrammatical also in Hebrew.

- The middle intensive template Hitpael is used throughout the story with a single root in the form ‘histakel’ (look around).

  1. “ima **histakla**”[[4]]
     ‘Mom **looked**$^{\text{middle}}_{\text{intensive}}$’[[4]]
     ‘Mom **looked around**’[[4]]
  2. “hakipodim **histaklu**”[[25]]
     ‘the-hedgehogs **looked**$^{\text{middle}}_{\text{intensive}}$’[[25]]
     ‘The hedgehogs **looked around**’[[25]]

  This pattern use can be contrasted with other stative/cognitive simple verbs that are optional in this context (e.g., ‘see’). Here the Hitpael verbs refer to an extended situation of looking and acknowledging something which then drives the narrative forward to the next episode. And so, the mother looking$^{\text{middle}}_{\text{intensive}}$ at the sky triggers the ride home, and the hedgehogs looking$^{\text{middle}}_{\text{intensive}}$ at the bird triggers leaving the monkey behind.

SUMMARY

Children by the age of 3–4 have already mastered the tense inflections and use them productively throughout the lexicon. However the younger children do not maintain a consistent reference point throughout the story. When such a point exists, the deviation forms are either arbitrary or triggered by semantic/aspectual features of the episode as expected under the *defective tense hypothesis*.

The use of non-simple verb forms is rare, and is almost always related to verbs that do not have simple form counterparts. However, the use of non-simple verbs is productive in expressing various aspectual phenomena as we discussed in part II and the use of the templates makes a better fit to the primitive lexical material (the roots) and the contribution of the picture to the course of events in the story.

Age group 4–5

GENERAL

- The task for children in this age group was still reduced and consisted of a single narration task while walking through the pictures.
- The younger children needed help with the ‘kickoff’ (initialization) of the story but the remainder of the narration was fairly voluntary and did not require further interaction with the experimenter.
- The narratives are still rather short (33–62 verb forms).

- In both of the narratives in this age group there is increasing evidence for the use of intentional verbs (want, try, succeed), which is more intimately related to the inclusion of goal/plan components in the narrative. These intension verbs were mostly used in the present tense with an infinite verb form complement to denote 'mini-goals' that drive the narrative forward.
- Both of the narratives were anchored in the present (more than 60% present tense forms)
- Both of the narratives were characterized by a dramatic increase in the use of non-simple verbs (more then 30% of the verb forms)

CM4

- The Hiphil is used repeatedly with the same verb form 'maǩziqa' (hold) to describe the ongoing activity of a protagonist holding the monkey (pictures [[4]],[[39]],[[40]],[[43]],[[46]]).
- A new function emerges in the use of Hiphils as aspectual verbs. In such cases, Hiphil verbs are used together with a non-finite verb complement, where the infinitive denotes a basic situation and the Hiphil verb focuses on a specific part of this situation.

  1. "vekan hi **hiclixa** **lehikanes**"[[36]]
     'and-here she **succeed**$_{\text{cause}}$ **to-get-in**'[[36]]
     'And here she **managed to get in**'[[36]]

- We see appropriate uses, both in past and present tense, of Piel verbs that denote ongoing activities.

  1. 'kan hi **tipla** (bo)'[[29]]
     'here she **took-care**$_{\text{intensive}}$ (of-him)'[[29]]
     'Here she **took care** of him'[[29]]
  2. 'saba **melateǩ** koǩ betoǩ mayim'[[34]]
     'Grandpa **pets**$_{\text{intensive}}$ monkey in water'[[34]]
     'Grandpa **is petting** the monkey in the water'[[34]]

- The use of Niphal verbs is only in the infinitive form, as complement to intentional/aspectual verbs, to mark a *desired* change of state.

  1. 'saǩta **roca** **lehikanes**'[[36]]
     'Grandma **wants to-get-in**$^{\text{middle}}_{\text{simple}}$'[[36]]
     'Grandma **wants to get in**'[[36]]

2. ‘vekan hi **hiclixa** **lehikanes**’[[36]]
   ‘and-here she **succeed**$_{\text{cause}}$ **to-get-in**$^{\text{middle}}_{\text{simple}}$’[[36]]
   ‘And here **managed to get in**’[[36]]

CF4;6

- Again we observe an increased use of Hiphil verbs (14.5%); almost half of them are used as aspectual verbs. Among the typical uses, we see a new function that the form is employed to serve. All of the following utterances refer to pictures that denote ongoing activity. The way the ongoingness aspect is expressed is by *negating* a viewpoint denoted by the Hiphil aspectual verb (in all cases, the canonical goal). This, in turn, coerces the achievement/accomplishment denoted by the lexical material of the infinitive form to an ongoing activity of trying to achieve the canonical goal.

  1. ‘hem **lo** **maclixim** **leharim** et hakoǒ’[[13]]
     ‘They **not succeed**$_{\text{cause}}$ **to-rise**$_{\text{cause}}$ ACC the-monkey’[[13]]
     ‘They **do not manage to raise** the monkey’[[13]]
  2. “hacipor **lo** **hiclixa** **lehǩnis** et hadubi
     ‘The-bird **not succeed**$_{\text{cause}}$ **to-enter**$_{\text{cause}}$ ACC the-teddybear
     labayit”[[28]]
     to-the-house’[[28]]
     ‘The bird **did not manage to put** the monkey **in** the house’[[28]]
  3. ‘hu **lo** **hicliax** **lehaxzir** et hakof’[[43]]
     ‘He not **succeed**$_{\text{cause}}$ **to-return**$_{\text{cause}}$ ACC the-monkey’[[43]]
     ‘He **did not manage to return** the monkey’[[43]]

- Piel verb forms are used in present tense to denote ongoing activities (‘mexapes’ (search) [[15]], ‘mesaxakim’ (play) [[18]]), but with the intentional verb ‘try’. This aspectual verb is a canonical example of the meaning of the Piel, and typically used to describe ongoing wide activities, in which one tries ‘intensively’ to achieve a goal that is denoted by the lexical material of the complement infinitive form.

  1. ‘**menase** **lehikanes**’[[17]]
     ‘**tries**$_{\text{intensive}}$ **to-enter**$^{\text{middle}}_{\text{simple}}$’[[17]]
     ‘He **is trying to get in**’[[17]]
  2. ‘**menase** **litpos** dagim’[[34]]
     ‘**tries**$_{\text{intensive}}$ **to-catch**$_{\text{simple}}$ fish’[[34]]
     ‘He **is trying to catch** fish’[[34]]

- Hiphil and Niphal verbs are used here repeatedly as complements of intentional verbs:

  1. 'hem **lo maclixim leharim** et hakoǒ'[[13]]
     'They **not succeed**$_{\text{cause}}$ **to-rise**$_{\text{cause}}$ ACC the-monkey'[[13]]
     'They **do not manage to raise** the monkey'[[13]]
  2. '**menase lehikanes**'[[17]]
     '**tries**$_{\text{intensive}}$ **to-enter**$^{\text{middle}}_{\text{simple}}$'[[17]]
     'He **is trying to get in**'[[17]]

  Both Niphal and Hiphil focus on specific parts of situations; Hiphil refers to the cause and Niphal refers to a resulting state, providing ingressive and resultative interpretations of the situation. Using them as complements of intentional verbs has the effect of instantiating the canonical goal of the 'intended' by the intentional verb.

- The Hitpael form 'histakel' is used again to denote an activity of looking around (as in [[4]]), and again it recapitulates the entire temporal span of the situation and its result state and drives the narrative forward to the next episode.

SUMMARY

It seems that children in this age group start to develop their 'aspectual awareness'. This is evident from the appropriate use of non-simple verb forms and the increased use of aspectual verbs. This is in accord with the development of the cognitive capacity evident by the use of underlying goal/plan structure in the narrative, which is manifested in the increased use of intentional verbs.

It has been noted [3] that the language-cognitive development is bi-directional, meaning that the cognitive development triggers the search for linguistic forms to express newly acquired concepts in spoken language, and newly acquired linguistic forms trigger the search for opportunities to use them and gradually learning to correctly apply them.

So it seems that at this age the development of the planning capacity triggers the search for linguistic forms to express more complex temporal relations within and between situations (the uses of verbs derived from non-simple templates as aspectual verbs) and the use of these newly acquired forms is extended to express an even wider phenomena (e.g., the *negation* of aspectual verbs to coerce telic events to ongoing activities).

Age group 5–7

GENERAL

- All children in this age group demonstrate the use of goal/plan structure knowledge in constructing a coherent story and expressing temporal relations. This is evident in the inclusion of settings (boy-monkey relation), initiating events (storm, mice, hedgehogs), internal responses (being sad), goals (to find the monkey) and a plot resolution (the happy reunion).
- The task for children in this age group consisted of the four parts (see chapter 9). The four tasks were presented sequentially, and were fully understood by the participants. Further communication during the narrative was not required.
- The elaborate task structure gives us an opportunity to evaluate aspectual choices that are made with respect to a situation in different contexts by the same narrator. Here switching between two forms is not a matter of individual preference but of specific shades of meaning one wants to convey with respect to the same basic lexical material.
- The full narrated story was much longer than in preceding age groups (in fact, the length was closer to the typical length of an adult narrative). The 'retelling' parts, however, were significantly shorter (20% – 30% of the original full story).
- In most narratives ('telling' — except for one — and 'retelling') the stories were anchored in the past.
- The use of non-simple verbs in these narratives increased with respect to the first age group (3–4) but decreased with respect to the second group (4–5). In all narratives the use of simple verb forms increased while retelling the story.

CM5;3

- Cognitively, this narrative matches the expectations we have from the current age group (including relevant planning components in the first story and successful recapitulation of episodes in the second story)
- Linguistically, the profile of the current interview resembles ones in the younger age groups (short narrative, use of present tense, use of non-simple verbs that do not have alternating templates).
- The resulting text is rather exceptional. This might be due to a different language development pace. Therefore, I exclude the present interview from

the analysis of the current age group.

CF5;6

- The present interview is considerably longer and much more involved than other interviews in this age group. In both stories a wide variety of linguistic forms are used (all tenses in both stories, all templates in the first story).
- In both stories we observe an increased use of future and imperative forms. These forms are used in sentences that are 'pretended' to be uttered by the protagonists (roughly 18% in each of the stories).
- Many non-simple verb forms in the stories (25% of them in the first story, 75% in the second) are used in the context of such 'inter-protagonist' interaction.

  1. '**tacil** oti kipod...'[[15]] 'hine **hecalti** otǩa!!'[[19]]
     '**rescue**$_{\text{cause}}$ me hedgehog..."[[15]] 'here, I-**rescued**$_{\text{cause}}$ you!'[[19]]
     '**rescue** me hedgehog...'[[15]] 'here, I **rescued** you!'[[19]]
  2. 've'az hu **amar** ladubi: ata **tišaer**
     'and-then he **said**$_{\text{simple}}$ to-the-teddybear: you **will-stay**$^{\text{middle}}_{\text{simple}}$
     iti'[[43]]
     with-me'[[43]]
     'And then he **said** to the teddybear: you **will stay** with me'[[43]]
  3. 'ani benataym **etgalec'** al haǩol'[[41]]
     'I meanwhile **will-slide**$^{\text{middle}}_{\text{intensive}}$ on the-sand'[[41]]
     'Meanwhile I **will be sliding** on the sand'[[41]]

  The use of Hiphil, Niphal and Hitpael in direct speech matches their association with imperfective viewpoints. In direct speech (future/imperative), the event talked about is clearly not complete. The imperative and future verbs usually encode goals, desired states and intensions. We see, for example, that the communication between the monkey and hedgehog indeed takes place *during* the 'rescuing' process, and the narrative that describes picture [[43]] relates a desired result state of the monkey to its present activity[4] stay$^{\text{middle}}_{\text{simple}}$.
- Other functions that non-simple verb forms serve in the first story are similar to the ones in the previous interviews, however using different (less common) lexical material. All such Piel verbs describe pictures that refer to ongoing efforts of certain activities/accomplishment.

[4] In fact, refraining from action.

1. ‘hu **sileq** et ha’aǩbarim’[[17]]
   ‘He **kicked-out**$_{\text{intensive}}$ ACC the-mice’[[17]]
   ‘He **kicked out** the mice’[[17]]
2. ‘hu **qileax** oto tob̌ tob̌’[[38]]
   ‘He **washed**$_{\text{intensive}}$ him well well’[[38]]
   ‘He **washed** him very well’[[38]]

Note that the adverbial repetition in 2 further indicates the ongoingness/intensity of the denoted action.

- In retelling the first part of the story, some of the episodes are described using simple verb forms and others using non-simple verb forms. Interestingly, the simple verbs are used to refer to complete and completed episodes that exist in the past relative to the speech time (the boy **had** the monkey, **took** the monkey, **rode** home…) and the non-simple verbs describe situations that were not completed or still have an effect on the present moment:

1. ‘oy ima, hakoǧ **ne’ebad** li’[[retelling I]]
   ‘oh mom, the-monkey **lost**$^{\text{middle}}_{\text{intensive}}$ to-me’[[retelling I]]
   ‘Oh mom, I **have lost** the monkey’[[retelling I]]
2. ‘hem **xipsu** ve**xipsu**’[[retelling I]]
   ‘They **searched**$_{\text{intensive}}$ and-**searched**$_{\text{intensive}}$’[[retelling I]]
   ‘They **were searching**’[[retelling I]]

The intensive verb ‘xipes’ (search) doesn’t have a simple verb form alternation in the same root. However note its use in a repetitive pattern, which is a common device for Hebrew-speaking children and adults to emphasize the ‘ongoingness’ and ‘durativeness’ of an activity (see also [50]).

