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**The psycholinguistics of verbal diathesis: the transitive-  
unaccusative alternation**

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by  
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## **Abstract**

The relationship between different linguistic manifestations of an eventuality denoting concept, referred to in the literature as diatheses or voices, is a well-studied topic in theoretical linguistics. Among researchers studying this phenomenon, it is widely agreed that there is a systematic, rule-governed relationship between the various diatheses of a concept. However, the nature of these relationships is at constant theoretical debate.

This dissertation aims to demonstrate that psycholinguistic research can shed light on theoretical debates regarding derivational relationships by means of examining how speakers perceive them. It addresses two central defining aspects of verbal diathesis: (i) sporadic gaps in the regularity of a derivational alternation (ii) the directionality of the operation which creates it, and reports the findings of a psycholinguistic study designed to examine how derivational relationships reflect on speakers' perception. In addition, as the empirical array for this purpose was the much-debated relationship between unaccusative verbs and their transitive equivalents, this research also provides a glimpse into speakers' perception of this particular derivational alternation.

First, I present the transitive-unaccusative alternation and overview the theoretical models suggested to account for this relationship, categorized according to the directionality route they propose: (a) 'root-based theories', which suggest a non-directional relationship in which both diatheses are separately derived from the same root (b) 'unaccusative-to-transitive' theories which argue for a derivation of a transitive output from an unaccusative input (c) 'transitive-to-unaccusative' theories claiming that an unaccusative output is derived from a transitive input. After

presenting this derivational relationship, I turn to cases in which it cross-linguistically exhibits sporadic gaps. I then present two logically possible accounts for these gaps (a) ‘non-existence’ accounts (b) ‘hidden-representation’ accounts, and review their implementations with regard to this specific alternation. I suggest that the validity of these two types of accounts can be psycholinguistically examined. Accordingly, I introduce GABLE (Graded Accessibility By Lexical Encoding), a general hypothesis about the relation between lexical encoding and the conceptual system, and report a series of experiments (experiments 1-3) I constructed and ran to test the predictions of this hypothesis. The theoretical implications of my findings are then discussed. Specifically, I show that the observed performance patterns support the psychological reality of a ‘hidden representation’ account for gaps in this alternation.

I then continue to the issue of derivational directionality. I present ICE (Input Contextual Effect), a general hypothesis regarding the contextual effect a basic entry should have on the retrieval of its corresponding derived alternate, and discuss its predictions regarding the transitive-unaccusative alternation. A series of cross-modal lexical priming experiments (experiments 4-6) I designed and ran to test the predictions of ICE is then reported and the theoretical implications of its findings are discussed. Specifically, I argue that based on how speakers perceive this alternation, transitive verbs are derivationally basic, while their unaccusative equivalents are derived.

The primary argument of this dissertation is that since the research of derivational relationships aims to provide model representations of psychologically real processes, theoretical debates about their attributes should be addressed by means of psycholinguistic research. Using the transitive-unaccusative alternation, the



current study demonstrates that this is not an impossible task and introduces new methodological designs, specifically developed and elaborated for this purpose.

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## Chapter 1: Introduction

### 1.1 Goals

General concepts denoting an eventuality can be linguistically expressed by various types of predicates. The eventuality concept of ‘closing’, for example, can be realized as a transitive verb, as an unaccusative verb, as a verbal passive, as an adjectival passive and as a middle:

Concept of ‘closing’

- (1) Transitive: Mary *closed* the door.
- (2) Unaccusative: The door *closed*.
- (3) Verbal passive: The door was *closed* by Mary.
- (4) Adjectival passive: The boy looked at the *closed* door.
- (5) Middle: Expensive doors *close* elegantly.

In the literature, there is a wide consensus that the various grammatical shapes an eventuality-denoting concept can take, referred to as diatheses or voices, are derivationally related. It is therefore a widely held assumption that there is a systematic, rule-governed, connection between different diatheses of the same eventuality concept (Harley 1995; Levin & Rappaport 1995; Pesetsky 1995; Marantz 1997; Chierchia 2004; Reinhart & Sioni 2005; Ramchand 2006; Horvath & Sioni 2008; Koontz-Garboden 2009, among others).

The objective of this study is to investigate the perception of two defining aspects of these systematic relationships: (i) derivational gaps in their regularity (ii) the directionality of the relation, as explained below.

### 1.1.1 Derivational Gaps

The first aspect of derivational alternations I examine is sporadic gaps: cases in which one alternate is idiosyncratically absent from the vocabulary of a certain language. This is a frequently observed phenomenon that is rarely given an explicit account in the literature, even though addressing sporadic gaps in a derivational alternation is essential for the characterization of its *regularity*. Consider, for example, unaccusative verbs and their transitive alternates. A model which views these voices as derivationally related is not complete if it does not account for the fact that in English, for instance, the unaccusatives *roll* and *close* have a transitive alternate while the unaccusatives *fall* and *vanish* do not:

- (6) a. The ball rolled.
- b. The girl/wind rolled the ball.
- (7) a. The door closed.
- b. The girl/wind closed the door.
- (8) a. The vase fell.
- b. \*The girl/wind fell the vase.
- (9) a. The diamonds vanished.
- b. \*The girl/earthquake vanished the diamonds.

If unaccusative and transitive verbs are connected by a systematic rule, the fact that some transitive equivalents of existing unaccusatives are absent from the English vocabulary cannot be overlooked. A complete analysis of this alternation would have to take a stand regarding this absence.

A priori, two types of approaches are possible:

I. The derivational rule is an operation that is not always productive, therefore some forms do not exist (Arad 2005); let us label this view ‘the nonexistence approach’.

II. There is a mechanism that sporadically excludes some lexical entries from the vocabulary of a certain language (Halle 1973; Jackendoff 1975; Reinhart 2002, 2010; Horvath & Siloni 2008); let us label it ‘the hidden representation approach’.

When discussing the latter approach I adopt Horvath and Siloni's (2008) terminology, which distinguishes between “the mental lexicon” – a component of grammar consisting of lexical entries – and “the actual vocabulary” of a particular language – the set of words speakers use. Accordingly, I define *hidden lexical entries* as forms that do not exist in the vocabulary of a language, but are assumed to have a representation in the mental lexicon.

Hidden lexical entries are often perceived as an ad hoc, unfalsifiable theoretical tool, whose postulation should be avoided (Aronoff 1976, Anderson 1992). Lacking a corresponding vocabulary item, these forms are always hidden in the mental lexicon and are never used in an utterance. Consequently, there appears to be no way of providing psycholinguistic evidence for their existence. The first goal of this study is thus to demonstrate that the assumption of hidden lexical entries is not unfalsifiable by the means of a psycholinguistic research designed to decide between ‘the nonexistence approach’ and ‘the hidden representation approach’.

In chapter 3 I argue that given the common assumption that the lexical component of a language interfaces with the conceptual system (Fodor 1975; Pinker 1994; Sperber & Wilson 1997, among others), it is not unreasonable to assume that lexical encoding affects the perception of the corresponding concept, i.e. the mental notion equivalent to it. Therefore, keeping in mind that the language faculty interacts with other components of the human cognitive system, the existence of a lexical representation should be traceable even when there is no direct evidence for it, i.e. no corresponding vocabulary item. Based on this assumption, I conducted an experimental study that

explores the psychological reality of hidden lexical entries. My empirical array for this purpose was the well-examined transitive-unaccusative alternation used here as a case study. The targeted population was adult native Hebrew speakers. As I show below, in addition to demonstrating that hidden lexical entries are not unfalsifiable theoretical constructs, the results of this investigation support the psychological reality of the hidden lexical entries mechanism suggested by Reinhart (2002, 2010) and Horvath and Siloni (2008).

### ***1.1.2 Directionality***

The second defining aspect of derivational alternations I explore in this study is the *directionality* of the derivation. As opposed to the issue of derivational gaps, derivational directionality is frequently debated: is one alternate derived from the other or is it the case that both originate from a single common source? If the former approach is correct, which is the basic alternate and which the derived one? If the latter is correct, what is the basic source? Different models anchored within diverse theoretical frameworks provide various conceptual, theoretical and distributional arguments to favor one derivational directionality route over the other (Chierchia 1989, 2004; Harley 1995; Levin & Rappaport 1995; Pesetsky 1995; Marantz 1997, 2007; Reinhart 2002, 2010; Doron 2003; Reinhart & Siloni 2003, 2005; Arad 2005; Ramchand 2006; Horvath & Siloni 2008, 2011; Koontz-Garboden 2009; Rappaport-Hovav & Levin 2011, among others).

The second goal of this study is therefore to show that psycholinguistic research can shed light on this aspect of derivational relationships as well. As the various views on derivational relationships were not formed to be purely theoretical entities but to constitute a model representation of psychologically real processes, I hold that derivational relationships should be reflected in speakers' perception. Accordingly,



this research aims to provide insight into what alternate, if any, speakers perceive as derivationally more basic.