- Lastly, we review the aspectual choice with respect to the main event of the story: losing the monkey. The root $[a][b][d]$ is grammatical with at least three different templates: the simple ‘aḃad’, be lost) the intensive (‘ibed’, lose) the simple-middle (get lost).[5]. Thus, the child refers twice to the event of losing the monkey. First when he doesn’t know the result of the search for the monkey (picture [[24]]), and second after the happy reunion (picture [[46]]).

1. ‘oy ima, hakoǧ **ne’ebad** li’[[retelling I]]
   ‘oh Mom, the-monkey **lost**$^{\text{middle}}_{\text{intensive}}$ to- me’[[retelling I]]
   ‘Oh Mom, I **have lost** the monkey’[[retelling I]]

[5]We shall exclude from the analysis the intensive-middle template in this root, for which the lexical meaning is ‘commit suicide’.

2. ‘oy ima, ma **na’ase**? akšav hakoǒ **ye’abed**
‘oh mom, what we-**will-do**$_{\text{simple}}$? now the-monkey **will-lose**$^{\text{middle}}_{\text{simple}}$
li’[[retelling II]]
to-me’[[retelling II]]
‘Oh Mom, what **shall** we **do**? now I **will lose** my monkey’[[retelling II]]

In the first quote, the use of the middle-simple form ‘ne’ebad’ (get-lost) focuses attention on the result state of ‘lose’ (an achievement) which is still relevant for the present moment (similar to English present perfect). In the second quote the child already knows that the monkey is yet to be found however the ‘lose’ reference to it is done in future tense. The intensive verb ‘lose’ in the future tense uttered at a point *after* the disappearance of the monkey makes it implausible that is refers to a ‘lose’ achievement. Rather, it is most naturally read as referring to the subsequent period of time (i.e., until the end of the story) in which the monkey cannot be found.

This is precisely how the meaning of the intensive Hebrew verb for ‘lose’ differs from its simple and middle forms counterpart. While the simple and middle verbs refer to the achievement and its result state respectively, the intensive verb refers to the time in which the monkey is searched for and cannot be found.

CF5;7

- The current interview is similar in its length and characteristics to the previous one. It is fairly long (around 120 verbs), anchored in the past (around 70% past verb forms) and uses less non-simple verbs than used by the previous age group.
- Again we see ‘quotes’ of ‘direct speech’ between protagonists (mostly future and imperative forms) using non-simple verb forms.

1. ‘lo, al **toci** li ze **koeb̆** li’[[29]]
‘no, don’t **go-out**$_{\text{cause}}$ to-me this **hurts**$_{\text{simple}}$ to-me’[[29]]
‘No, don’t **take** it **out** it **hurts** me’[[29]]
2. ‘toda raba še’ata **meyabeš** oti’[[39]]
‘thank much that-you **dry**$_{\text{intensive}}$ me’[[39]]
‘thank you very much for **drying** me’[[39]]
3. “iš exad **amar** li še’ani **eša’er** az **niš’arti**”[[43]]
‘man one **told**$_{\text{simple}}$ me that-I **will-stay**$^{\text{middle}}_{\text{simple}}$ so I-**stayed**$^{\text{middle}}_{\text{simple}}$’[[43]]
‘One man **had told** me **to stay** so I **stayed**’

- Hiphil verbs, either denominal or ones that have simple form counterparts, are used extensively and constitute about 10% of the verb forms in the entire narrative. The context in which such verbs are used is in reference to activities or progression of run-up achievements. E.g., note the marked use of $\text{fly}_{\text{cause}}$ in the following utterance for the picture in which the monkey 'flies' into the water. This marked choice puts emphasis on the initiation/development of the monkey's fall instead of referring to an achievement of 'falling into the water'.

  1. 'hu **he'if** oto lamayim'[[30]]
     'he **flew**$_{\text{cause}}$ him to-the-water'[[30]]
     'He **caused it to fly** into the water'[[30]]

- Niphal verbs are mostly used to mark physical/emotional changes of state of the protagonists for which the result state takes effect in the present moment.

  1. 'hu **nirdam**'[[1]]
     'He **sleep**$^{\text{middle}}_{\text{simple}}$'[[1]]
     'He **fell asleep**'[[1]]
  2. 'hi **nivhala**'[[1]]
     'She **scared**$^{\text{middle}}_{\text{simple}}$'[[1]]
     'She **got scared**'[[1]]

- In both of the 'retelling' parts the child uses mostly simple verbs. The non-simple verb forms that are used refer to the lost monkey.
- The aspectual choice for the event of 'losing the monkey' highlights the intensive aspect during the story ([[6]]) and the result state in the first 'retelling' part ([[retelling I]]).

  1. "hu **ibed** et hakof"[[6]]
     'He **lost**$_{\text{intensive}}$ the monkey'[[6]]
     'He **lost** the monkey'[[6]]
  2. "hakof **ne'ebad**"[[retelling I]]
     'The-monkey **lost**$^{\text{middle}}_{\text{simple}}$'[[retelling I]]
     'The monkey **got lost**'[[retelling I]]

SUMMARY

In this age group we find non-simple verb forms that function as aspectual verbs in a similar manner to what was evident in the previous group. One difference is however that we start to identify use of non-simple verb forms even when they

have optional simple form counterparts with the same root. This is done mainly in the context of ongoing activities or incomplete (achievement/accomplishment) situations (e.g., bring in, take out, make fly).

In addition, we see that children in this age group explore the use of non-simple verb forms in direct speech or interaction between protagonists. It is possible to view such situation descriptions as 'imperfective' (extended, incompletive) as they naturally occupy the present moment and their crucial part (the canonical goal) is yet to be achieved.

Here we can start to appreciate the value of 'aspectual choices' between equi-root alternating templates by the contrasting different forms that are used to refer to the same situation in different contexts. The value of such aspectual choices was exemplified using the lose-lost template alternation.

Age group 7–11

GENERAL

- The narratives in this age group are, cognitively and linguistically, very similar to the ones in the previous group.
- Cognitively, all planning components are included in the first story and most of them are included in the second. One notable difference however is that the older children make their stories shorter. This can be attributed to the fact that these school children perceived as a 'test' or a 'duty' (rather then a 'fun' experience as it is for kindergarden children) and thus, the resulting narratives are rather 'functional'. They include precisely what is necessary, and are not so much emotionally and linguistically involved.
- Linguistically, most narratives (all but one) are anchored in the past. In all of them, however, all tenses are represented. Most of the narratives (all but one) use 71%-79% simple verbs, however all other templates are attested as well.
- One notable exception is an interview with a higher percentage of non-simple verbs in the second story. As we shall see this interview's profile is more similar to an adult narrative.

CF7;6

- The stories in this interview are fairly elaborate (110 verbs in the first narrative, 61 in the second). Simple mathematics shows that for the 45 pictures of the story, more than one verb on average is used to describe each. These 'redundant verbs' are used in various ways.

- One way, already familiar by now, is the use of Hiphil aspectual verbs with one (or even more) non-finite verb complements:

  1. ‘ha’oreb̆ **menase** **litpos** otam’[[26]]
     ‘the-magpie **tries**$_{\text{intensive}}$ **to-catch**$_{\text{simple}}$ them’[[26]]
     ‘The magpie **is trying to catch** them’[[26]]
  2. ‘az hu **hicliax** **lakaxat** et hakof’[[27]]
     ‘then he **succeeded**$_{\text{cause}}$ **to-take**$_{\text{simple}}$ ACC the-monkey’[[27]]
     ‘So he **managed to take** the monkey’[[27]]

  The Piel refers again to an ongoing activity and the Hiphil refers to a particular part of the situation (here, the desired result).

- Another way in which the ‘redundant’ verbs are used is in providing the two different viewpoints of two different protagonists for one and the same situation. Not very surprisingly, these references often differ in their verbal template.

  1. ‘hu **ibed** et hakof [...] vehakof
     ‘He **lost**$_{\text{intensive}}$ ACC the-monkey [...] and-the-monkey
     ne’elam’[[7]]
     disappeared$^{\text{middle}}_{\text{simple}}$’[[7]]
     ‘He **lost** the monkey [...] and the monkey **disappeared**’[[7]]
  2. ‘hem **mitxabim** [...] vehaoreb̆ **menase** **litpos**
     ‘They **hide**$^{\text{middle}}_{\text{intensive}}$ [...] and-the-magpie **tries**$_{\text{intensive}}$ **to-catch**$_{\text{simple}}$
     otam’[[26]]
     them’[[26]]
     ‘They are **hiding** [...] and the magpie **is trying to-catch** them’[[26]]

  In the first example the boy’s perspective on losing the monkey is stated using an intensive activity and the perspective of the monkey refers to its result state (it has disappeared) using the Niphal (the sum of these two can be seen as an accomplishment of ‘losing the monkey’ on some abstract level).

  In the second example the Hitpael template describes the hedgehogs ‘hiding themselves’ during the episode, providing an extended background to the intensive activity of the bird trying to catch them.

- Piel verbs are used here more freely and naturally with various roots in the past form. In the ‘retelling’ parts of the story they too are employed to describe completed accomplishments that were clearly temporally extended in the past.

1. ‘hu **yibeš** et habeged’[[39]]
   ‘He **dried**$_{\text{intensive}}$ ACC the-cloth’[[39]]
   ‘He **dried** the cloth’[[39]]
2. ‘(hem) **perqu** oto legamrey’[[retelling]]
   ‘(They) **dissassembled**$_{\text{intensive}}$ him completely’[[retelling]]
   ‘(They) **dissassembled** him altogther’[[retelling]]
3. “hu tiken et hakof”[[retelling]]
   ‘He fixed$_{\text{intensive}}$ the monkey’[[retelling]]
4. ‘**xipsu** oto, vehem lo **mac’u**’[[retelling]]
   ‘**searched**$_{\text{intensive}}$ him, and-they not **found**$_{\text{simple}}$’[[retelling]]
   ‘They **were searching** for him, but they **did not find** him’[[retelling]]
5. ‘hayeled šehu **xipes** oto, hu **maca** oto
   ‘the-boy that-he **searched**$_{\text{intensive}}$ for-him, he **found**$_{\text{simple}}$ him
   baxanut’[[retelling]]
   in-the-store’[[retelling]]
   ‘The boy that **searched** for it, **found** it in the store’[[retelling]]

Note that in the last two examples the simple verb ‘find’ marks the telic point of the activity ‘search’ thus creating some sort of ‘higher-level accomplishment’ that describes the picture.

- Lastly, we see again how the lose/lost/get-lost alternation is reflected in the use of different templates to denote different points of view.

1. ‘hu **ibed** et hakof’[[7]]
   ‘he **lost**$_{\text{intensive}}$ ACC the-monkey’[[7]]
   ‘He **lost** the monkey’[[7]]
2. ‘hadubi šeli **ne’ebad** [...] ani **yaǩol liknot** oto?’[[45]]
   ‘the-teddybear mine lost$^{\text{middle}}_{\text{simple}}$ [...] I **can** **to-buy**$_{\text{simple}}$ him?’[[45]]
   ‘My teddybear got lost [...] **can** I **buy** it?’[[45]]
3. “axarey šehem **ibedu** et ze”[[retelling I]]
   ‘After that-they **lost**$_{\text{intensive}}$ ACC it’[[retelling I]]
   ‘After they **lost** it’[[retelling I]]
4. “hakof **ne’ebad** layeled axarey šehem **nas’u**
   ‘The-monkey **lost**$^{\text{middle}}_{\text{simple}}$ to-the-child after that-they **rode**$_{\text{simple}}$
   baoǩanayim”[[retelling II]]
   in-the-bicycle’[[retelling II]]
   ‘The child **had lost** the monkey after they **rode** the bicycle’[[retelling II]]

- The linguistic profile of the current interview differs significantly from other narratives of children in this age group. The narrative is relatively short, however there is a wealth of non-simple verb forms that are used in all parts of the interview. The percentage and the kind of forms that are used are similar in essence to the ones found in adult narratives.
- This has two possible explanations. One explanation is that since the story is anchored in the present, it provides a productive environment for incorporating ongoing, extended (Piel, Hitpael) situations and 'imperfective' (Hiphil, Niphal) viewpoints. This is, however, a weak argument, since the parts of retelling the story are anchored in the past, but still demonstrate a high percentage of non-simple verb forms usage.
- The other possible explanation is that the child is simply more linguistically 'competent' than others in this age group. Indeed, a close examination shows that he narrates his stories in a similar fashion to adult narrations. I adopt this explanation, and exclude this particular interview from the analysis of phenomena that characterize narrators in this age group.
- However, this interview provides us with an opportunity to look forward to the role templates play in narrating different aspectual viewpoints for mature Hebrew-speakers. I illustrate it by a sampled piece of discourse from the second part of the interview ([[retelling I]]).

  Note that in the discourse below all simple verb forms refer to situations viewed in the 'perfective' in the sense that they are completed and lack reference to internal structure, and all non-simple verb form are used in 'imperfective' context in the sense that they *temporally include* following events in the course of the narrative.

  1. "hem **halǩu**$_{\text{simple}}$ laya'ar vepit'om hem **ra'u**$_{\text{simple}}$ .. mmm ... **matxil**$_{\text{cause}}$ **lihiyot**$_{\text{simple}}$ se'ara. kofiko **naǧal**$_{\text{simple}}$ meha'oǧanayim, ve**nixnas**$^{\text{middle}}_{\text{simple}}$ letoǩ geza ec. xuldot **laqxu**$_{\text{simple}}$ oto, **hitxilu**$_{\text{cause}}$ **lesaxeq**$_{\text{intensive}}$ ito, pit'om **ba**$_{\text{simple}}$ qipod. haqipod **raca**$_{\text{simple}}$ et ze, haxuldot **paxadu**$_{\text{simple}}$ mimeno, vehem **natnu**$_{\text{simple}}$ lo et kofiko. axar kaǩ hu **lakax**$_{\text{simple}}$ et kofiko, **hevi**$_{\text{cause}}$ oto lamišpaxa šelo, veha'aba **hoǩil**$_{\text{cause}}$ otam leanšehu..." [[retelling 24]]

     'They **went**$_{\text{simple}}$ to-the-woods and-suddenly they **saw**$_{\text{simple}}$ .. mmm ... **starts**$_{\text{cause}}$ **to-be**$_{\text{simple}}$ storm. Monkie **fell**$_{\text{simple}}$ off-the-bike, and-**got-in**$^{mid}_{\text{simple}}$ into the tree. Rats **took**$_{\text{simple}}$ him, **started**$_{\text{cause}}$ **to-play**$_{\text{intensive}}$ with-him, suddenly **comes**$_{\text{simple}}$ hedgehog. The-hedgehog **wanted**$_{\text{simple}}$ ACC it, the-rats **feared**$_{\text{simple}}$ from-him, and-they **gave**$_{\text{simple}}$ him ACC

Monkie. After that he **took**$_{\text{simple}}$ ACC Monkie, **brought**$_{\text{cause}}$ him to-family his, and-the-father **led**$_{\text{cause}}$ them somewhere...'[[retelling 24]]

'They **went** to the woods and suddenly they **saw** .. mmm ... a storm **starts**. Monkie **fell** off the bike, and **got** into the tree. Rats **took** him, **started to-play** with him, suddenly **comes** a hedgehog. The hedgehog **wanted** it, The rats **feared** it, and they **gave**$_{\text{simple}}$ him Monkie. Afterwards he **took** Monkie, **brought** him to his family, and-the-father **led** them somewhere...'[[retelling 24]]

To illustrate, 'the storm starts' includes the fall of the monkey, 'entering into the tree' includes the consequent actions of the rats, 'started to play' includes the coming by of the hedgehog, and 'brought' and 'led' leave the situation open to include subsequent events that are not yet known to the narrator, as they will be elaborated in the pictures yet to come.

CF10

- This interview is typical for this age group in its length (81/31 verbs in the first/second stories), and the distribution of simple and non-simple verb forms (roughly 30% non-simple verbs).
- In order to see how the ability to alternate between viewpoints using different templates (as presented in the previous interview) develops towards mature use of the templates we start looking at aspectual choices across different stories with respect to the same basic situation.

  Ideally, we would like the different morphological templates to be used with the same root to represent different viewpoints on the same situation (similar to English simple past and perfect for instance). However we have already established that the patterns are not fully productive and cannot be applied across the entire lexicon.

  Thus, I claim that narrators choose primitive lexical items with 'similar' lexical content that are compatible with the different templates that express different viewpoints, and choose between them. I call this kind of choice a *wide* aspectual choice (as opposed to a *narrow* aspectual choice that is made between two alternating templates with the same root).

  In this age group we start to see evidence for such wide aspectual choice when referring to the same situation in 'telling' and 'retelling' the story.

  1. '**hitxil** **libǩot**'[[8]]
     '**started**$_{\text{cause}}$ **to-cry**$_{\text{simple}}$'[[8]]
     'he **started to-cry**$_{\text{simple}}$'[[8]]

2. ‘hayeled **haya**$_{\text{simple}}$ acuv’[[retelling II]]
   ‘The boy **was**$_{\text{simple}}$ sad’[[retelling II]]]
   ‘The boy **was** sad’[[retelling II]]]

1. “cipor **hiv̆rixa** et hadorbanim”[[26]]
   ‘bird **escape**$_{\text{cause}}$ ACC the-hedgehogs’[[28]]
   A bird made the hedgehogs run away’[[28]]
2. “cipor **laqxa** oto”[[retelling II]]
   ‘bird **took**$_{\text{simple}}$ him’[[retelling]]
   ‘A bird **took** him’[[retelling]]

1. ‘hamqel haze [...] **he’ev̆ir** oto lema’la’[[33]]
   ‘The-stick the-this [...] **pass**$_{\text{cause}}$ him to-up’[[33]]
   ‘This stick [...] **passed** him upwards’[[33]]
2. ‘xaka **asta** lo mašehu [...] **dag** oto’[[retelling II]]
   ‘hook **did**$_{\text{simple}}$ to-him something [...] **fish**$_{\text{simple}}$ him’[[retelling II]]
   ‘A hook **did** something with it [...] **caught** it’[[retelling II]]

1. ‘hayeled **histakel** al kofiko’[[42]]
   ‘The-boy **looked**$^{\text{middle}}_{\text{intensive}}$ on Monkie’[[42]]
   ‘The boy **looked** at Monkie’
2. ‘hayeled **ra’a** et kofiko’[[retelling II]]
   ‘The-boy **saw**$_{\text{simple}}$ ACC Monkie’[[retelling II]]
   ‘The boy **saw** Monkie’[[retelling II]]

In all of the above pairs, a non-simple verb is used while walking through the pictures and a simple verb is used in the ‘retelling’ part. The primitive roots in those alternations are not the same, but they carry ‘similar’ lexical content and are used to express the same situations. Still, the roots that are compatible with the causative/middle viewpoints are preferred when narrating ongoing or imperfective situations, while the simple verbs are preferred in narrating completive, punctual, perfective ones.

SUMMARY

The narratives in this sample are prima facie similar to the ones in the previous age group, however a close examination of the aspectual relations that are expressed using various linguistic forms reveals a more mature implementation of what we have called ‘aspectual choice’.

First, it is not uncommon that more than one verb form is used to describe a single situation (in our case, a single picture). In these cases, different viewpoints of

the different protagonists are expressed using different verbal templates, in a way that captures the relation between the protagonist's action/state and the present situation.

Second, the scope of the aspectual choices is 'widened' to include primitive lexical items (roots) that carry *similar*, but not identical, content. However such similar roots may be compatible with alternating templates. The causative and middle templates are generally preferred when referring to situations that are extended in time, ongoing, incomplete, and show relevancy (or provide background) to subsequent events.

Finally, we have seen one example of a mature narrative that makes use of alternating verbal templates to distinguish different (perfective/imperfective) viewpoints on situations in the course of the narrative.

Age group 11–15

GENERAL

- This age group consists of the oldest children in my sample, roughly at the age of late-elementary school and the beginning of junior-high.
- Not very surprisingly, the narratives show linguistic forms and uses that are similar to the ones attested in adult narratives in my sample. The interviews (and in particular the ones I am going to examine below) are long, and all four parts of the interview are relatively elaborate. This is partly due to an increased collaboration I received from these children. These children understood the value of their participation and willingly engaged with the task, just like adults did.
- The narratives demonstrate mature language use. This is reflected in the increased use of non-simple verbs (in both 'telling' and 'retelling' parts of the story). The 'retelling' part, however, has a higher percentage of simple verb forms relative to the 'telling' parts.
- Throughout the interviews we observe the use of verbs in different templates used with 'new' lexical material (that is, new to our sample), which stems from either using elevated literary language, or the use of street language and 'slang' .
- We see increasing evidence for 'wide' aspectual choices as described in the previous section. In particular, we see alternating templates that correspond to alternating viewpoints in a single sentence that refers to a single picture/situation.

CF11

- This interview is the longest in this age group (141 verbs in the first story, 69 in the second). All parts of interviews (telling, retelling) are anchored in the past, and all tenses are attested.
- We see an increased use of nested aspectual verbs, e.g.,

  1. ‘hem **hexelitu** **lacet** **lexapes** et
     ‘They **decided**$_{\text{cause}}$ **to-go-out**$_{\text{simple}}$ **to-search**$_{\text{intensive}}$ ACC
     kofiko’[[9]]
     Monkie’[[9]]
     ‘They **decided to go search** for Monkie’[[9]]
  2. ‘hu **hitxil** **liv̌kot** ve**lacet** **lexapes**
     ‘He **started**$_{\text{cause}}$ **to-cry**$_{\text{simple}}$ and-**to-go-out**$_{\text{simple}}$ **to-search**$_{\text{intensive}}$
     oto im ima’[[retelling I]]
     him with mom’[[retelling I]]
     ‘He **started to cry** and **went out to search** for him with his mother’ [[retelling I]]

  The meaning of such nested aspectual verbs was not explicitly treated in the theoretical part of the study, however I’d like to comment about it informally. Cognitively, such nesting can be viewed as nesting of goals and subgoals. Thus, in 1 *lacet* (to go out) is a subgoal of the high level goal *to search*. Linguistically, such nesting provides means for ‘incremental coercion’. For instance in 1 *hexelit* (decide) is an achievement, *hexelit lacet* marks the beginning of an activity of going out, and *hexelit lacet lexapes* captures the beginning of a higher level accomplishment of looking for Monkie.

- More specifically we see increased use of the causative verb ‘hexelit’ (decide) (13% of the verbs in the entire interview are inflections of the verb ‘hexelit’).

  The pictures that are described using such phrases are ones that show ongoing activities (playing with the monkey, pushing it outside, fixing the monkey, etc.). I take the repetitive use of this verb in similar contexts as evidence that it can be seen as an aspectual verb.[6]

  1. ‘ha’ak̆bar **hexelit** **lehorid** lo et
     ‘The-mouse **decided**$_{\text{cause}}$ **to-get-off**$_{\text{cause}}$ to-him ACC
     habgadim’[[14]]
     the-clothes’[[14]]
     ‘The mouse **decided to take** his clothes **off** him’[[14]]

[6] Just like started, continued, end etc. See section 6.3 for further discussion of aspectual verbs.

2. ‘hem **hexelitu** **leha’aḇir** oto lakipod’[[retelling I]]
‘They **decided**$_{\text{cause}}$ **to-pass**$_{\text{cause}}$ him to-the-hedgehog’[[retelling I]]
‘They **decided to pass** him to the hedgehog’[[retelling I]]

3. ‘hu **hexelit** **lirxoc** oto ve**letapel**
‘He **decided**$_{\text{cause}}$ **to-wash**$_{\text{simple}}$ ACC-him and-**take-care**$_{\text{intensive}}$
bo’[[38]]
of-him’[[38]]
‘He **decided to wash** him and **take care** of him’[[38]]

4. ‘hem **hexelitu** **larxuc** ve**la’azov** et
‘They **decided**$_{\text{cause}}$ **to-run**$_{\text{simple}}$ and-**to-leave**$_{\text{simple}}$ ACC
Kofiko’[[retelling II]]
Monkie’[[retelling II]]
‘They **decided to run** and **leave** Monkie’[[retelling II]]

What the use of ‘decide’ does in these cases is to focus attention on the instantiation of a plan to achieve a desired goal. This moment marks the start of execution of the plan and thus can be viewed as expressing an ingressive interpretation of accomplishments. Not very surprisingly, this verb in Hebrew (just like ‘begin’/‘continue’ etc.) is grammatical only with the causative template.

- Also, we continue to see reflection of wide aspectual choices in referring to the same episode across different stories:

1. ‘dani **hexeziq** et hakof, ve’ima **he’eḵila** et
‘Dani **held**$_{\text{cause}}$ ACC the-monkey and-mom **ate**$_{\text{cause}}$ ACC
habarvazim’[[2]]
the-ducks’[[2]]
‘Dani **got hold**$_{\text{cause}}$ of the monkey and mom **fed**$_{\text{cause}}$ the ducks’

2. ‘hem **halḵu** **lehaḇi** oḵel labarvazim’[[retelling]]
‘They **went**$_{\text{simple}}$ **to-come**$_{\text{cause}}$ food to-the-ducks’[[retelling]
‘They **went to bring** food for the ducks’[[retelling]

1. ‘balayla hem **hitkasu** bo **vehitxamemu**
‘At-the-night they **covered**$^{\text{middle}}_{\text{intensive}}$ with-him and-**warm**$^{\text{middle}}_{\text{intensive}}$
ito’[[22]]
with-him’[[22]]
‘At night they **covered themselves** and **warm themselves up** with him’[[22]]

2. ‘hem **yašnu** ito layla’[[retelling I]]
‘They **slept**$_{\text{simple}}$ with-him night’[[retelling I]]
‘They **slept** with him one night’[[retelling I]]

1. ‘ha’oreb̆ **hosip̆** et kofiko laoseṕ’[[28]]
   ‘The-magpie **added**$_{\text{cause}}$ ACC Monkie to-the-collection’[[28]]
   ‘The magpie **added** Monkie to his collection’[[28]]
2. ‘ha’orev **tala** oto et kofiko al
   ‘The-magpie **hung**$_{\text{simple}}$ ACC Monkie on the-tree,
   ha’ec, baoseṕ haxadaš šelo’[[retelling II]]
   in-the-collection the-new of-him’[[retelling II]]
   ‘The magpie **hung** Monkie on the tree, together with his new collection’[[retelling II]]

Again, while walking through the picture we see an extensive use of non-simple verbs, while in the ‘retelling’ part she makes use of simple verbs with similar lexical content.