In chapter 4 I present a cross-modal lexical priming study designed to examine how speakers perceive the directionality of derivational relationships. Here as well, the transitive-unaccusative alternation was employed as a case study and the targeted population was adult native Hebrew speakers. As will be discussed below, the findings of this empirical examination suggest that transitive verbs are perceived as derivationally basic, while their unaccusative equivalents are perceived as derived.

## **1.2 Outline**

This dissertation is structured as follows: chapter 2 describes the linguistic phenomenon this research uses as a case-study, namely the transitive-unaccusative alternation. Accordingly, 2.3 provides an overview of the theoretical models suggested to account for this relationship categorized according to the directionality route they propose: (a) a non-directional relationship in which both diatheses are separately derived from the same root (Harley 1995; Marantz 1997, 2007; Alexiadou et al 2004; Doron 2004; Arad 2005) (b) a derivation of a transitive output from an unaccusative input (Pesetsky 1995; Ramchand 2006; Rappaport-Hovav & Levin 2011) (c) a derivation of an unaccusative output from a transitive input (Chierchia 1989, 2004; Levin & Rappaport 1995; Reinhart 2002, 2010; Reinhart & Siloni 2003, 2005, Horvath & Siloni 2008, 2011; Koontz-Garboden 2009). Having presented the various possible approaches, section 2.4 discusses sporadic instances where the transitive alternate is absent, and compares the ‘non-existence’ account provided to these cases by Arad (2005) to the ‘hidden-representation’ account suggested by Reinhart (2002, 2010) and Horvath and Siloni (2008).

Chapter 3 reports the finding of a psycholinguistic study I designed to compare the validity of these two accounts. In 3.1 I suggest GABLE (Graded Accessibility By Lexical Encoding), a general hypothesis about the relation between lexical encoding and the conceptual system, and discuss its predictions regarding the transitive-unaccusative alternation. In 3.2, 3.3 and 3.4 I describe experiments 1-3, which were constructed to test the predictions of GABLE. Section 3.5 brings a summary of the performance patterns observed in experiments 1-3 and a general discussion of their theoretical implications.

Chapter 4 turns to the issue of derivational directionality. In 4.1 I present ICE (Input Contextual Effect), a general hypothesis regarding the contextual effect a basic entry should have on the retrieval of its corresponding derived alternate, and discuss its predictions regarding the transitive-unaccusative alternation. In 4.4, 4.5 and 4.6 I describe a series of cross-modal lexical priming experiments (henceforth: experiments 4-6). These experiments were designed and run to test the predictions of ICE. In Section 4.7 I summarize the performance patterns observed in experiments 4-6 and discuss their theoretical implications.

Finally, chapter 5 discusses the methodological implications of this study for future research.

## Chapter 2: Unaccusative verbs and their transitive counterparts

### 2.1 Unaccusativity

Ever since the formulation of the unaccusative hypothesis by Perlmutter (1978), unaccusativity has been a topic of much research. The notion that the class of intransitive verbs includes two distinct sub-types, *unaccusative* verbs (*break, vanish, roll*, sometimes referred to as *inchoative* verbs) and *unergative* verbs (*walk, run, sing*) was the target of many analyses within different frameworks and views of grammar.

A very general definition of unaccusative verbs is that they are intransitive verbs with a Theme argument that lack the ability to assign accusative case. Within the principles and parameters framework (Chomsky 1981), it is argued that their Theme argument initially merges as the verb's complement and arrives at the external argument's position by syntactic movement. Thus, while the subcategorization frame of unergative verbs is assumed to be [NP \_] the one assumed for unaccusatives is [\_ NP/CP] (Perlmutter 1978; Chomsky 1981; Burzio 1986; Chierchia 1989; Reinhart 1991; Borer 1994; Levin & Rappaport 1995; Pesetsky 1995; Reinhart 2002, 2010; Alexiadou et al 2004; Reinhart & Siloni 2005; among many others).

This analysis is supported by the fact that the subject of unaccusative verbs is crosslinguistically recognized as an internal argument by various internality-detecting diagnostics, while that of unergatives is diagnosed as externally mapped. Consider, for example, the following diagnostics and judgments from English, Hebrew, Italian and Russian:

- (10) English: Agent nominals (*-er* nominals) can be derived only from verbs with an external argument (Reinhart & Siloni 2005):

a.\*She moves so gracefully because she is an experienced mover.

(Unaccusative)

b. She runs so fast because she is an experienced runner. (Unergative)

- (11) Hebrew: possessive datives can only modify internal arguments (Borer & Grodzinsky 1986; Reinhart & Siloni 2005):

a. ha-sefer nafal le-dan (Unaccusative)

the-book fell to-Dan

‘Dan's book fell.’

b. \* ha-kelev šaxav le-dina (Unergative)

the-dog lay to-Dina

(Does not mean: Dina's dog lay)

- (12) Italian: *ne*-cliticization is only possible with underlying objects (Belletti & Rizzi 1981; Burzio 1986):

a. ne arriveranno molti (Unaccusative)

of-them will-arrive many

‘Many of them will arrive.’

b. \*ne telefoneranno molti (Unergative)

of-them will-telephone many

- (13) Russian: internal arguments but not external ones can receive genitive case under negation (Pesetsky 1982; Reinhart & Siloni 2005):

a. ne objavilos' studentov (Unaccusative)

NEG showed-up students- GEN

‘No students showed-up.’

b. \*ne tancevalo studentov (Unergative)

NEG danced students- GEN

Further reinforcement for the unaccusative/unergative split comes from psycholinguistic and neurolinguistic studies: Friedmann, Taranto, Shapiro and Swinney (2008) found that the subject of unaccusative verbs, but not that of unergatives, is reactivated after the verb, which provides direct evidence in favor of the hypothesis that the former, but not the latter is internally mapped. Furthermore, according to neuroimaging research by Shetreet, Friedmann and Hadar (2010) different activation patterns reveal that the brain distinguishes between unaccusative and unergative verbs; an eye-tracking study by Lee and Thompson (2011) revealed that the processing of unaccusatives is distinct from that of unergatives among individuals with agrammatism as well as healthy subjects.

There are, of course, other views. One example is Van Valin (1990) who believes that unaccusativity should be given a semantic analysis and need not be encoded in the syntax (labeled by Levin and Rappaport 1995 a 'semantic approach'). Another example is Sorace (1995, 2000), who argues for a completely different concept of unaccusativity. According to her view there isn't a distinct, unaccusative, subset of intransitive verbs, but an unaccusativity hierarchy scale, based on aspectual and thematic properties, with unaccusatives and unergatives on its edges and ambiguous intransitives in the middle.

The current research adopts the former view of unaccusativity, i.e. it assumes that unaccusatives are a distinct subtype of intransitives and that their unique characteristics are reflected in the syntactic mapping of their arguments.

## 2.2 The transitive-unaccusative alternation

A prominent crosslinguistic fact about unaccusative verbs is that they tend to have a transitive alternate<sup>1</sup>, a phenomenon I will refer to as the transitive-unaccusative alternation:

### English

- (14) a. The window broke. (Unaccusative)  
 b. The girl/stone broke the window. (Transitive)
- (15) a. The ball rolled. (Unaccusative)  
 b. The girl/wind rolled the ball. (Transitive)

### Hebrew:

- (16) a. ha-kadur hitgalgel (Unaccusative)  
 the-ball rolled  
 'The ball rolled.'
- b. roza/ ha-ru'ax gilgela 'et ha-kadur (Transitive)  
 Roza/ the-wind rolled-TRANS ACC the-ball  
 'Roza/the wind rolled the ball.'
- (17) a. ha-'agartal nafal (Unaccusative)  
 The-vase fell  
 'The vase fell.'
- b. ha-tinok/kadur hipil 'et ha-'agartal (Transitive)  
 The-baby/ball fall-TRANS ACC the-vase  
 'The baby/ ball caused the vase fall.'

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<sup>1</sup> For a discussion of exceptions to this rule are see 2.4 below.

The transitive-unaccusative alternation inspired researchers to assume a derivational relationship between the two alternates (Levin & Rappaport 1995; Harley 1995; Pesetsky 1995; Marantz 1997, 2007; Reinhart 2002, 2010; Doron 2003; Reinhart & Siloni 2003, 2005; Chierchia 2004; Arad 2005; Alexiadou et al 2006; Ramchand 2006; Horvath & Siloni 2008, 2011; Pylkkänen 2008; Koontz-Garboden 2009 among many others).

The views regarding the nature of this relationship vary. Some theories consider both alternates to originate from a third, abstract, linguistic entity, while others consider one of the alternates to be derived from the other. I will refer to the former type of theories as *root-based theories* and to the latter as *transitive-to-unaccusative theories* and *unaccusative-to-transitive theories*, according to the direction of the derivation they suggest. In the following section, I present an overview of these three types of analyses.

## 2.3 Views of directionality<sup>2</sup>

### 2.3.1 *Root-based theories- no directionality*

According to *root-based* theories, the derivational relationship between unaccusatives and their transitive alternates is not the result of one of them being created from the other, but rather that they both originate from the same abstract root. Accordingly, these models provide a distinct structural representation for each alternate (as will be seen in Figure 1 below). In addition, root-based analyses share the assumption that the primitives mapped to the syntax are category neutral ‘atomic roots’ and functional heads/features, which merge together in the syntactic

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<sup>2</sup> For another overview of various analyses for the transitive-unaccusative alternation, see Schäfer (2009).

component, the only operative (computational) component of the grammar. These analyses thus adopt the assumptions about grammar made within the framework of Distributed Morphology (Halle & Marantz 1993; Marantz 1997) and other syntactocentric approaches, such as Borer (2003).

This type of analysis can be found in Arad's (2005) study of the morpho-syntax of Hebrew. Similarly to other root-based theories, Arad views the mental lexicon as populated by roots and functional features. Roots become words only after they have merged with a category determining head in the syntax. In the case of verbalized roots, their unaccusative or transitive properties are determined by the type of verbalizing head that attaches to them. Importantly, the relationship between the transitive and the unaccusative alternates associated with the same concept is viewed as the direct result of the fact that both originate from the same root. Schematized in figure 1 below, is the structure Arad (2005) proposes for alternating transitive-unaccusative pairs. Notice that the transitive alternate is a combination of the root with a transitive verbalizing head (V causative) and the unaccusative is a combination of the root with an unaccusative verbalizing head (V inchoative), thus neither of them is contained within the other:

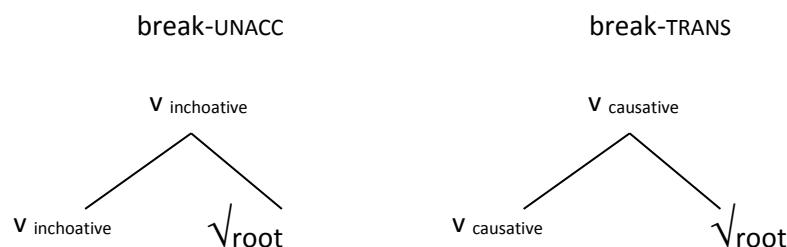


Figure 1

Root-based analyses are also suggested by Doron (2003), Harley (1995) and



Marantz (1997, 2007). According to Doron (2003) verbal alternations originate from the same root, but differ with respect to the functional heads that attach to it. Harley (1995) and Marantz (1997, 2007) suggest that transitive *v*Ps are projected by a causative little-*v*, while unaccusative *v*Ps are projected by a distinct, unaccusative little-*v* which selects no external argument.

Another approach I choose to label root-based is offered by Alexiadou, Anagnostopoulou and Schäfer (2006), who classify their view as anti-derivational. Building on Kratzer (2004), they take [Voice [CAUS [Root]]] to be the core structure of all change of state verbs (among which are unaccusatives and their transitive alternates), where CAUS introduces a causal relation between a causing event and the resultant state, while Voice is responsible for the introduction of the external argument. Roots are classified with regard to their encyclopedic semantics: agentive (*murder*), internally caused (*blossom*), externally caused (*destroy*), and unspecified cause (*break*). All types of roots combine with CAUS, and their external or internal causation property determines what types of Voice head (agentive, non agentive, no voice head) they can be combined with. Languages differ with respect to the possible CAUS-Voice combinations they allow, which results in crosslinguistic variation in verbal inventory. For example, an unaccusative verb created from an externally caused root ‘destroy’ and a non-agentive Voice head exists in Greek and Hebrew (*katasterfo* and *neheras*, respectively) but is absent from English and German, since non-agentive Voice can be used to create unaccusative verbs in the former languages but not in the latter.

Importantly, according to Alexiadou et al, the difference between unaccusatives and their transitive alternates is due to the specific Voice head attached to the root, which depends on both the root's encyclopedic meaning and

the specific language. Thus, this analysis does not assume one alternate is derived from the other, nor does it suggest a fixed structure where one of the alternates is more basic; hence, it falls under the definition of root-based approaches presented above.

### ***2.3.2 Unaccusative-to-transitive theories***

I define *unaccusative-to-transitive theories* as analyses which view the unaccusative alternate as more basic than its transitive counterpart and provide the former with a structural representation embedded in that of the latter. Unaccusative-to-transitive approaches are suggested by Pesetsky (1995) and Ramchand (2006), who argue that the transitive alternate is the product of adding a cause element to an intransitive. According to Pesetsky (1995), unaccusatives are the basic forms and the derivation of their transitive alternates is created by an addition of a CAUS affix.

In Ramchand's (2008) system, the notion of verb is always a composite which involves some or all of the following categorical elements that project inside the verb phrase: *init* ('initiation', which is associated with the causation event and licenses the external argument), *proc* (which specifies the nature of the change or process and licenses the entity undergoing it) and *res* (which gives the 'telos' or 'the result state' of the event and licenses the argument that comes to hold the result state). The process responsible of the transitive-unaccusative alternation is 'causativization', which involves the addition of a *init* feature in the syntax to lexical entries that do not already possess one, such as the unaccusative *break* [*proc*, *res*], for example. The resulting structure is schematized in figure 2, a [*init*, *proc*, *res*] *initP* which embeds the original intransitive [*proc*, *res*] *procP*.

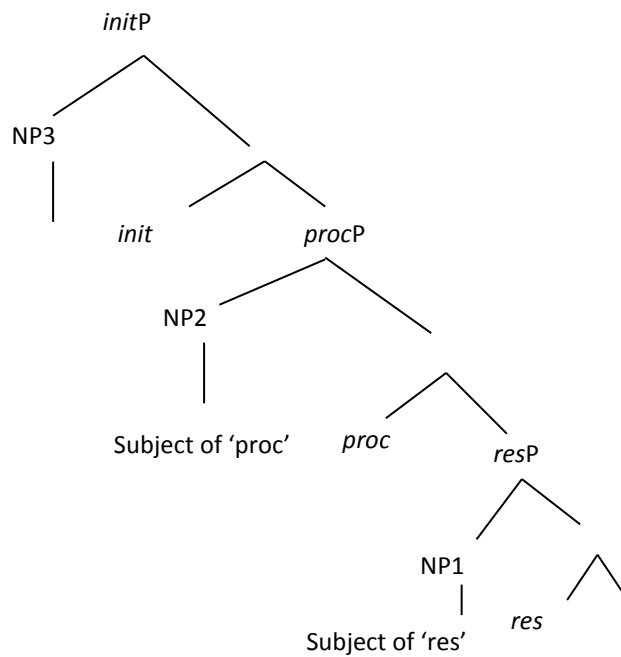


Figure 2

Finally, Rappaport-Hovav and Levin (2011) argue that alternating English verbs do not impose selectional restrictions on the subject of their transitive (‘causative’) variant while, for the Theme argument, it is possible to isolate a constant element of change (for example, ‘open’: removing an obstruction to allow access to a formerly inaccessible space). They propose that the latter is the only information these verbs lexicalize and that the properties of the transitive variant's subject are determined fully by the context. Accordingly, they provide this alternation with an unaccusative-to-transitive analysis which suggests that the transitive variant of these verbs is created by an addition of a Cause argument to the syntactic structure projected by their unaccusative variant.

### 2.3.3 Transitive-to-unaccusative theories

The third class of theories view the unaccusative alternate as derived from its transitive counterpart by manipulation on the input's external argument.

Chierchia (1989, 2004) views the relation between unaccusatives and their transitive alternates as the result of an operation on the transitive alternate's theta-grid, specifically, an operation of reflexivization that identifies the external and internal roles of the transitive alternate, forming a single, internally mapped argument that is later externalized via NP movement. Following Chierchia's view, Koontz-Garboden (2009) (henceforth K-G) suggests that at least in some languages, unaccusative verbs are created from their transitive alternates via 'anticausativization by reflexivization', a semantic operation which unifies the Theme participant and the cause participant of the transitive verb.<sup>3</sup> The following is the semantic representation of the transitive Spanish *romper* 'break', and the semantic representation of its unaccusative alternate *romperse*, in which the cause participant *EFFECTOR* and the Theme participant *THEME* apply to the same individual:

(18)

Basic alternate: transitive *romper*

$[[romper]] = \lambda x \lambda y \lambda s \lambda e [\exists v [CAUSE(v, e) \wedge EFFECTOR(v, y) \wedge BECOME(e, s) \wedge THEME(s, x) \wedge not\_whole(s)]]$

Derivationally complex alternate: unaccusative *romperse*

$[[romperse]] = \lambda x \lambda s \lambda e [\exists v [CAUSE(v, e) \wedge EFFECTOR(v, x) \wedge BECOME(e, s) \wedge THEME(s, x) \wedge not\_whole(s)]]$

Another transitive-to-unaccusative analysis is suggested by Levin and Rappaport (1995). This analysis considers the set of unaccusatives labeled 'externally caused' to

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<sup>3</sup> Koontz-Garboden's analysis is somewhat morpho-phonologically driven. Thus he hesitates to argue that in languages where this alternation is not coded by overt morphology on the unaccusative verb (English, for example) unaccusatives are also derived by anticausativization.

be derived by lexical binding, an operation on the verb's lexical semantic representation (LSR), which includes a causing sub-event and a central sub-event. As schematized in (19) below, lexical binding applies to the transitive lexical entry's external cause in the mapping from LSR to argument structure, thus preventing the external argument's placement in argument structure.