- Finally, I show mature alternation between viewpoints in a single piece of the discourse that describes punctual, complete and completed situations as well as continuative, ongoing, incomplete ones.

  1. ‘dani **xazar** habayta ratub̆ u’meyu’aš, vekšehu **herim** et hasmiḱa še**kana** mehaxanut, **ra’a** šebaqup̆sa, kofiko lo **nimca**’[[7]]

     ‘Dani **returned**$_{\text{simple}}$ to-the-home wet and-despair, and-when-he **rise**$_{\text{cause}}$ the-blanket that-**bought**$_{\text{simple}}$ from-the-store, **saw**$_{\text{simple}}$ that- Monkie not **find**$^{\text{middle}}_{\text{simple}}$.[[7]]

     ‘Dani **returned** home wet and despairing, and when he **raised** the blanket that he **bought** from the store, he **saw**$_{\text{simple}}$ that Monkie is not (/cannot be) **found**.[[7]]

  Again, the ‘raised’ (causative) result state is temporally extended to include the ‘seeing’ event, and the ‘not found’ (middle) provides a result state that conceptually triggers the next situation (the decision to look for Monkie). The simple verb forms ‘return’, ‘bought’, ‘see’, are again viewed as punctual perfective events in the past on the story time line.

CF13;6

- Here we examine a fairly long interview, anchored in the past, with a wealth of non-simple verb forms that are used throughout stories.
- Examples of newly introduced verb forms (with respect to the set of verbs used by previous interviewees):

1. ‘ha’avzim vehabarvazim **nitpelu** el kofiko, vehu
   ‘The-geese and-the-ducks **take-care**$^{\text{middle}}_{\text{simple}}$ to Monkie and-he
   ne’elac **lišmor** ’alav’[[3]]
   force$^{\text{middle}}_{\text{simple}}$ **to-watch** on-him’[[3]]
   ‘The geese and the ducks **picked on** Monkie and he **was forced to watch** him’[[3]]
2. ‘ha’aǩbarim **hitlahaḃu** mekofiko [...] **hištolelu**
   ‘the-mice **enthusiastic**$^{\text{middle}}_{\text{intensive}}$ from-Monkie [...] **messed**$^{\text{middle}}_{\text{intensive}}$
   ve**siǩaqu**’[[12]]
   and-**played**$_{\text{intensive}}$’[[12]]
   ‘the mice **became enthusiastic** about Monkie [...] **messed up** and **played**’ [[12]]
3. ‘kofiko **nišva** al-yedey ha’aǩbarim’[[retelling I]]
   ‘Monkey **take-hostage**$^{\text{middle}}_{\text{simple}}$ by the-mice’[[retelling I]]
   ‘Monkey **was taken as a hostage** by the mice’[[retelling I]]
4. ‘vekulam **nidlequ** al kofiko’[[retelling I]]
   “And-everybody **light**$^{\text{middle}}_{\text{simple}}$ on Monkie”[[retelling I]]
   ‘And everybody were ‘**turned on**’ by Monkie[[retelling I]]

In the first example we see middle voice alternations of the root $[t][p][l]$. This root is available also in the simple intensive template $tipel$ (took care of someone, something). In the medio-passive template the meaning shifts to ‘picking on’ someone, in the sense of forcing someone to pay attention. This also shifts the viewpoint from the boy (causative, ‘feed’) to the ducks (middle, ‘being taken care of’). In both cases we are concerned with a situation that is ongoing and still has an affect on the present moment.

In the second example the denominal root $[l][h][v]$ (flame, burn) is used to describe the inchoative situation of becoming enthusiastic about something.

In the third example the denominal root of ‘take-hostages’ is used in the Niphal to denote the inchoative sense of being taken as a hostage, shifting the viewpoint to from the mice to the Monkie and its current state.

The last example is maybe the most interesting one. In this case street-slang language is employed. There is a common slang use of templates using the root $[d][l][k]$ (the ‘light’ verb). In its simple form it refers to the activity of a light being ‘on’. The causative/middle alternations of this root derive particular meanings, both in their dictionary meaning and in colloquial language, as exemplified in (310) and (311) respectively.

(310) *formal*

a. $[d][l][k] + B_{\text{s}} = dalak$ (light)

b. $[d][l][k] + B_{\mathrm{c}} = hidlik$ (light up)

c. $[d][l][k] + B_{\mathrm{s}}^{\mathrm{m}} = nidlak$ (be lit)

(311) *colloquial*

a. $[d][l][k] + B_{\mathrm{c}} = hidlik$ ('turn someone on')

b. $[d][l][k] + B_{\mathrm{s}}^{\mathrm{m}} = nidlak$ ('be turned on by someone')

The aspectual phenomena in all cases comply with our formal definitions.

- Next we show wide aspectual choices related to specific pictures across in different narratives:

1. 'kšše**xazar** habayta hu **hivxin** leṗeta'...'[[3]]
   'When-**returned**$_{\mathrm{simple}}$ to-the-home he **examined**$_{\mathrm{cause}}$ suddenly...'[[3]]
   'When he **returned** home he suddenly **noticed**...'[[3]]
2. 'xazar habyta ve**ra'a**...'[[3]]
   'returned$_{\mathrm{simple}}$ to-the-home and-**saw**$_{\mathrm{simple}}$...'[[3]]
   '**returned** home and **saw**...'[[3]]

1. '**horidu** lo ta'zanav'[[12]]
   '**get-off**$_{\mathrm{cause}}$ to-him ACC-the-tail'[[12]]
   '**took off** his tail'[[12]]
2. '**pac'u** oto'[[retelling I]]
   '**hurt**$_{\mathrm{simple}}$ him '[[retelling I]]
   '**hurt** him '[[retelling I]]

1. '**hexezir** lo'[[46]]
   '**returned**$_{\mathrm{cause}}$ to-him'[[46]]
   '**gave** him **back**'[[46]]
2. '**natan** lo'[[retelling II]]
   '**gave**$_{\mathrm{simple}}$ him '[[retelling II]]
   '**gave** him '[[retelling II]]

Again, the see/notice take-off/hurt and gave-back/gave alternations show clear preference of non-simple verb forms over simple ones (to express roughly the same meaning) when referring to an episode in focus which is still relevant or ongoing.

SUMMARY

Narratives in this age group consistently show patterns of mature language use, reflected in elaborated narratives and an increasing amount of non-simple verb forms.

The aspectual choices that are made throughout the stories are either *narrow*, in the sense of choosing between alternating templates with the same root, or *wide*, in the sense of choosing between alternating templates with 'similar' roots.

In all cases the aspectual choice clearly helps to emphasis aspectual phenomena with respect to the preferred/adopted viewpoints — external viewpoint of the narrator (backgrounding or foregrounding of events), or internal viewpoint of either of the protagonists (inchoative, egressive, resultative interpretations of events).

Adults

GENERAL

- The adult portion of my sample can be used as a reference point for mature langauge use. Their narratives are rather long and are characterized by 50%-50% division (on average) of simple and non-simple verb forms.
- All stories except for one are anchored in the past. One of the stories is anchored half in the present and half in the past, and the division is clearly marked by the interruption point (the retelling part).
- Deviations from the anchored tenses are not uncommon and are made to serve specific purposes. Among other things, they can be used to mark background/foreground distinctions, relations of anteriority and simultaneity, etc. (See also [3] and [50])
- We start to see the use of the *past habitual* tense,[7] mostly to mark background information. However, due to its peculiar properties and limited use I leave the discussion of this tense out of the scope of this analysis.
- The verbal templates are used freely and extensively throughout *all* parts of the experiment.
- As opposed to what was evident in other age groups, in both of the narratives we do not see a decrease in the use of non-simple verbs in the 'retelling'

[7] The past habitual tense is a Hebrew verbal construction that grammatically resembles past progressive in English (copular+present form) however it is used to mark habits (as in 1) or unreal conditionals (as in 2)

1. Hu haya holeǩ kol yom lagan
   He was go every day to-the-garden
   He used to go everyday to the garden
2. Hu haya holeǩ im hi hayita magi'a
   He was go if she was arrive
   He would have gone if she had arrived

parts. The reason for that is twofold. First, adults often have a different interpretation of the task, and they tend to retell the story in the exact manner they told it in the first place, to the new audience. Secondly, adults make pragmatic use of certain verbs or verb alternations to form a more literary language, and to construct a more 'interesting' story by switching between background, foreground, and varying viewpoints.

- An analysis of the pragmatic factors (within storytelling and in general) remains out of the scope of this study. Instead, I show below some canonical examples of mature aspectual choices that are employed to convey certain aspectual meanings, either with reference to the same picture across different narratives, or in reference to several pictures (episodes) within a single piece of discourse.

CF26A

- The following minimal pair shows how a *narrow* aspectual choice triggers alternation between a simple and a non-simple template in order to provide different interpretations of the same situation. In the first it is an extended inchoative interpretation (a developing event), and in the second it is a perfective viewpoint (a past completive event in the course of the story).

  1. 'hašamayim **mitqadrim**'[[4]]
     'the-skies **darkened**$^{\text{middle}}_{\text{intensive}}$'[[4]]
     'The skies **were becoming dark**'[[4]]
  2. 'hašamayim **kadru**'[[retelling]]
     'the-skies **darkened**$_{\text{simple}}$'[[retelling]]
     'The skies **darkened**'[[retelling]]

- The following piece of discourse shows an alternation between simple and non-simple verbs to distinguish events that are in the past from ones that have present relevancy.

  1. 'Pitom hem **nitkelu** ba'orev, az hem **xazru**
     'Suddenly they **bumped**$^{\text{middle}}_{\text{simple}}$ in-the-magpie, so they **returned**$_{\text{simple}}$
     ve**hiširu** et kofiko meaǩoreyhem'[[retelling]]
     and-**remain**$_{\text{cause}}$ ACC Monkie behind-them'[[retelling]
     'Suddenly they **bumped into** the magpie, so they **went back** and **left** Monkie behind'[[retelling]]

CF26B

- The following minimal pair shows how a *wide* aspectual choice triggers alternation between simple and non-simple templates in order to provide different interpretations of the same situation. In the first it is an ongoing activity interpretation and in the second it one of a high level achievement.

  1. ‘**hitnadnedu** alav’[[14]]
     ‘**marry-go-round**$^{\text{middle}}_{\text{intensive}}$ on-him‘’[[14]]
     ‘Played around with him’[[4]]
  2. ‘**haǰku** oto legan misxaqim’[[retelling]]
     ‘**turned**$_{\text{simple}}$ him to-garden games’[[retelling]]
     ‘**turned**$_{\text{simple}}$ him **into** a playground’[[retelling]]

- Finally, the following piece of discourse mixes simple and non-simple verb forms to alternate between various viewpoints of situations in the course of the story.

  1. “yom exad, bemahalaǰ hatiyul hayomi šelhem, pit’om **hitxil** [...] gešem, ima veben **racu** maher la’oǰanayim ve**nas’u** [...] pit’om kšehem **higi’u** habayta hem **samu-lev** šekofiko **nafal** baderek̆”[[retelling]]

     ‘day one, during the-tour daily their, suddenly **started**$_{\text{cause}}$ [...] rain, mom and-ben **ran**$_{\text{simple}}$ quickly to-the-bike and-**rode**$_{\text{simple}}$ [...] suddenly when-that-they **arrived**$_{\text{cause}}$ home they **heed**$_{\text{simple}}$ that-Monkey **fell**$_{\text{simple}}$ on-the-way”[[retelling]]

     ‘One day, during their daily tour, suddenly it **started** [...] to rain. Mom and Ben **ran** quickly to the bike and **rode** [...] suddenly when they **arrived** home they **realized** the fact that Monkey **fell** on the way”[[retelling]]

  Again, the rain and the arrival serve as background to the current point in which the boy and the mother are at home looking for the monkey (as opposed to, for instance, their ‘ride’, which has already finished).

SUMMARY

Adults show an almost equal distribution of simple and non-simple verb forms over a wider lexicon of lexical morphemes (roots).

They use alternations between templates in identical or similar roots is, in constructing the intended aspectual meaning of the utterance, and they use alternations

between tenses to express particular temporal relations based on their semantic and pragmatic properties.

The analysis of the adult narratives calls for a pragmatic account that complements the current proposed semantics, however I leave such an investigation for further research.