(19) break. TRANS

LSR:	[[x DO SOMETHING] CAUSE [y BECOME BROKEN]]	
Linking rules	↓	↓
Argument structure	x	< y >

break. INTRANS

LSR:	[[x DO SOMETHING] CAUSE [y BECOME BROKEN]]	
	↓	
<b>Lexical binding</b>	<b>∅</b>	
Linking rules		↓
Argument structure		<y>

Similarly to Chierchia (1989, 2004) the analysis of unaccusative verbs proposed by Reinhart (2002, 2010), Reinhart and Siloni (2003, 2005) and Horvath and Siloni (2008, 2011) argues that a manipulation of the transitive theta grid is the source of the relationship between unaccusatives and their transitive counterparts.

As will be discussed in more detail in 2.4.2 below, following Pesetsky (1995), this view distinguishes between one-place unaccusatives and two-place unaccusatives. It suggests that while the latter are underived entries, one-place unaccusative verbs are derived from transitive verbs with a Cause external theta role: a theta role undefined with regard to mental state, which can therefore be assigned to either an animate or

an inanimate argument. This contrasts with the Agent external theta role. For example, *open* assigns a Cause theta role to its external argument while *eat* assigns an Agent theta role to its external argument. Consequently, (20)a, which has an animate argument in the external position is grammatical while (21)b, which has an inanimate argument in this position is not. Importantly for this analysis, as shown in (21)c, verbs like *eat* (also *sing*, *paint* etc.) do not have an unaccusative alternate:

- (20) a. Max opened the door.  
       b. The wind opened the door.
- (21) a. Max ate the soup.  
       b.\*The spoon ate the soup.  
       c.\* The soup ate.

According to this view, then, transitive verbs with a Cause external role serve as input for the lexical operation of **d**ecausatization. This operation, as shown in (22), eliminates the transitive entry's external theta role (as well as its accusative case feature) altogether:

- (22) Transitive:  $V_{ACC} (\theta_{Cause} \theta_{Theme}) \rightarrow$  Unaccusative:  $V \theta_{Theme}$

### 2.3.4 Summary

As described above, the derivational relationship between unaccusative verbs and their transitive counterparts has been provided with numerous analyses, suggesting one of the following derivational directionality routes: a transitive-to-unaccusative derivation, an unaccusative-to-transitive derivation or a separate derivation from one mutual abstract root. In chapter 4 I present a series of experiments specifically designed to examine which of these three approaches is consistent with speakers' perception of this derivational relationship.

However, let us first address the issue of sporadic derivational gaps.

## 2.4 Sporadic gaps in the transitive-unaccusative alternation

The transitive-unaccusative alternation, like other derivational alternations, exhibits derivational gaps. As illustrated and listed below for English and Hebrew, there are cases in which the transitive counterpart of the unaccusative verb is idiosyncratically missing from the vocabulary of the language:

(23) a. The vase fell.

b. \*The wind/ girl fell the vase

(24) a. The spot vanished.

b. \*The cleaners/ detergent vanished the spot

(25) a. ha-cemax naval

(Hebrew)

the-plant wilted

‘The plant wilted.’

b. \*ha-zman/ganan hinbil/nibel<sup>4</sup> 'et ha-cemax

the-time/gardner wilt-TRANS ACC the-plant

‘Time/the gardener caused the plant to wilt.’

(26) Further examples for non-alternating unaccusatives<sup>5</sup>:

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<sup>4</sup> These non-existent Hebrew verbs are given in the *CiCeC* and *hiC.CiC* verbal templates, which are typical of Hebrew transitive verbs.

<sup>5</sup> When referring to Hebrew verbs outside of a sentence I use their citation form, which is past tense, third person singular masculine. When referring to English verbs outside of a sentence I use the present tense.

**Hebrew:** *hirkiv* ‘get rotten’, *kamaš* ‘wither’, *daha* ‘fade’, *hexmic*<sup>6</sup> ‘turn sour’, *hexlid* ‘becomee rusty.’ **English** (from Friedmann et al 2008): appear, arise, arrive, stand, emerge, depart, exist, disappear, and flower.

The gaps presented above occur sporadically. First, they idiosyncratically appear in a certain language and not in others, hence their absence from the vocabulary cannot be explained semantically. The items *fall*, *vanish* and *wilt*, for example, do not have a transitive counterpart in English, but have a transitive alternate in other languages (e.g., *Hebrew: hipil* and *he'elim*; *Hungarian: elhervaszt*, respectively, from Horvath and Siloni 2008). Therefore it is unreasonable to consider the semantics of these transitives as the cause of their absence from the vocabulary of English. In addition, the morpho-phonology of these verbs can also be discarded as the reason they lack a vocabulary item. First, in English the transitive and unaccusative forms are identical; so there could be no morpho-phonological reason for ruling out the one but not the other. Second, in Hebrew the unaccusative *nafal* ‘fall’, for instance, has a transitive counterpart in the vocabulary (*hipil*) while the phonetically minimally different *naval* ‘wilt’ does not.<sup>7</sup> Finally, the process of “blocking” (Aronoff 1976, Parsons 1990 and Embick & Marantz 2008) in which a morphological rule is blocked when its output is semantically equivalent to an already existing item, is also not likely to be source of these gaps, since in the case of the unaccusatives presented above, there are no

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<sup>6</sup> *hexmic* is ambiguous between ‘turned sour’ (an unaccusative) and ‘pickled’ (a transitive). But the latter is not the transitive alternate of the former.

<sup>7</sup> Some of the Hebrew unaccusatives presented in (26) (e.g. *hirkiv*, *hexlid*) appear in the hiC.CiC template, which is typically a causative/transitive template. Nonetheless, this cannot be the reason for the absence of their transitive counterparts from the vocabulary as there are many instances where the same hiC.CiC form is used for both unaccusatives and transitives. Some examples are *hexšix* (became-dark/ made-dark), *hisri'ax* (smelled/ made-smell), *he'mik* (deepen) and *hivšil* (ripen).



semantically compatible existing transitive verbs which can be viewed as their morpho-phonologically unrelated transitive counterparts.

As demonstrated above, then, there is no characteristic that singles out these absent transitive forms from the existing ones. Some forms are idiosyncratically absent from specific vocabularies and their nonexistence cannot be attributed to any independent constraint. Consequently, an analysis of the transitive-unaccusative alternation (like other analyses of derivational alternations), would not be complete without addressing this phenomenon.

#### ***2.4.1 Explaining sporadic gaps***

As mentioned in chapter 1, a priori there are two possible approaches of addressing sporadic derivational gaps:

- I. ‘The Nonexistence approach’: The corresponding entries radically do not exist.
- II. ‘The hidden representation approach’: The corresponding lexical entries exist, but are prevented from occurring as actual vocabulary items.

According to the nonexistence approach, then, certain forms are missing because the derivational operation which connects them to their counterparts is not always productive. Under the hidden representation approach, the missing alternates exist, but are prevented from being part of a particular language's actual vocabulary by some mechanism. Two implementations of this approach can be found in Halle (1973) and Jackendoff (1975), which attempt to provide an exhaustive analysis for the regularities observed between different lexical items. Both analyses use verbs and their corresponding deverbal nouns to illustrate the accounts they propose for derivational gaps, each targeting an opposite end of this alternation.<sup>8</sup> Halle notes that

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<sup>8</sup> Halle (1973) and Jackendoff (1975) offer lexicalist models of the mental lexicon, i.e., models that view the mental lexicon as an active component of grammar, which includes rule governed derivational

assuming a rule that creates the noun *transformation* from the verb *transform* and the noun *proposition* from the verb *propose* erroneously predicts the existence of nouns, like *\*arrivation* and *\*refusation* created from the verbs *arrive* and *refuse*, respectively. There is no particular independent (semantic or morpho-phonological) reason for these forms to be excluded from the vocabulary of English. Therefore, a model which assumes a rule-governed connection between verbs and the corresponding deverbal nouns must provide an account for the fact that some of this rule's potential outputs are absent from the vocabulary. To account for this phenomenon, Halle suggests that these are cases of “accidental gaps” between the lexicon and “the list of actual words” that occur when outputs of lexical rules are arbitrarily marked [-lexical insertion], which results in their exclusion from the list of actual words.

Jackendoff (1975) observes that this paradigm also exhibits cases of gaps in the input, as it implies a derivational connection between the noun *retribution* and the non-existent verb *\*retribute* and a similar connection between the noun *aggression* and non-existent verb *\*aggress*. To account for these cases, Jackendoff suggests that these forms are not independently represented in the mental lexicon as an actual word would be; rather, they are subparts of the lexical entries corresponding to the words with which they are connected. Accordingly, a form like *\*retribute*, for instance, would be listed in the mental lexicon as a subpart of the lexical entry corresponding to the noun *retribution*, but would lack an independent lexical representation and therefore would not exist as an actual word.