10.4 Results

10.4.1 Aspectual choice from a linguistic point of view

According to our theoretical account, a speaker that tries to convey aspectual meanings makes choices of lexical and grammatical morphemes to express her choice of a situation type and a viewpoint respectively.

In Hebrew the speaker chooses the lexical morpheme, the root, and puts it in a certain grammatical environment that manifests certain aspectual properties. The kind of grammatical choices that a user can make in order to express desired temporal ralations/interpretations consist of several components.

First, the choice of one of the three grammatical *tenses* (past, present and future) has certain aspectual implications according to their default features. For example, we have shown that past tense is preferred at younger ages when referring to punctual or telic events whereas the present is preferred when describing ongoing, continuative or unbounded situations.

Second, the choice of a *morphological template* helps to specify or put emphasis on particular elements or temporal relations within the eventuality denoted by the root. For example, we have shown how the intensive templates are preferred for describing ongoing and temporally extended activities, and the causative and middle templates are preferred when describing situations in which certain elements (the background cause/agency, the result state) are relevant to the present moment.

On the other hand, the simple verbs are preferred when describing sequential events on the story timeline without any particular reference to their internal aspectual structure and thus can be seen as some sort of ‘perfective’ (reminiscent of the French Passé Simple).

Last of all, we have seen that a choice between templates that express different viewpoints can be *narrow*, when both templates are available with the same root, or *wide*, when a template alternation with the same root is ungrammatical and *similar* lexical morphemes that are compatible with the other templates are considered.

Thus, the resulting aspectual meaning is the ‘sum’ of all the aspectual properties contributed by the lexical morpheme, the tense, the template, and the *contrast* with other optional root-template constellations that are available in the same context.

10.4.2 Aspectual choice from a developmental point of view

Young children at the age of 3–4 already master the use of the three grammatical tenses, however they are not always employed to express temporal relations per se. Sometime they are used with respect to aspectual properties such as complete vs. incomplete or punctual vs. extended (the defective tense hypothesis). Children at this age use mainly simple verb forms, with exceptions in the case where non-simple verbs do not have a simple form counterpart.

Children at the age of 4–5 start to explore the use of aspectual verbs (mainly the intensive and the causative templates). Although these verbs usually do not have a grammatical simple verb form alternation, they are used to serve a different function than was attested for the younger children: they attach aspectual verbs to an infinitive form of an additional lexical morpheme thus focusing the attention on a particular part or component of the situation denoted by the infinitive.

Old pre-schoolers and early schoolchildren at the ages of 5–7 show increased use of non-simple verbs, however most of them are still default conjugations of newly acquired lexical morphemes, or specific uses such as aspectual (start, begin, continue to…) or intentional verbs (want, try, decide to…).

Later, at the ages of 7–11 we see a similar distribution between simple and non-simple verb forms, however children at these ages start to show voluntary alternation between templates that are available with the same root. Such alternations are usually meant to emphasize different shades of aspectual value meanings of the described situation.

Children in the age group 11-15 show increased use of non-simple verb forms that follow from voluntary *narrow* and *wide* aspectual choices between possible root-template alternatives. Also, we see uses of verbs derived from denominal roots, formally or in colloquial manner. The function that such choices are meant to serve is to make meaningful distinctions between viewpoints of an eventuality, either internal (relevancy for particular participants in the situation) or external (conceptualizing the situation in the foreground or background of the story timeline).

Adults indeed employ all four levels of temporal expressions we have mentioned (lexical morpheme, tense, template, wide aspectual choice), however they ‘operate’ on a much larger lexicon (primitive roots), and incorporate pragmatic factors in conveying aspectual meaning. Also, certain root-template combinations are employed here to serve additional (not necessarily aspectual) functions on the basis of individual preference, story-telling style, etc.

Chapter 11

Summary and Conclusions

11.1 Summary

In this part of the study we analyzed narratives by native Hebrew speaking children and adults based on a wordless storybook in order to learn the range of function and the developmental history of the simple and non-simple verb forms in the language.

Following a preliminary investigation of 22 interviews of children and adults in ten different age groups based on the Hebrew version of the 'Monkie' [45] storybook, we were able to show how the default semantic features of the Hebrew tenses together with the morphological templates work in accord with our proposed semantic account.

Moreover, using a qualitative individual analysis of differently narrated descriptions of the same situation we were able to identify a voluntary choice of a constellation of linguistic devices to convey certain aspectual meanings. This choice usually consists of the lexical material of the basic morpheme (the root), the default features of the grammatical tenses, the morphological templates, and the contrast between the specific combination used and other alternatives provided by the Hebrew grammar.

Finally, we were able to see that a mastery of these linguistic devices and a full employment of these factors for conveying aspectual messages (in the same way it is done by adults) appears at rather late ages of subjects in my sample: school children at the ages 11–15.

11.2 Conclusions

The picture that emerges from the preceding discussion is that some aspectual meaning in Hebrew is already inherent in the language. This is the case not only with respect to the inherent meanings of the lexical morphemes (situation types denoted by roots), but also with the default semantic features of morphological templates.

Thus, it seems that Hebrew indeed grammaticalizes aspect at some level. Under a very simplistic description it can be claimed that in Hebrew narratives the intensive templates (Piel and Hitpael) share semantic properties with the English progressive tenses (a dynamic extended situation), and the medio-passive template shares semantic properties with the English present perfect (the relevancy of the result state), while the causative operates as a super-lexical morpheme (reminiscent of the Russian super-lexical morpheme *za*).

Still, Hebrew speakers do not have free choice within this full range of alternatives. Some of the lexical choice is already inherent in the grammar of the language. Thus, the verbs $sixek$ (play) $nisa$ (try) or $xipes$ (search) that describe ongoing activities are grammatical only in the intensive templates, and the aspectual verbs $hitxil$ (start) $himšiǩ$ (continue), $hexelit$ (decide) that focus on particular parts of the event pick by default the causative template. Such inherent grammatical choices are picked up rather early in the langauge development process.

However, following the exploration and the use of such lexical items as aspectual verbs, possibly in conjunction with other (infinitive) lexical morphemes, Hebrew-speaking children start to explore the range of *voluntary* aspectual choices that they have in the language by means of alternating between *optional* root-template combinations for conveying specific shades of meaning.

Note that the above discussion is not meant to undermine the fact that some derivations of verbs from roots are subject to significant idiosyncracy, but to draw attention to the fact that despite the inherent idiosyncracy, *narrow* and *wide* aspectual choices are indeed employed by speakers of the langauge.

As a last note I'd like to propose that the advent of a *tense* prominent system during *Mišnaic Hebrew* left some void in the Hebrew language, and a lack of means to denote meaningful aspectual distinctions that up until that time were foundational in the Hebrew grammar. Therefore, I suggest that the morphological non-simple templates, the *binyanim*, together with their peculiar semantic features (thematic and others) 'took over' the role of the Hebrew imperfective form *'WAY-kitol'*.

This hypothesis is plausible from a linguistic point of view. The simple form (*binyan Paal*) in the subordinative closed system of the morphological templates is unmarked and underspecified with respect to specific features of the event's internal structure. On a pragmatic level, following Grice's *Maxim of Quality* [23] this is

interpreted as 'lack of internal structure' which we have defined to be an important feature of the perfective.

Empirically, this was evident from the increased use of simple verb forms in the 'retelling' parts of the story, and the incorporation of non-simple verb forms in the description of extended, continuative, and incomplete situations that serve as background to the present reference point.

11.3 Further Research

As has already been mentioned, this section has provided only preliminary evidence for the plausibility of the proposed semantic account. The developmental story we have shown is *a* possible developmental trend rather than the only possible one.

Further establishing these results will require recruiting a much larger sample of interviewees in each of the age-groups, and conducting a similar experiment (possibly using the same design and method of analysis) on a much wider range. This would allow statistical measures such as mean and variance to be taken, and generalizations to be made.

Nevertheless, even in the fairly limited data set we are concerned with, there is much more to be explored and investigated. Among other things, possible directions of investigations are the form and function of tense alternation, the developmental 'story' of *specific* templates, the role of additional lexical material (e.g., time adverbials) especially when interacting with default features of Hebrew tenses and morphological templates, and aspectual features of subordinate and adjacent clauses.

Moreover, such a language-oriented study always deserves a cross-linguistic perspective, and thus it would be interesting to compare and contrast the pace of acquisition of various aspectual concepts in languages that mark these notion using obligatory grammatical inflections.

Finally, further conclusions with respect to the proposed semantic features can be drawn from the analysis of errors in speech, e.g., we can ask whether the use of the root $[y][s][n]$ (sleep) in the *yošen* active form rather then the *yašen* stative form is triggered by some aspectual features that are inherent in the situation (i.e., viewing it as a strict activity rather than as a state). On a similar note, a study of the acquisition of L2 by native Hebrew speakers, in terms of the errors they make or the forms that are more easily adopted, may also shed light on aspectual distinctions that a Hebrew-speaking person is skilled to perform.

Part IV

Epilogue

Chapter 12

Summary and Conclusions

12.1 Summary

The ultimate goals of this study were to suggest the essential ingredients for an account of Modern Hebrew aspect and to shed more light on the semantic contribution of the Hebrew verbal templates, the *binyanim*.

We started out our investigation by characterizing the Semitic languages in general and identifying the main characteristics of the Hebrew verbal system in particular. The consonant-based lexical system and the rich derivational morphology that is used to derive verbs have been maintained throughout the years (as opposed to, for instance, tense inflections), and Modern Hebrew in fact adheres to the same principles of verb derivations as its ancient ancestor, Biblical Hebrew.

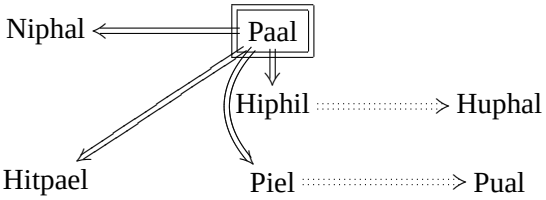
At first glance, the results of these verb derivations show a lot of idiosyncracy. However, we argued together with Doron [15] in favor of the systematic semantic contribution of the Semitic templates and introduced preliminary arguments for their significance with respect to aspectual relations.

The theory that was chosen to frame our findings was Smith's [47] two-component theory of aspect in which aspectual meanings of sentences are the result of an interplay between two *aspectual choices* a speaker makes: the choice of a *situation type* expressed via the selected *lexical* material, and the choice of a *viewpoint*, typically denoted by *grammatical* morphemes.

The formalism that was chosen to accompany the semantic treatment is van Lambalgen and Hamm's *Event Calculus (EC)* [52], a cognitive-oriented approach for expressing temporal relations based on the notion of *planning*. Together with the EC formalism we adopted the six-way classification of situation types (also termed *Aktionsarten*) proposed by [52], and extended it with a formal description of the participants in different kinds of situations.

In this thesis we argued that (i) following principles of *Distributed Morphology (DM)*, both roots and the morphemes realized in the Semitic templates are part of a narrow lexicon on which the syntax operates in order to derive verbs, (ii) the verbal templates are in fact grammatical morphemes that have systematic contribution to the meaning of the resulting verbs, and (iii) the systematic contribution of the templates alters aspectual characteristics of the situations denoted by the basic lexical material, the root.

A productive way to appreciate the systematic aspectual contribution of the templates is by arranging them in *aspectual pairs*. An aspectual pair is a pair of verbs that adhere to a single root and two different templates. Not all possible pairs have been examined, but only the ones that were proven significant for the aspectual investigation via a theory of *markedness*. The aspectual pairs that were considered are summarized in the diagram below.



Then, we assumed that the simple template *Paal* approximates the meaning of the root and that its situation type remains unmodified. We characterized the semantic contribution of the other templates with respect to this unmodified situational meaning of the root.

We have shown that the intensive template *Piel* introduces a dynamics and may result in coercing the basic situation to a wide activity or an accomplishment. The causative template *Hiphil* and the middle template *Niphal* alter the viewpoint on the situation and may be seen as complements of each other. The causative template puts emphasis on the intiation/development of the situation (an *inchoative/inceptive* viewpoint) whereas the middle template emphasizes the resulting change of state (an *egressive/resultative* viewpoint). Finally, the intensive-middle template *Hitpael* benefits from the contribution of both the intensive and the middle morphemes thus providing the underlying event structure of a full-fledged accomplishment to any lexical material that is put through it.

In sum, the templates were seen to contribute to the temporal extension of the event (durativeness, phases) and the specific part of the event on which focus is directed (begining/development/change-of-state/result-state). However, they remain surprisingly neutral with respect to the telicity of events (a notion which, interestingly, did not always coincide with a resulting change of state).

The claim that the semantic contribution of the templates allows us to make precise predictions with respect to aspectual meanings of verbs was made possible only by virtue of a complete formalization and systematic application of the proposed

semantic features using the logical and computational machinery proposed by the Event Calculus.

In fact, there appears to be a nice fit between the characteristics of the Hebrew verbal system and the Event Calculus as a semantic framework for expressing temporal relations. First, the Event Calculus machinery allowed us to abstract from verb idiosyncracy and focus on the underlying event structure, thus allowing us to pinpoint the components that are affected by the semantic features realized in the templates.