The accounts Halle and Jackendoff provide for derivational gaps are similar. Both

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relations between the entries listed in it (see also Chomsky 1970; Aronoff 1976; Reinhart 1996, 2002, 2010; Siloni 2002; Horvath and Siloni to appear, among others).

their models assume that the missing forms exist at some level of linguistic representation, but are prevented from appearing as actual words.

#### ***2.4.2 Explaining sporadic gaps in the transitive-unaccusative alternation***

Turning to the nonexistence approach, let us examine the possible accounts for sporadic derivational gaps in the transitive-unaccusative alternation found in Arad's (2005). Arad offers a root-based analysis, which, as mentioned in 2.3.1 above, assumes that 'atomic-roots' turn into words only after they have merged with a category determining head in the syntax. Arad mentions two alternative ways of accounting for sporadic derivational gaps, and considers them empirically equal: (a) The missing items are absent because they lack an interpretation. There is no suitable item to match their syntactic structure in the encyclopedia; therefore, they crash at LF. (b) Certain roots are marked as unable to be combined with certain verbalizing structures.

Another theoretic model that suggests an analysis of sporadic derivational gaps in the transitive-unaccusative alternation is the transitive-to-unaccusative approach proposed by Reinhart (2002, 2010), Reinhart and Siloni (2003, 2005) and Horvath and Siloni (2008, 2011). As mentioned in 2.3.3 above, this analysis view all one-place unaccusative verbs as derived by a lexical operation applying to the theta grid of their corresponding transitive, reducing the transitive verb's Cause (external) role.

If so, then how come certain transitive alternates of one-place unaccusatives are missing? Reinhart (2002, 2010) and Horvath and Siloni (2008) observe that all one-place unaccusative verbs seem to have a transitive alternate in one language or another, or had one in an earlier stage of the language. They assume with Fodor (1975) (among others) that lexical information is largely universal, i.e., that other than phonological matrixes, information coded in the lexicon is by and large common

across natural languages. This means that transitives that are missing from the vocabulary of a particular language but exist in other vocabularies must be listed in the lexicon. Following Chierchia (2004), Reinhart and Horvath and Siloni suggest that in such cases the representation in the mental lexicon is abstract or “frozen”. Frozen lexical entries are entries that cannot be inserted into the syntax, and hence are not part of the language’s actual vocabulary. However, being lexical entries, they can serve as inputs to lexical operations, specifically, they can feed decausativization ((27)b) on a par with non-frozen entries ((27)a) (the non-existent form is marked by \*):

(27) Decausativization:  $V_{ACC} (\theta_{Cause} \theta_{Theme}) \rightarrow V \theta_{Theme}$

a. open-TRANS  $\rightarrow$  open-UNACC

And also:

b. \*vanish-TRANS  $\rightarrow$  vanish-UNACC

Thus, while Arad's account is a nonexistence approach, Reinhart and Horvath & Siloni believe that there are hidden lexical representations.

At first blush, the former seems like the preferable option. It seems like the null hypothesis – a transitive form is missing in a certain language because it simply does not exist. Nevertheless, if there is independent evidence supporting the hidden representation approach, the nonexistence approach should be abandoned. But is there a way of telling apart a hidden lexical representation from a non-existing one? After all, what type of evidence can support the claim that a missing form is in fact listed in the mental lexicon?

### 2.4.3 Three classes of unaccusative verbs and three types of transitive concepts

Horvath & Siloni (2008) classify unaccusative verbs with no transitive counterpart in the vocabulary into two types: “the *arrive* class” and “the *appeal* class”. The *arrive* class consists of unaccusative verbs for which the transitive alternates are idiosyncratically absent from the vocabulary of certain languages while existing in others. An example (from Horvath and Siloni) is given in (28):

- (28)
- |    |   |  |
|----|---|--|
| a. | Hungarian:                                | Hebrew:                                  |
|    | Unaccusative: <i>összeesik</i> ‘collapse’ | Unaccusative: <i>hitmotet</i> ‘collapse’ |
|    | No transitive alternate                   | Transitive: <i>motet</i>                 |
| b. | Hebrew:                                   | Hungarian :                              |
|    | Unaccusative: <i>naval</i> ‘wilt’         | Unaccusative: <i>elhervad</i> ‘wilt’     |
|    | No transitive alternate                   | Transitive: <i>elhervaszt</i>            |
| c. | English:                                  | Hebrew:                                  |
|    | Unaccusative: <i>vanish</i>               | Unaccusative: <i>ne'elam</i> ‘vanish’    |
|    | No transitive alternate                   | Transitive: <i>he'elim</i>               |

In languages that morphologically mark valence reduction, these unaccusatives often bear morphological forms typical of valence reducing operations.

The *appeal* class consists of two-place unaccusative Experiencer verbs with a nominative Theme argument that is generated internally and an Experiencer, which (in most cases) bears an oblique case (Belletti & Rizzi 1988; Pesetsky 1995). Importantly, this class constitutes a crosslinguistic phenomenon. Unlike the *arrive* class, these verbs systematically do not have a transitive alternate across languages (as far as known). There is, thus, no crosslinguistic evidence to assume the existence of a frozen transitive alternate (Reinhart 2002, 2010). Moreover, these verbs do not appear

in a morphological form typical of valence reducing operations, as illustrated below (examples are from Horvath & Siloni 2008):

- (29) ha-ra'ayon xamak mimeni (Hebrew)  
 The-idea escaped from+me  
 'The idea escaped me.'
- (30) ze medaber elay  
 It talks to+me  
 'It appeals to me.'

Another characteristic that distinguishes the *appeal* class from the *arrive* class, is that *arrive* class unaccusatives have adjectival passive counterparts, while *appeal* class unaccusatives do not (Pesetsky 1995). For example (from Horvath and Siloni 2008):

- (31) a. Dan kana praxim nevim (Hebrew)  
 Dan bought flowers wilted  
 'Dan bought wilted flowers.'
- b. \*ha- ra'ayon ha-ze xamuk (mimeni)  
 the-idea the- this escaped (from+me)  
 \* 'this idea is escaped (from me).'

Based on these observations, Horvath & Siloni (2008) conclude that unaccusatives of the *arrive* class have frozen (hidden) transitive alternates that serve as input for the lexical operation that creates unaccusative verbs (decausativization) and for the lexical operation of adjectival passive formation, while unaccusatives of the *appeal* class are crosslinguistically underived and have no corresponding transitive entry, not even a frozen one. On the hypothesis that the operation forming adjectival passives

applies in the mental lexicon and requires transitive entries as input, this analysis also accounts for the correlation between the lack of crosslinguistic evidence for transitive entries and the absence of adjectival passive alternates.

This classification enables us to tease apart hidden-representation from nonexistence, because it allows comparing items with no transitive alternate whatsoever to those argued to have frozen/hidden alternates. If the behavior of the two sets can be shown to be different in a relevant way, the hidden existence approach would receive significant support. The existence of a class of underived unaccusative verbs, then, turns out to be crucial for our purposes.

Given Horvath and Siloni's observations, there are three possible types of unaccusative verbs:

- (32)
- a. Type (i): derived, with a transitive alternate in the vocabulary (e.g. *open*)
  - b. Type (ii): derived, with a frozen transitive alternate (e.g. *fall*, *vanish*)
  - c. Type (iii): underived, with no transitive alternate at all (e.g. *appeal*, *escape*)

These three types of unaccusatives are related to the following three types of logically possible concepts denoting the causation of these eventualities. As these concepts involve the same set of participants (arguments) as the corresponding transitive verb, I will label them 'transitive concepts':

- (33)
- a. Type I transitive concepts: with a corresponding vocabulary item (e.g. *making something open*; i.e. *opening something*)
  - b. Type II transitive concepts: with a corresponding hidden lexical representation (e.g. *making something vanish*)
  - c. Type III transitive concepts: with no lexical representation at all, not even a hidden one (e.g. *making something escape the mind of someone*)

I hold that the different lexical representation attributed to each type of transitive concept is predicted to reflect on their accessibility. In the following chapter, I show how the lexical encoding is predicted to affect the accessibility of a concept, and how it can be used to explore the psychological reality of hidden lexical representations.



## Chapter 3: The psycholinguistics of sporadic derivational gaps

### 3.1 The GABLE hypothesis

The effect that the existence of a vocabulary item has on the perception of the corresponding concept is a well-studied topic in the psycholinguistic research of color terms. Kay and Kempton (1984), for example, found that even though color concepts are universally defined, speakers of languages which use separate vocabulary items to refer to perceptually close colors such as blue and green utilize the linguistic classification when asked to categorize intermediate shades of these colors.

Kay and Kempton label this tactic “the name strategy”, and suggest that the existence of a parallel word affects the facilitation of a concept. I take this view one step further and argue that in light of the fact that the mental lexicon must have an interface with the conceptual system, any type of lexical representation, even a hidden one, is predicted to have an effect on the perception of the corresponding concept. I therefore formulate the following general hypothesis regarding the connection between lexical encoding and the accessibility of concepts.

(34) Graded Accessibility By Lexical Encoding (GABLE):

The relative accessibility level of a concept is affected by its lexical encoding:

- (a) The existence of a word in the vocabulary of a language X is an accessibility enhancer for the concept it represents.
- (b) The existence of a lexical entry (with or without a corresponding vocabulary item) is also an accessibility enhancer for the concept it represents.
- (c) The enhancing effects of (a) and (b) are additive.

According to the GABLE hypothesis, then, a concept with a corresponding vocabulary item will be more accessible than a concept without a corresponding vocabulary item, and a concept with a corresponding lexical entry will be more accessible than a concept without a corresponding lexical entry. In other words, it predicts a difference between hidden and non-existent lexical entries corresponding respectively to type II and type III concepts ((33)b-c (chapter 2)) repeated below as (35)a-b:

- (35) a. Type II transitive concepts: with a corresponding hidden lexical representation (e.g. *making something vanish*)
- b. Type III transitive concepts: with no lexical representation at all, not even a hidden one (e.g. *making something escape the mind of someone*)

Thus, provided with a method designed to measure the accessibility level of concepts, the GABLE hypothesis can be used to detect the existence of hidden lexical entries.

The viability of employing speakers' perception to trace a linguistic representation of an eventuality receives reinforcement from Wolff's (2003) psycholinguistic study, which revealed a strong correlation between speakers' perception of a causation eventuality and the way they choose to linguistically express its occurrence. However, it is important to note that the subject matter of Wolff's investigation was the correlation between direct causation and speakers' tendency of using lexical, non-periphrastic causative verbs to describe it, while the current study was designed to compare the accessibility levels of type II and III transitive concepts, which, by definition, can only be described by periphrastic structures. This means that even though both studies attempt to tap into the relationship between perception and

linguistic representation, the particular findings of Wolff's study are not directly relevant to our current purposes.

### **3.1.1 Predictions**

With regard to gaps in the transitive-unaccusative alternation, the GABLE hypothesis makes two predictions. First, if frozen lexical entries are psychologically real the GABLE hypothesis predicts that type I transitive concepts, with two accessibility enhancers (vocabulary item and lexical entry) will be more accessible than type II transitive verbal concepts, with one accessibility enhancer (a hidden lexical entry) and that type II concepts will be more accessible than type III transitive concepts, which have no accessibility enhancers. This three-way distinction is schematized in figure 3.

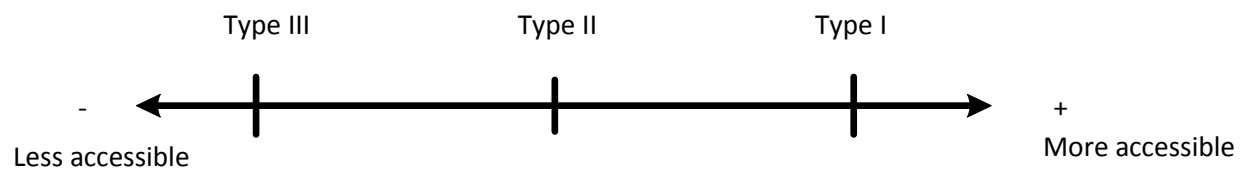


Figure 3: A three-way distinction

A three-way distinction is consistent with Reinhart's (2002, 2010) and Horvath and Siloni (2008) hidden representation account, since it uses the notion of hidden lexical entries ("frozen lexical entries") to explain gaps in the transitive-unaccusative alternation. In contrast, a three-way distinction of this kind would be inconsistent with Arad's (2005) nonexistence account. This is because it only distinguishes between concepts with a corresponding vocabulary item (hence, with a lexical representation) and concepts without a vocabulary item (hence, with no lexical representation).

The second prediction the GABLE hypothesis makes regarding gaps in the transitive-unaccusative alternation, is that if frozen lexical entries are not psychologically real, a two-way distinction should be observed. If type (ii) unaccusatives do not have a hidden transitive alternate and are identical to type (iii) unaccusatives with regard to lexical encoding, the prediction is that type I transitive concepts (two accessibility enhancers) will be more accessible than type II and III transitive concepts (no accessibility enhancers). In other words, as shown in figure 4, the accessibility levels of types II and III are not expected to be different.

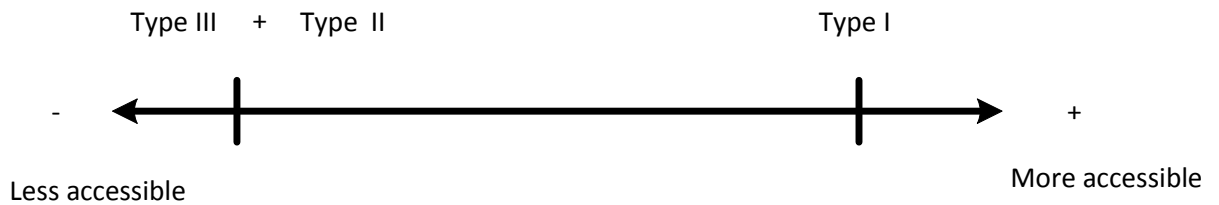


Figure 4: A two-way distinction

A two-way distinction would be inconsistent with Reinhart (2002, 2010) and Horvath & Siloni (2008), who predict a three-way distinction, but compatible with Arad (2005), who assumes only two types of unaccusatives, those with a corresponding transitive in the vocabulary and those without one.

## 3.2 Experiment 1

The following experiment was designed to measure the relative accessibility levels of type I, II and III transitive concepts once a speaker is exposed to their unaccusative verbal variant, hence to compare the validity of the approaches described above.

### 3.2.1. Participants

Participants included 20 adult native Hebrew speakers, 10 male and 10 female, with an education level of 13 years or more. Participants' age ranged from 19 to 29 (mean age 24.1). None had any relevant prior linguistic education.

### 3.2.2 Method

#### stimuli

The stimuli consisted of 9 unaccusative verbs with a corresponding transitive in the vocabulary (type i); 6 unaccusative verbs with no transitive alternate in the vocabulary, but with a parallel adjectival passive alternate, which, following Horvath & Siloni (2008), was taken to suggest that they have a frozen/hidden transitive alternate (type ii); and 6 two-place unaccusative verbs with no transitive alternate, no adjectival passive alternates and no known cases of transitive alternates in the vocabulary of languages other than Hebrew (type iii). Here, as well as in the rest of the experiments described in this dissertation, unaccusatives were identified based on two Hebrew unaccusativity diagnostics: modification by a possessive dative and simple inversion (Borer & Grodzinsky 1986; Shlonsky 1997; Reinhart & Siloni 2005; Meltzer & Siloni 2013), as demonstrated in (36) and (37):

(36) Diagnostic: Possessive datives can only modify internal arguments

- |    |            |           |        |
|----|------------|-----------|--------|
| a. | ha-mexonit | nisrefa   | le-dan |
|    | the-car    | got-burnt | to-Dan |

‘Dan's car got burnt.’

- b. ha-ayfon nišbar le-lucie  
the-iPhone broke to-Lucie

‘Lucie's iPhone broke.’

- c.\* ha-xatul hithapex le-dina  
the-cat rolled-over to-Dina

(Does not mean: Dina's cat rolled-over)

(37) Diagnostic: A verb can precede the subject in a predicate initial sentence

(‘simple inversion’) only when the subject is an internal argument.

- a. nirtevu arba'a ayfonim  
got-wet four iPhons

‘Four iPhones got wet.’

- b. hitmotetu šney binyanim  
collapsed two buildings

‘Two buildings collapsed.’

- c. \* šaru arba'a tenorim  
Sang four tenors

For the full list of unaccusative verbs used in this experiment 1 see appendix A.

### Design

For each of the 21 unaccusative verbs, a very short story was composed. The stories included scenarios that established the status of an entity as the causer of some event through relevant content. In each story, the event was only labeled towards the end of the vignette, using a sentence with one of the types of the unaccusative verbs (‘the

unaccusative sentence’). The very last sentence of the story described an outcome of the event (‘the outcome sentence’).

Subjects were then asked to rate from 1 (least acceptable) to 8 (most acceptable) the extent to which they perceived the causer of the event to be ‘the executor of a specific action’ that resulted in whatever the outcome sentence described. Examples (38) and (39) are translations of stories, stimuli sentences and tasks composed for the unaccusatives *nafal* ‘fall’, a Hebrew type (i) unaccusative, and *xamak me-*‘escape (the mind of)’, a type (iii) unaccusative.

(38)

John and Mary are twins. They are a bit similar and a bit different. John, for example, is a clumsy boy who always drops stuff and Mary is not clumsy at all. In fact, teasing John about his clumsiness is Mary’s very annoying habit. Last week they were on their way to Grandma’s house for a holiday dinner. John carried the cake and his sister Mary carried a glass dish that contained some fish. The dish was cold, slippery and heavy. Mary felt how it began to slip out of her grip.