Second, the Event Calculus provides a straightforward way to accommodate a discussion of the aspectual contribution of participants in situations by virtue of their thematic roles. In fact, the Event Calculus provides a framework in which properties of events and thematic relations are tightly connected via the formal description of the constituents of a plan, which in turn allows for semantic properties in one domain to productively affect the other, and vice versa.

On a more general note, the Semitic verbal system is essentially different from other Indo-European languages (e.g., English) in the sense that it has a relatively narrow lexicon from which a wide range of verbs is derived. The verbs are derived by dynamic morpho-syntactic processes that make use of a narrow lexicon and a fairly limited set of grammatical morphemes. This dynamic view and the productivity of these processes is further supported by the active word derivation that was undertaken by the revivers of the language, and by active derivation (and comprehension) of new words as performed by ordinary speakers of the language.

This dynamic view was nicely captured by the Event Calculus, that allows us to productively construct different kinds of events and to express different shades of meanings from the contribution of different constituents and the interaction between them. This allowed us to take an *active, synthetic* approach, rather than a *static, analytic* one, in which the resulting aspectual meaning of Hebrew verbs is *constructed* (and in fact, computed), rather then *decomposed* from its constituent morphemes.

A notion that underlies this study and unifies its conceptual, methodological, and empirical components is the notion of an *aspectual choice*. Conceptually, we started out by constructing aspectual meanings from aspectual choices of lexical and grammatical morphemes. Methodologically, we used contrasting values of aspectual pairs in analyzing the aspectual choice between the options available to a speaker of the language. Empirically, we were able to show preliminary empirical evidence for the plausibility of the proposed account mainly by identifying different levels of aspectual choice at different ages and in different contexts.

This preliminary evidence was shown via the analysis of 22 interviews of Hebrew-speaking children and adults. The interviews consisted of various narratives based on a wordless storybook, which demonstrated the *aspectual choices* that are made by speakers to convey aspectual meanings of different pictures at different ages.

In fact, we were able to identify increasing levels of implementation and sophistication of *aspectual choice* with age, and to propose a developmental trend in the way linguistic forms (morphological templates in connection with tense inflections) function to serve the expression of aspectual distinctions in Hebrew narratives.

The ultimate conclusion from this analysis was that *narrow* and *wide* aspectual choices are indeed employed by speakers to make aspectual distinctions, and moreover, we have shown that non-simple verbs are preferred in descriptions of situations that can be seen as *imperfective*, and the simple verbs are preferred in contexts that are naturally read as *perfective*.

The final hypothesis is, therefore, that with the advent of a tense-prominent system in *Mišnaic Hebrew*, Hebrew speakers and writers lacked precisely the means to express the distinctions that were denoted by the *Biblical* perfective/imperfective grammatical morphemes. And so, throughout the years the morphological templates 'took over' this grammatical role, and their semantic features were adopted and employed by speakers to denote aspectual distinctions.[1]

12.2 Concluding Comments

This thesis summarizes an attempt to decompose 'Hebrew aspect' and construct aspectual meanings by virtue of the semantic contributions of morphological templates.

The proposed account is not the only possible answer to these questions, and by no means is this the end of the story. A different way in which this thesis can be thought of is as an attempt to 'break' traditional associative relations and encourage considering new ones.

In the Hebrew linguistic arena, I argue against the 'Hebrew aspect equals lexical aspect' equation. By this I hope to have encouraged a doubled-dimension investigation of Hebrew aspect as proposed by general linguistic theory and reflected typologically in many other language. Alongside these aspectual claims I attempted to show supporting evidence for a stronger connection between the contributions of morphological templates and the meanings of verbs derived from them.

In the general linguistic arena, I advocate stronger (bi-directional) relations between semantic properties of events and the thematic roles of their participants. Also, I suggest a weaker connection between 'resulting change of state' and an event's 'telicity'. These suggestions have been explored before (in [10] and [55]

[1] Additional supporting evidence for this hypothesis is that such distinctions are especially evident in literary language, of which the Bible provides a de-facto standard. Thus, the alternation between the simple form *halaḵ* (walk) and the intensive forms *hileḵ/hithalek* (walk around, walk about) is not so common in everyday speech, but is more associated with literary/poetic writings.

respectively), however, I believe that the results of this work provide supporting evidence for these directions of investigation.

In a cross-linguistic arena, I suggest that the contribution of specific constructions in different languages (not necessarily 'grammatical tenses') might have ramifications for an aspectual investigation. An example for this is the suggestion to re-examine the connection between causative constructions and event structure as evident in the discussion of the causative template *Hiphil* (section 6.3). A cross-linguistic investigation of causative constructions may shed some more light on this matter.

Finally, I hope to have exemplified the importance of a parallel empirical evaluation of a theoretical investigation of linguistic forms by means of identifying patterns of real language use and possible developmental trends in the functions these linguistic forms are meant to serve. Such a parallel investigation is more likely to yield successful results with respect to *linguistic adequacy* as well as *cognitive plausibility* of the proposed account.

Appendix A

Story plot

Attached please find five clusters with the selected pictures from the ’Monkie’ story book [45] that formed the wordless storybook we used in our experimental investigation (part III).

Cluster number	From picture –	To picture –
1	[[1]]	[[9]]
2	[[10]]	[[19]]
3	[[22]]	[[28]]
4	[[29]]	[[37]]
5	[[38]]	[[46]]

Appendix B

Statistics

B.1 Tables

B.1.1 CF3;6

PART I+III	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	6	2	11	1	1	21(87.5%)
Hiphil			1			1 (4.1%)
Hitpael	1		1			2 (8.3%)
Total	7	2	13	1	1	24
Paal	6	1	11		3	21 (87.5%)
Piel			1			1 (4.1%)
Niphal		2				2 (8.3%)
Total	6	3	12		3	24

STORY I	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	12	3	22	1	4	42(87.5%)
Piel			1			1 (2.1%)
Hiphil			1			1 (2.1%)
Niphal		2				2 (4.2%)
Hitpael	1		1			2 (4.2%)
Total	13(27%)	5 (10.4%)	25(52%)	1 (2.1%)	4 (8.3%)	48

B.1.2 CF3;10

PART I+III	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	43				1	44(86%)
Piel	1					1(1.9%)
Hiphil	3					3(5.8%)
Niphal	1					1(1.9%)
Hitpael	2					2(3.9%)
Total	50 (98%)				1 (1.9%)	51
Paal	37		1			38(84.4%)
Piel	1		1			2(4.4%)
Hiphil						0 (0%)
Niphal	1	2				3(6.6%)
Hitpael	1		1			2(4.4%)
Total	40 (88.8%)	2(4.4%)	3 (6.6%)			45

STORY I	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	80		1		1	82 (85.4%)
Piel	2		1			3 (3.125%)
Hiphil	3					3 (3.125%)
Niphal	2	2				4 (4.16%)
Hitpael	3		1			4 (4.16%)
Total	90(93.75%)	5 (5.2%)	3(3.125%)	1 (1%)	1 (1%)	96

B.1.3 CM4

STORY I	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	4(1)	1	15(2)		1	21(67.7%)
Piel	1		1			2(6.45%)
Hiphil	1(1)		5			6(19.3%)
Niphal					2	2(6.45%)
Hitpael						0(0%)
Total	6(19.35%)	1(3.22%)	21(67.7%)	0(0%)	3(9.67%)	31

B.1.4 CF4

PART I+III	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	78(11)		6(2)	3	18	105(85.36%)
Piel						0(%)
Hiphil	13					13(10.56%)
Niphal		2				2(1.62%)
Hitpael	2	1				3(2.43%)
Total	93 (75.6%)	3 (2.43%)	6 (4.87%)	3(2.43%)	18(14.63%)	123
Paal	65(6)	3(2)	7	7	24	106 (65.43%)
Piel	7				4	11 (6.79%)
Hiphil	27(21)			1	5	33(20.37%)
Niphal						0 (%)
Hitpael					2	2(12.3%)
Total	99(61.11%)	3 (1.85%)	7 (11.29%)	8 (4.93%)	35 (21.6%)	162

STORY I	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	143(17)	3(2)	13(2)	10	42	211(76.76%)
Piel	7				4	11(4%)
Hiphil	40(21)			1	5	46(16.72%)
Niphal		2				2(0.72%)
Hitpael	2	1			2	5(1.81%)
Total	192 (69.8%)	6 (2.18%)	13 (4.72%)	11 (4%)	53(30.28%)	275

B.1.5 CF4;6

PART I+III	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	5	1	10			16(55.17%)
Piel			6(3)			6(20.6%)
Hiphil	2		2(1)		2	6(20.6%)
Niphal						0(0%)
Hitpael			1			1(3.44%)
Total	7 (24.13%)	1 (3.44%)	19 (65.5%)	0(0%)	2(6.89%)	29
Paal	3	3	16(1)		1	23(69.69%)
Piel			3(1)			3(9.09%)
Hiphil	1			2	3	6(18.18%)
Niphal		1				1(3.03%)
Hitpael						0(0%)
Total	4 (12.12%)	4 (12.12%)	19 (57.57%)	2(6.06%)	4(12.12%)	33

STORY I	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	8	4	26(1)		1	39(62.9%)
Piel			9(4)			9(14.5%)
Hiphil	3		2(1)	2	5	12(19.35%)
Niphal		1				1(1.61%)
Hitpael			1			1(1.61%)
Total	11(17.74%)	5 (8.06%)	38 (61.29%)	2(3.22%)	6(9.67%)	62

STORY II	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	21(1)	3				24(53.33%)
Piel	4(4)					4(8.88%)
Hiphil	8(4)				7	15(33.33%)
Niphal	1					1(2.22%)
Hitpael	1					1(2.22%)
Total	35(%)	3 (%)	0 (0%)	0(0%)	7(%)	45

B.1.6 CM5;3

PART I+II+III	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	22	3	20	4		49(87.5%)
Piel	1		1			2(3.5%)
Hiphil	2		1			3(5.3%)
Niphal		1				1(1.5%)
Hitpael			1			1(1.5%)
Total	25 (44.6%)	4 (7.1%)	23 (41%)	4(7.1%)		56
Paal	9					9(100%)
Total	9					9
Paal	13(1)	2	8		4	27(79%)
Hiphil	1		1			2(5.9%)
Niphal		1				1(2.9%)
Hitpael			4			4(11.7%)
Total	14(41.1%)	3(8.8%)	13(38.2%)		4(11.7%)	34

STORY I	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	25(1)	5	28	4	4	66(82.5%)
Piel	1		1			2(2.5%)
Hiphil	3		2			5(6.25%)
Niphal		2				2(2.5%)
Hitpael			5			5(6.25%)
Total	29 (36.25%)	7 (8.75%)	36 (45%)	4(5%)	4(5%)	80

STORY II	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	11	4				15(93.75%)
Piel					1	1(6.25%)
Total	11 (68.75%)	4 (25%)			1(6.25%)	16

B.1.7 CF5;6

PART I+II+III	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	39(1)		2	10		51(83.6%)
Piel	2			1	1	4(6.5%)
Hiphil	2			1		3(4.9%)
Niphal		2				1(1.6%)
Hitpael	1					1(1.6%)
Total	44 (72.1%)	2 (3.2%)	2 (3.2%)	12(19.6%)	1(1.6%)	61
Paal	17(1)					17(73%)
Piel	3				1	4(17.4%)
Hiphil	1			1		2(8.7%)
Niphal		1				1(4.3%)
Hitpael						0(0%)
Total	21 (91.3%)	1 (4.3%)	2 (8.7%)	1(4.3%)	1(%)	23
Paal	29		3(1)	3	1	36(73%)
Piel	5					5(10.2%)
Hiphil	1(1)			1		2(4%)
Niphal		1		2		3(6.1%)
Hitpael				2	1	3(6.1%)
Total	35 (71.4%)	1 (2%)	3 (6.1%)	8(16.3%)	2(4%)	49

STORY I	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	68(1)		5(1)	13	2	88(76.5%)
Piel	7			1	1	9(7.8%)
Hiphil	3(1)			2		5(4.3%)
Niphal		3		2	1	6(5.2%)
Hitpael	1			2	4	7(6%)
Total	79 (68.7%)	3 (2.6%)	5 (4.3%)	20(17.4%)	8(6.9%)	115

STORY II	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	45(2)	1	2	4		52(85%)
Piel	2					2(3.2%)
Hiphil						0(0%)
Niphal				6		6(9.8%)
Hitpael				1		1(1.6%)
Total	47 (77%)	1 (1.6%)	2(3.2%)	11(18%)		61

B.1.8 CF6;6

PART I+II+III	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	42(1)	3	3	2	2	52(72.2%)
Piel	4		1(1)		2	7(9.7%)
Hiphil	3		2			5(6.9%)
Niphal	1	6				7(9.7%)
Hitpael	1					1(1.4%)
Total	51 (70.8%)	9 (12.5%)	6 (8.3%)	2(2.8%)	4(5.5%)	72
Paal	11(1)	1				12(92.3%)
Hiphil					1	1(7.7%)
Total	11 (84.6%)	1 (7.7%)			1(7.7%)	13
Paal	33	4	5		4	46(70%)
Piel	6(2)				1	7(10.7%)
Hiphil	6		1			7(10.7%)
Niphal	1	3				4(6.15%)
Hitpael			1			1(1.5%)
Total	46 (70%)	7 (10.7%)	7 (10.7%)		5(7.7%)	65