The dish **fell** on the sidewalk. John gloated.

On a scale of 1-8, how acceptable/conceivable for you is it to consider Mary as the executor of **one specific action** that resulted in the gloating of John?

(39)

Danny was very happy; he was elected chairman of the prom's decoration committee. He was excited about the chance to finally express his creative side. Unfortunately, as the date approached, Danny found it very difficult to come up with a good enough

decorating idea. It was about two days before prom night when Danny made himself sit in his room and think really hard. After sitting there for nearly two hours, it seemed to him that this method might be working and that an idea should pop up very soon. But – alas! in the exact moment he felt an idea getting structured in his mind, his sister shouted from the other room: “Danny, would you be a dear and make me a sandwich?”

The idea **escaped** Danny's mind. It was now completely empty.

On a scale of 1-8, how acceptable/conceivable for you is it to consider Danny's sister to be the executor of **one specific action** that resulted in the emptiness of his mind?

The rationale behind this task is that in order to grade the extent to which the causer (e.g. Mary, Danny's sister) is the executor of the event described by the unaccusative verb (e.g. the falling of the dish, and the escaping of the idea from Danny's mind), participants must access the transitive concept corresponding to it. Recall that the GABLE hypothesis predicts that for each unaccusative, if the relevant transitive concept has a parallel vocabulary item in Hebrew, it should be more accessible than transitive concepts without a parallel vocabulary item, and that if the relevant transitive concept does not have a parallel vocabulary item, but does have a parallel lexical entry (a hidden lexical entry) it should be more accessible than a concept with no representation in the mental lexicon at all. The more accessible a transitive concept is for speakers, the more prominent the role of the causer as the event's executor should be. Therefore these different accessibility levels should positively correspond with the acceptability ratings participants give to causers.



Finally, as described and illustrated above, this experimental design used outcome sentences as mediators between the unaccusative sentence and the task. This was done for two reasons. First, a question that directly concerns the event described in the unaccusative sentence (e.g. how acceptable/conceivable for you is to consider Mary as causing the dish to fall?) would have to include the unaccusative counterpart of the transitive concept whose accessibility we wish to measure. This might blur the picture, since it might induce the facilitation of all three types of transitive concepts, thus masking the differences between them. Second, the use of outcome sentences differentiates the task from a simple content question. This is important since it ensures participants will not concentrate on memorizing the details of the stories, which could disrupt the process of providing an intuitive judgment.

See appendix B for the stimuli sentences used in this experiment, their translation to English and a translated version of each context story.

### Procedure

Each subject participated in a short, one on one, practice session which included two items. Two Subjects that did not show a full understanding of the task were excluded from the experiment.<sup>9</sup>

The experiment was conducted using a PowerPoint slide show and an answer form. The first slide included the first story. Only in the next slide, after pressing the ENTER key, did the subject encounter the unaccusative sentence, the outcome sentence and the task. This separation was maintained in order to ensure that it is the unaccusative's verbal concept participants were considering while answering and not

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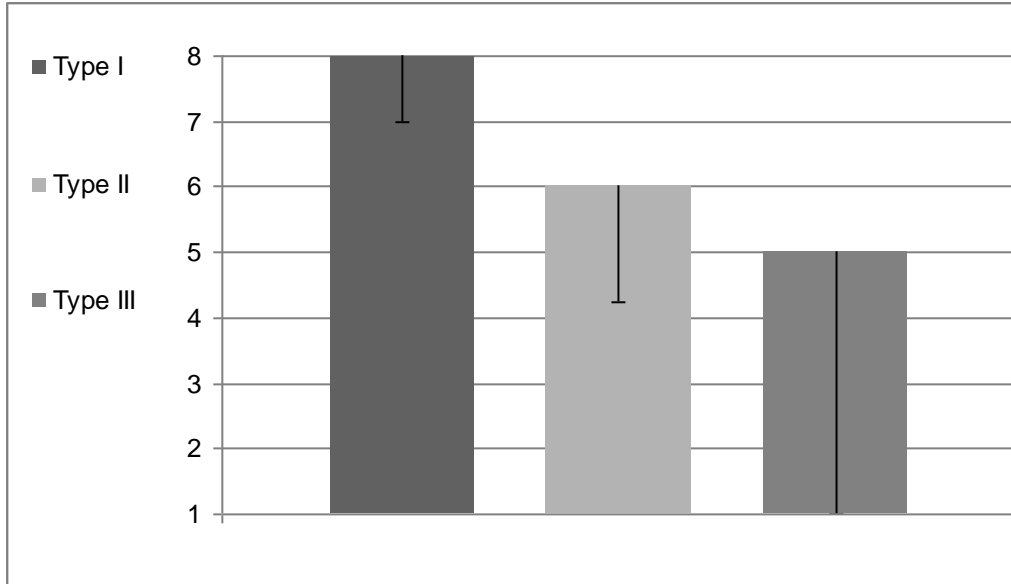
<sup>9</sup> These participants provided long and detailed philosophical explanations for their performance in the practice session, thus demonstrated a clear misconception of the intuitive judgment they were asked to give.

any other verbal concepts mentioned in the story. Also for this purpose, participants were instructed that once they have moved on to the next slide they cannot go back. In addition, the unaccusative verbs appeared in boldface.

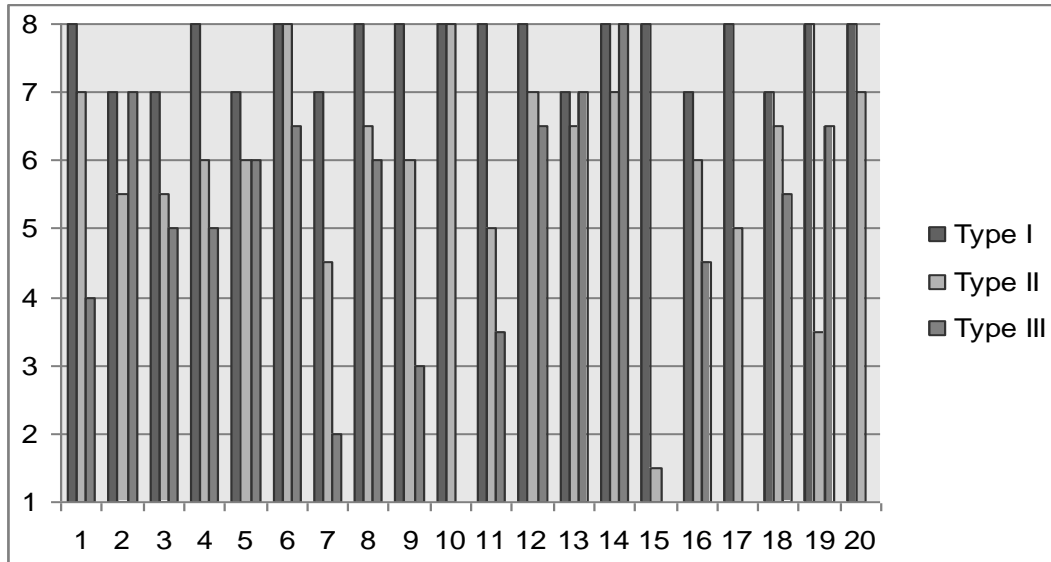
### **3.2.3 Results**

Since the data was measured on an ordinal scale, nonparametric statistics were used to analyze the results. A Friedman test revealed a significant effect of verb-type on median ratings per subject ( $X^2(2) = 25.73, p < 0.001$ ). A post hoc Wilcoxon signed-rank test comparing median acceptability ratings per participant per verb-type showed that the median ratings for type (i) unaccusatives (Median = 8, inter-quartile range = 1) were significantly higher than the median ratings for type (ii) (Median = 6, inter-quartile range = 1.75) (one-tailed:  $W(18) = 171, p < 0.001$ ), and that the median ratings for type (ii) unaccusatives were significantly higher than the median ratings for type (iii) unaccusatives (Median = 5, inter-quartile range = 4) (one-tailed:  $W(19) = 119, p = 0.0087$ ). When  $p$  was corrected for multiple comparisons, this pattern remained intact (i.e.: Type I > Type II > Type III).

**Chart 1: Median ratings per verb type (error bars represent inter-quartile range)**



**Chart 2: Median ratings per subject**



### 3.2.4 Discussion

As detailed above, a statistical analysis of participants' performance found the ratings for type I concepts (which have a corresponding vocabulary item) significantly higher than the ratings for type II concepts (which are assumed to have a corresponding *hidden* lexical representation), and the latter significantly higher than the ratings for type III concepts (which are assumed to not have a lexical representation). Hence, type I concepts were found to be more accessible than type II concepts and type II were found to be more accessible than type III.