Story I	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	75(1)	7	8	2	6	98(71.5%)
Piel	10(2)		1(1)		3	14(10.2%)
Hiphil	9		3			12(8.75%)
Niphal	2	9				11(8%)
Hitpael	1		1			2(1.45%)
Total	97 (70.8%)	16 (11.6%)	13 (9.5%)	2(1.45%)	9(6.5%)	137

Story II	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	14(2)	8	1		1	24(85.7%)
Piel					1	1(4.16%)
Hiphil					1	1(4.16%)
Niphal	1	1				2(7.14%)
Hitpael						0(0%)
Total	15(53.5%)	9 (32.14%)	1(4.16%)	0(0%)	3(10.7%)	28

B.1.9 CF6;7

PART I+II+III	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	35(2)	1	9	1	1	47(82.4%)
Piel	2				1	2(3.5%)
Hiphil	4(2)				1	4(7.1%)
Niphal	1	2				3(5.2%)
Hitpael	1					1(1.7%)
Total	43 (75.4%)	3 (5.2%)	9 (15.7%)	1(1.7%)	3(5.2%)	57
Paal	6					6(75%)
Hiphil	1					1(12.5%)
Niphal		1				1(12.5%)
Total	7 (87.5%)	1(12.5%)				8
Paal	40(2)	4(1)	3(2)	2	5	54(84.3%)
Piel			1			1(1.5%)
Hiphil	3			2	1	6(9.3%)
Niphal	1			1		3(4.7%)
Hitpael	1					1(1.5%)
Total	45 (70.3%)	4 (6.25%)	4 (6.25%)	5(7.8%)	6(9.375%)	64

Story I	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	75(4)	5	12(2)	3	6	101(82.1%)
Piel	2		1		1	4(3.25%)
Hiphil	7(2)			2	2	11(8.9%)
Niphal	2	2		1		5(4%)
Hitpael	2					2(1.6%)
Total	88 (71.5%)	7 (5.7%)	13 (10.5%)	6(4.8%)	9(7.3%)	123

Story II	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	26		3			29(87%)
Piel	2	1				3(9%)
Niphal		1				1(3%)
Total	28(84.8%)	2 (6%)	3(9%)			33

B.1.10 CM7;6

PART I+II+III	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	66(5)		10(2)	4	5	85(74.5%)
Piel	4		5(5)		2	11(9.6%)
Hiphil	8(3)				4	12(10.5%)
Niphal	1	2				3(2.6%)
Hitpael	3					3(2.6%)
Total	82 (71.9%)	2 (1.75%)	15 (13.15%)	4(3.5%)	11(9.6%)	114
Paal	23			1	1	25(69.4%)
Piel	5			2		7(19.4%)
Hiphil	4					4(11.11%)
Niphal						0(0%)
Hitpael						(0%)
Total	32 (88.88%)	0(0%)	0(0%)	3(8.33%)	1(27.7%)	36
Paal	47(2) (hab 1)	6(1)	5(3)		7	66(70.2%)
Piel	5(1)		3		1	9(9.5%)
Hiphil	4		3(1)		1	8(8.5%)
Niphal	1	7			1	9(9.5%)
Hitpael	2					2(2.12%)
Total	60 (63.8%)	13(13.8%)	11(11.7%)	0(0%)	10(10.6%)	94

STORY I	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	113(7)(h1)	6(1)	15(5)	4	12	141(71.2%)
Piel	9(1)		8(5)		3	20(10.1%)
Hiphil	12(3)		3(1)		5	20(10.1%)
Niphal	2	9			1	12(6%)
Hitpael	5					5(2.5%)
Total	132 (66.66%)	15 (7.5%)	26 (13.13%)	4(2%)	21(10.6%)	198

STORY II	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	41(4)	4	1	7	3	56(74.6%)
Piel	1				5	6(8%)
Hiphil	6		1	1	2	10(13.3%)
Niphal	1	2				3(4%)
Hitpael						0(0%)
Total	49 (65.3%)	6 (8%)	2 (2.7%)	9(12%)	10(13.3%)	75

B.1.11 CF7;6

PART I+II+III	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	47(3)	1	2		1	51(77.2%)
Piel	2				2	4(6%)
Hiphil	7					7(10.6%)
Niphal		3				3(4.5%)
Hitpael	1					1(1.5%)
Total	57 (86.3%)	4 (6%)	2 (3%)	0(0%)	3(4.5%)	66
Paal	16(1)		1			17(80.9%)
Piel	2				1	3(14.2%)
Hiphil						0(0%)
Niphal		1				1(4.7%)
Hitpael						0(0%)
Total	18 (85.7%)	1 (4.7%)	1 (4.7%)	0(0%)	1(4.7%)	21
Paal	21	4	2		4	31(70%)
Piel	1		2(2)			3(6.8%)
Hiphil	4(2)					4(9%)
Niphal	2	1				3(6.8%)
Hitpael	1		2			3(6.8%)
Total	29 (65.9%)	5 (11.3%)	6 (13.6%)	0(0%)	4(9%)	44

STORY I	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	68(3)	5	4		5	82(74.5%)
Piel	3		2(2)		2	7(6.3%)
Hiphil	11(2)					11(10%)
Niphal	2	4				6(5.4%)
Hitpael	2		2			4(3.6%)
Total	86(78.1%)	9 (8.1%)	8 (7.2%)	0(0%)	7(6.3%)	110

STORY II	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	44(2)	3			2	49(79%)
Piel	7(2)				1	8(12.9%)
Hiphil	2				1	3(4.8%)
Niphal	1	1				2(3.2%)
Hitpael						0(%)
Total	54(87.1%)	4 (6.4%)	0(0%)	0(0%)	4(6.4%)	62

B.1.12 CF8

PART I+II+III	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	37(1)	1	2	1	1	42(80%)
Piel	1					1(1.9%)
Hiphil	6		1			7(13.4%)
Niphal		1				1(1.9%)
Hitpael	1					1(1.9%)
Total	45 (86.53%)	2 (3.8%)	3 (5.7%)	1(1.9%)	1(%)	52
Paal	13(2)				1	14(87.5%)
Piel					1	1(6.25%)
Hiphil	1					1(6.25%)
Total	14 (87.5%)	0 (0%)	0 (0%)	0(0%)	2(12.5%)	16
Paal	23	3(1)	5(2)	1	3	35(76%)
Piel	3				1	4(8.6%)
Hiphil	5(1)					5(10.8%)
Niphal	1	1				2(4.3%)
Hitpael						0(0%)
Total	32 (69.5%)	4 (8.6%)	5 (10.8%)	1(2.1%)	4(8.6%)	46

STORY I	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	60(1)	4(1)	7(2)	2	4	77(78.5%)
Piel	4				1	5(5.1%)
Hiphil	11(1)		1			12(12.2%)
Niphal	1	2				3(3.06%)
Hitpael	1					1(1.02%)
Total	77 (78.5%)	6 (6.12%)	8 (8.16%)	2(2.04%)	5(5.1%)	98

STORY II	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	26(1)	4			1	31(79.4%)
Piel	3					3(7.7%)
Hiphil	2(1)					2(5.12%)
Niphal	2					2(5.12%)
Hitpael	1					1(2.56%)
Total	35 (89.7%)	4 (10.2%)	0(0%)	0(0%)	1(2.56%)	39

B.1.13 CM8;9

PART I+II+III	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	1		16			17(53.12%)
Piel	1		4(1)			5(15.6%)
Hiphil	1		3			4(12.5%)
Niphal					1	1(3.125%)
Hitpael			5			5(15.6%)
Total	3 (9.3%)	0(0%)	28 (87.5%)	0(0%)	1(3.125%)	32
Paal	9				1	10(62.5%)
Piel					1	1(6.25%)
Hiphil	3(1)		1(1)			4(25%)
Niphal		1				1(6.25%)
Hitpael						0(0%)
Total	12 (75%)	1(6.25%)	1 (6.25%)	0(0%)	2(12.5%)	16
Paal	2	1	11(1)		2	16(50%)
Piel	1		1		2	4(12.5%)
Hiphil	3(1)		4		1	8(25%)
Niphal		2	1			3(9.375%)
Hitpael			1			1(3.125%)
Total	6 (18.75%)	3(9.375%)	18 (56.25%)	0(0%)	5(15.625%)	32

STORY I	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	3	1	27(1)		2	33 (54.09%)
Piel	2		2(1)		2	6 (9.8%)
Hiphil	4(1)		7		1	12 (19.6%)
Niphal		2	1		1	4 (6.5%)
Hitpael			6			6 (9.8%)
Total	9 (14.7%)	3(4.9%)	43 (70.49%)	0(0%)	6(9.8%)	61

STORY II	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	18(1)	4(1)			4	26 (68.42%)
Piel	3				2	5 (13.15%)
Hiphil	4(2)		1			5 (13.15%)
Niphal	1	1				2 (5.2%)
Hitpael						0 (0%)
Total	26 (68.42%)	5(13.15%)	1 (2.6%)	0(0%)	6(15.7%)	38

B.1.14 CM9

PART I+II+III	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	18(1)				2	20(60.6%)
Piel	5(1)				1	6(18.18%)
Hiphil	5(1)			(1)1		6(18.18%)
Niphal					1	1(3.03%)
Hitpael						0(0%)
Total	28 (84.84%)	0(0%)	0(0%)	1(3.03%)	4(12.12%)	33
Paal	8(1)	1	1			10(71.4%)
Piel	3				1	4(28.5%)
Total	11 (78.5%)	1(7.14%)	1(7.14%)	0(0%)	1(7.14%)	14
Paal	23(2)	1			2	26(92.8%)
Piel	2					2(7.14%)
Total	25 (89.2%)	1(3.5%)	0(0%)	0(0%)	2(7.14%)	28

STORY I	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	41(3)	1			4	45(75%)
Piel	7(1)				1	8(13.33%)
Hiphil	5(1)			1(1)		6(10%)
Niphal					1	1(1.66%)
Hitpael						0(0%)
Total	53 (88.33%)	1(1.66%)	0(0%)	1(1.66%)	6(10%)	60

STORY II	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	22(4)				1	23 (76.6%)
Piel	3				2	5 (16.66%)
Hiphil	2					2 (6.66%)
Niphal						0(0%)
Hitpael						0(0%)
Total	27 (%)	0(0%)	0(0%)	0(0%)	4(0%)	30

B.1.15 CM10

PART I+II+III	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	27(1)	1	2(2)		7	37(74%)
Piel	1				1	2(4%)
Hiphil	6					6(12%)
Niphal		2				2(4%)
Hitpael	3					3(6%)
Total	37 (74%)	3(6%)	2(4%)	0(0%)	8(16%)	50
Paal	8	1				9(81.81%)
Piel						0(0%)
Hiphil	1					1(9.09%)
Niphal						0(0%)
Hitpael	1					1(9.09%)
Total	10 (90.9%)	1(9.09%)	0(0%)	0(0%)	0(0%)	11
Paal	21					21(67.74%)
Piel	3					3(9.6%)
Hiphil	3					3(9.6%)
Niphal		2				2(6.4%)
Hitpael	2					2(6.4%)
Total	29 (93.5%)	2(6.4%)	0(0%)	0(0%)	0(0%)	31

STORY I	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	48(1)	1	2(2)		7	58(71.6%)
Piel	4				1	5(6.17%)
Hiphil	9					9(11.11%)
Niphal		4				4(4.9%)
Hitpael	5					5(6.17%)
Total	66 (81.48%)	5(6.17%)	2(2.46%)	0(0%)	8(9.8%)	81

STORY II	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	20	4	2	2		28(90.3%)
Piel	1					1(3.22%)
Hiphil						0(0%)
Niphal		1				1(3.22%)
Hitpael	1					1(3.22%)
Total	22 (70.9%)	5(16.12%)	2(6.4%)	2(6.4%)	0(0%)	31

B.1.16 CF11

PART I+II+III	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	23(2)	4(2)	2		9	38(48%)
Piel	4					4(5%)
Hiphil	22(10)				3	25(31.6%)
Niphal		3			2	5(6.3%)
Hitpael	6				1	7(8.8%)
Total	55 (69.6%)	7(8.8%)	2(2.5%)	0(0%)	15(18.9%)	79
Paal	12(3)	2			4	18(58%)
Piel	1				2	3(9.6%)
Hiphil	4(4)				4	8(25.8%)
Niphal		2				2(6.45%)
Hitpael						0(0%)
Total	17 (54.8%)	4(12.9%)	0(0%)	0(0%)	10(32.25%)	31
Paal	18(2)	2(1)			8	28(45.16%)
Piel	4				3	7(11.2%)
Hiphil	20(9)			1	2	23(37.09%)
Niphal	1	2			1	4(6.45%)
Hitpael						0(0%)
Total	43 (69.35%)	4(6.45%)	0(0%)	1(1.61%)	14(22.5%)	62

STORY I	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	41(4)	6(3)	2		17	66(46.8%)
Piel	8				3	11(7.8%)
Hiphil	42(19)			1	5	48(34.04%)
Niphal	1	5			3	9(6.38%)
Hitpael	6				1	7(4.9%)
Total	98(69.5%)	11(7.8%)	2(1.4%)	1(7.09%)	29(20.5%)	141

STORY II	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	26(2)	4(1)	1		7	38(55.07%)
Piel	3			2	6	11(15.9%)
Hiphil	13(10)				2	15(21.7%)
Niphal	1	4				5(7.24%)
Hitpael						0(0%)
Total	43(62.3%)	8(11.59%)	1(1.44%)	2(2.89%)	15(21.73%)	69

B.1.17 CM12.6

PART I+II+III	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	25(3)			1	1	27(71.05%)
Piel	6				1	7(18.42%)
Hiphil	2				1	3(7.89%)
Niphal						0(0%)
Hitpael	1					1(2.6%)
Total	34 (89.4%)	0(0%)	0(0%)	1(2.6%)	3(7.89%)	38
Paal	4					4(66.66%)
Hiphil	2					2(33.33%)
Total	6 (100%)	0(0%)	0(0%)	0(0%)	0(0%)	6
Paal	19	1			3	23(62.31%)
Piel	3(1)				1	4(10.8%)
Hiphil	7(2)					7(18.9%)
Niphal	1	2				3(8.1%)
Hitpael						0(0%)
Total	30 (81.08%)	3(8.1%)	0(0%)	0(0%)	4(10.6%)	37

STORY I	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	44(3)	1		1	4	50(66.66%)
Piel	9(1)				2	11(14.66%)
Hiphil	9(2)				1	10(13.33%)
Niphal	1	2				3(4%)
Hitpael	1					1(1.33%)
Total	64 (85.33%)	3(4%)	0(0%)	1(1.33%)	7(9.33%)	75

STORY II	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	15					15(71.42%)
Piel	1		1			2(9.5%)
Hiphil	4					4(19.04%)
Niphal						0(0%)
Hitpael						0(0%)
Total	20 (95.2%)	0(0%)	1(4.76%)	0(0%)	0(0%)	20

B.1.18 CM13.6

PART I+II+III	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	40(1)		1		2	43(57.33%)
Piel	3		1		5	9(12%)
Hiphil	17(6)					17(22.66%)
Niphal	2		2			4(5.33%)
Hitpael	2					2(2.66%)
Total	64(85.33%)	0(0%)	4(5.33%)	0(0%)	7(9.33%)	75
Paal	18				2	20(58.8%)
Piel	3				3	6(17.6%)
Hiphil	6(4)					6(17.6%)
Niphal	1	1				2(5.88%)
Hitpael						0(0%)
Total	28(82.35%)	1(2.9%)	0(0%)	0(0%)	5(14.7%)	34
Paal	17	1	1	1	4	24(61.5%)
Piel	6(2)		1			7(17.9%)
Hiphil	6(1)					6(15.3%)
Niphal	1					1(2.56%)
Hitpael	1					1(2.56%)
Total	31(78.48%)	1(2.56%)	2(5.12%)	1(2.56%)	4 (10.2%)	39

STORY I	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	57(1)	1	2	1	6	67(58.77%)
Piel	9(2)		2		5	16(14%)
Hiphil	23(7)					23(20.17%)
Niphal	3		2			5(4.38%)
Hitpael	3					3(2.63%)
Total	95(83.33%)	1(0.87%)	6(5.26%)	1(0.87%)	11(9.64%)	114

STORY II	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	34(1)		6	2	5	47(61.84%)
Piel	8(2)				2	10(13.15%)
Hiphil	13(1)					13(17.1%)
Niphal	1		3			4(5.16%)
Hitpael	2					2(2.63%)
Total	58(76.3%)	0(0%)	9(11.8%)	2(2.63%)	7(9.2%)	76

B.1.19 CF14.7

PART I+II+III	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	22(1)		1		5	28(57.14%)
Piel	6(1)		1		2	9(18.36%)
Hiphil	8(5)				1	9(18.36%)
Niphal					1	1(2.04%)
Hitpael	1		1			2(4.08%)
Total	37(75.5%)	0(0%)	3(6.12%)	0(0%)	9(18.36%)	49
Paal	6(2)	2(1)	3		5	16(69.56%)
Piel	1					1(4.34%)
Hiphil	4(1)				2	6(26.08%)
Total	11(47.8%)	2(8.69%)	3(13.04%)	0(0%)	7(30.43%)	23
Paal	19	1	5(1)		1	26(74.28%)
Piel	2					2(5.7%)
Hiphil	6					6(17.14%)
Niphal	1					1(2.85%)
Hitpael						0(0%)
Total	28(80%)	1(2.85%)	5(14.28%)	0(0%)	1(2.85%)	35

STORY I	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	41(1)	1	6(1)		6	54(64.28%)
Piel	8(1)		1		2	11(13.09%)
Hiphil	14(5)				1	15(17.85%)
Niphal	1				1	2(2.38%)
Hitpael	1		1			2(2.38%)
Total	65(77.38%)	1(1.19%)	8(9.5%)	0(0%)	10(11.9%)	84

STORY II	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	22(5)	4		1	5	32(72.72%)
Piel	5				1	6(13.63%)
Hiphil	5(2)				1	6(13.63%)
Total	32(72.72%)	4(9.09%)	0(0%)	1(2.27%)	7(15.9%)	44

B.1.20 AF26a

PART I+II+III	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	34(2)	4	5		4	47(70.14%)
Piel	5				2	7(10.44%)
Hiphil	9					9(13.43%)
Niphal		2				2(2.98%)
Hitpael	1		1			2(2.98%)
Total	49(73.13%)	6(8.95%)	6(8.95%)	0(0%)	6(8.95%)	67
Paal	17(3)	1	1		2	21(58.33%)
Piel	5				3	8(22.22%)
Hiphil	4					4(11.11%)
Niphal	1	1				2(5.55%)
Hitpael	1					1(2.77%)
Total	28(77.77%)	2(5.55%)	1(2.77%)	0(0%)	5(13.88%)	36
Paal	17(1)	4	3		4	28(56%)
Piel	4(1)		2		1	7(14%)
Hiphil	9					9(18%)
Niphal	1	1				2(4%)
Hitpael	4					4(8%)
Total	35(70%)	5(10%)	5(10%)	0(0%)	5(10%)	50

STORY I	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	51(3)	8	8		8	75(64.1%)
Piel	9(1)		2		3	14(11.9%)
Hiphil	18					18(15.38%)
Niphal	1	3				4(3.41%)
Hitpael	5		1			6(5.12%)
Total	84(71.19%)	11(9.4%)	11(9.4%)	0(0%)	11(9.4%)	117

STORY II	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	28(1)	2			1	31(58.49%)
Piel	8		1		1	10(18.86%)
Hiphil	6(1)					6(11.3%)
Niphal	2	2				4(7.54%)
Hitpael	1		1			2(3.77%)
Total	45(84.9%)	4(7.54%)	2(3.77%)	0(0%)	2(3.77%)	53

B.1.21 AF26b

PART I+II+III	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	5(1)	1	18	1	1	26 (37.68%)
Piel	2(1)		5(1)		4	11 (15.94%)
Hiphil	1		11(4)	2	2	16 (23.18%)
Niphal	2	6			1	9 (13.04%)
Hitpael	1		5		1	7 (10.14%)
Total	11(15.94%)	7(10.14%)	39(56.52%)	3(4.34%)	9(13.04%)	69
Paal	20				2	22 (55%)
Piel	7(1)				1	8 (20%)
Hiphil	8(2)					8 (20%)
Niphal						(%)
Hitpael	2					2 (5%)
Total	37(92.5%)	0(0%)	0(0%)	0(0%)	3(7.5%)	40
Paal	25(1)	2	1		6	34 (60.71%)
Piel	1(1)		1		3	5 (8.92%)
Hiphil	12(4)				1	13 (2.32%)
Niphal	1	2				3 (5.35%)
Hitpael	1(1)					1 (1.78%)
Total	40(71.42%)	4(7.14%)	2(3.57%)	0(0%)	10(17.8%)	56

STORY I	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	30(2)	3	19	1	7	60 (48%)
Piel	3(2)		6(1)		7	16 (12.8%)
Hiphil	13(4)		11(4)	2	3	29 (23.2%)
Niphal	3	8			1	12 (9.6%)
Hitpael	2(1)		5		1	8 (6.4%)
Total	51(40.8%)	11(8.8%)	41(32.8%)	3(2.4%)	19(15.2%)	125

STORY II	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	56(2)(h1)	2	1	1	3	64 (65.9%)
Piel	9(1)					9 (9.27%)
Hiphil	14(3)				3	17 (17.52%)
Niphal	2	3				5 (5.15%)
Hitpael	2					2 (2.06%)
Total	84(86.59%)	5(5.15%)	1(1.03%)	1(1.03%)	6(6.18%)	97

B.1.22 AF26c

PART I+II+III	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	32(2) (h4)		1	2	3	42 (50.6%)
Piel	2 (h1)				3	6 (7.22%)
Hiphil	18(7) (h5)		1		4	28 (33.73%)
Niphal		2			1	3 (3.61%)
Hitpael	2		1		1	4 (4.81%)
Total	64 (77.1%)	2(2.4%)	3(3.6%)	2(2.32%)	12(14.45%)	83
Paal	17(h2)		1			20 (66.66%)
Piel	1				1	2 (6.66%)
Hiphil	4 (h1)				1	6 (20%)
Niphal						(%)
Hitpael	2					2 (6.66%)
Total	27 (90%)	0(0%)	1(3.33%)	0(0%)	2(6.66%)	30
Paal	40(1)	4	4	3	1	52 (70.27%)
Piel	4(1)				2	6 (8.1%)
Hiphil	7(1)					7 (9.45%)
Niphal	2	3				5 (6.75%)
Hitpael	1		1		2	4 (5.4%)
Total	54(72.97%)	7(9.45%)	5(6.75%)	3(4.05%)	5(6.75%)	74

STORY I	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	72(3) (h4)	4	5	5	4	94(59.87%)
Piel	6(1) (h1)				5	12(7.64%)
Hiphil	25(8) (h5)		1		4	35(22.29%)
Niphal	2	5			1	8(5.09%)
Hitpael	3		2		3	8(5.09%)
Total	118(75.15%)	9(5.73%)	8(5.09%)	5(3.18%)	17(10.82%)	157

STORY II	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	67(2) (h2)	1	1	2	2	75(75.75%)
Piel	6 (h1)				3	10(10.1%)
Hiphil	6				2	8(8.08%)
Niphal	1	1				2(2.02%)
Hitpael	3		1			4(4.04%)
Total	86(86.86%)	2(2.02%)	2(2.02%)	2(2.02%)	7(7.07%)	99

B.1.23 AF28

PART I+II+III	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	37(2)	2	5	5(1)	10	59(60.82%)
Piel	5		3		3	11(11.34%)
Hiphil	16(7)					16(16.49%)
Niphal	1	2			1	4(4.12%)
Hitpael	7					7(7.2%)
Total	66(68.04%)	4(4.12%)	8(8.24%)	5(5.15%)	14(14.4%)	97
Paal	24(3)	1	3	4(1)	3	35(60.34%)
Piel	4(1)		1		2	7(12.06%)
Hiphil	11(3)		1			12(20.68%)
Niphal	1		1		2	4(6.89%)
Hitpael						0(0%)
Total	40(68.96%)	1(1.72%)	6(10.34%)	4(6.89%)	7(12.06%)	58
Paal	49(1)	1	3	2	2	57(66.27%)
Piel	7		2	1	1	11(12.79%)
Hiphil	7(1)			1	1	9(10.46%)
Niphal	1					1(1.16%)
Hitpael	8					8(9.3%)
Total	72(83.72%)	1(1.16%)	5(5.81%)	4(4.65%)	4(4.65%)	86

STORY I	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	86(3)	3	8	7(1)	12	116(63.38%)
Piel	12		5	1	4	22(12.02%)
Hiphil	23(8)			1	1	25(13.66%)
Niphal	2	2			1	5(2.73%)
Hitpael	15					15(8.19%)
Total	138(75.4%)	5(2.73%)	13(7.1%)	9(4.91%)	18(9.83%)	183

STORY II	Past	Ambiguous	Present	Future/Imp	Infinitive	Total
Paal	74(1)	4	4(1)	8	5	95(62.9%)
Piel	14		2	1	3	20(13.24%)
Hiphil	20(8)		1			21(13.9%)
Niphal	2	4			1	7(4.63%)
Hitpael	7				1	8(5.29%)
Total	117(77.4%)	8(5.29%)	7(4.63%)	9(5.59%)	10(6.62%)	151

Appendix C

Hebrew transcription

alef	bet	gimel	dalet	heh	vav	zain	chet	tet	yod
a	b,b̆	g	d	h	v	z	x	t	y
a	b,v	g	d	h	v	z	ch	t	y
kaf	lamed	mem	nun	samech	ayin	pe	tsadi	kof	resh
k,k̆	l	m	n	s	’	p,p̆	c	q	r
k,kh	l	m	n	s	’	p,f	ts	q	r
shin	tav								
s,š	t								
s,sh	t								

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