Furthermore, as schematized in figure 5 below, the collected ratings are not distributed evenly across the accessibility scale. The difference in the ratings provided for type I concepts and type II concepts, is greater than the difference between type II and type III. This suggests that the enhancing effect a vocabulary item has on the accessibility of the corresponding concept is greater than that of a (hidden) lexical entry. This observation is interesting but not at all surprising. It shows that the accessibility enhancing effect of a vocabulary item used in spoken and written language is greater than the effect a hidden lexical entry has on a concept's accessibility. This is an expected outcome, since the recurring use of these vocabulary items is predicted to render the corresponding concept highly accessible.

In addition, the variance among speakers is rather small when rating the causer of a type I transitive concepts (inter-quartile range=1), higher (inter-quartile range= 1.75) when rating the causer of a type II concept, and much higher (inter-quartile range=4) when rating the causer of a type III concept. This pattern of a decreasing consistency among speakers' ratings of causers as the accessibility enhancers associated with it are fewer is also expected. When the accessibility of a transitive concept is lower, speakers' automatic certainty in a causer's responsibility weakens. This, in turn,

allows more scope for individual variation caused by non-linguistic factors, such as the specific scenario set as context for the causer's involvement, the participant's personal experiences, etc., which are very likely to vary among speakers, as observed.

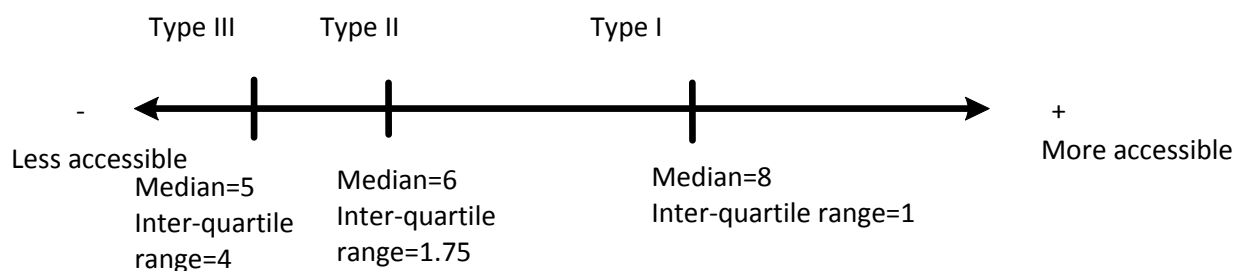


Figure 5: Observed accessibility pattern

There is, however, an issue concerning the particular details described in the context scenarios that need to be excluded as an underlying factor.<sup>10</sup> Scenarios used as contexts for verbs like *hitrofef* 'loosen', *naval* 'wilt' and *kamaš* 'wither' described the event as coming about by the means of not acting (for instance: forgetting to water a plant). Consequently, causers of these eventualities might have been assigned lower ratings since it was their lack of action that caused the event. Therefore, a further statistical analysis was conducted, this time one type (i) unaccusative and two type (ii) unaccusatives preceded by a context describing a causer avoidance of an action (*hitrofef* 'loosen', *naval* 'wilt' and *kamaš* 'wither', median rating 6, 4.5 and 5.5, respectively) were removed. An analyses of the remaining unaccusatives reveals an accessibility pattern identical to the one reported above. The median ratings for type

<sup>10</sup> I thank an anonymous reviewer of 'The Theta System: Argument Structure at the Interface' (Oxford University Press) for raising this issue.

(i) unaccusatives (median=8, inter-quartile range:1 ) are significantly higher than the median ratings for type (ii) (one tailed:  $W(13)=91$ ,  $p<0.001$ ) and the median ratings for type (ii) unaccusatives (median=6, inter-quartile range: 2) are significantly higher than the median ratings for type (iii) (median=5, inter-quartile range= 4) (one tailed:  $W(15)=73$ ,  $p=0.02$ ). Therefore, speakers' judgments were not influenced by this variable.

The results of experiment 1 reveal a three-way distinction between type I, type II, and type III transitive verbal concepts. Considering the observed pattern of accessibility, it is clear that some property, uniquely possessed by type II transitive concepts, renders them more accessible than type III transitive concepts, even though both types lack a corresponding word in the vocabulary of Hebrew. This is evidence in favor of Reinhart's (2002, 2010) and Horvath & Siloni's (2008) hidden representation account and against nonexistence accounts such as Arad's (2005).

Recall that according to the nonexistence accounts derivational gaps occur when a part of a derivational alternation simply does not exist in a particular language. Consequently, for these accounts, type II and type III transitive concepts are identical. They both lack a corresponding vocabulary item as well as a lexical representation, and are therefore not expected to trigger different accessibility for their transitive alternates, contrary to fact. On the other hand, according to the hidden representation account assumed by Reinhart (2002, 2010), and Horvath and Siloni (2008), while type II transitive verbal concepts are listed in the mental lexicon in a hidden manner, type III verbal concepts are not listed in the mental lexicon at all. As a result (under the assumption that the lexical encoding of a concept affects its perception) this account predicts that the accessibility levels of type III concepts will be lower than the

accessibility levels of type II concepts. As stated, this prediction is borne out by the results of experiment 1.

### 3.2.5 *An alternative analysis*

The difference suggested by Horvath & Siloni (2008) between unaccusatives of the *arrive* class (type (ii)) and unaccusatives of the *appeal* class (type (iii)), presented in (32)b-c (chapter 2) and repeated below as (40)a-b below, is not the only way to distinguish between these two classes of verbs.

- (40) a. Type (ii): derived, with a frozen transitive alternate (e.g. *fall, vanish*)  
 b. Type (iii): underived, with no transitive alternate at all (e.g. *appeal, escape*)

These classes also differ with respect to their argument structure: type (ii) are one-place predicates whereas type (iii) are two-place predicates, and the fact that type (iii) verbs are psychological, whereas type (ii) are not. Consequently, it may be that these differences influenced the imageability and concreteness of the corresponding transitive concepts, and hence are responsible for the significant difference between type II and type III concepts.<sup>11</sup> In particular, it could be that it is not the different linguistic encoding of type II and III concepts that caused the different accessibility levels observed in experiment 1, but the difficulty to conceive a situation where a specific entity causes a psychological process (for instance, something appealing to someone) compared to a situation where a specific entity caused a non-psychological process (such as making something wilt). Accordingly, it is possible that the difference observed between type I and II transitive concepts is due to the absence of

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<sup>11</sup> I thank an anonymous reviewer of 'The Theta System: Argument Structure at the Interface' (Oxford University Press) drawing my attention to this point.

type II concepts from the vocabulary, while the difference observed between types II and III is due to non-linguistic factors.<sup>12</sup> Therefore, if the conditions of the experiment can be controlled with regard to these factors, the conclusions drawn from its results will possess a higher degree of certainty. With these particular classes of verbs, such an experimental design is impossible, since the class of unaccusatives suspected as underived are two-place psychological verbs, while the other two classes are not.

Nevertheless, there is a class of two-place psychological (Experiencer) verbs argued to have a corresponding lexical entry which encodes a hidden Cause theta role, i.e. a Cause that cannot be realized in syntax. In that respect, these verbs are similar to type (ii) unaccusatives, however, since they are two-place and psychological, just like type (iii) unaccusatives, they are ideally suitable for an empirical examination of the effect these factors have on speaker's performance in this task.<sup>13</sup>

### 3.2.5.1 Hidden Cause subject-Experiencer verbs

This set of verbs participate in the alternation between object-Experiencer verbs and their one-place, subject-Experiencer counterparts (from Reinhart 2010):

- (41) a. The doctor worried the patient. (object-Experiencer)  
 b. The patient worried (about her health). (subject-Experiencer)

As observed by Pesetsky (1995), usually, object-Experiencer verbs do not entail their subject-Experiencer counterparts. For example, 42(a) does not entail 42(b), since in a scenario where Dan caused Dina to be afraid of something other than himself, say a test, the likelihood of an earthquake etc., 42(a) is still true while 43(b) is false:

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<sup>12</sup> I thank Hans van de Koot (P.C) for raising this issue.

<sup>13</sup> I am thankful to Tal Siloni (P.C.) for pointing out the relevance of these verbs for this study's purposes.



(42) From Siloni (2009): (Hebrew)

a. Dan hifxid et Dina (Object-Experiencer)

Dan frightened ACC Dina

‘Dan frightened Dina.’

b. Dina paxada mi-Dan. (Subject-Experiencer)

Dina feared from-Dan

‘Dina feared Dan.’

According to Pesetsky (1995), the theta grid of object-Experiencer verbs consists of three theta roles: Cause, Experiencer, and Subject matter, which is the object of emotion. Pesetsky further argues that Cause and Subject-matter cannot co-occur, and hence only one of them can be realized in a particular derivation (sentence).<sup>14</sup> In 42(a), then, Dan can be interpreted as either the Subject-matter of Dina's fear or as the Cause. Therefore, it does not entail 42(b), where Dan is only interpreted as the Subject-matter. Siloni (2009) notes that this non-entailment relationship does not always hold. Some Hebrew object-Experiencer verbs do entail their subject-Experiencer counterpart. For example *hiršim* ‘impress’ in 43(a) entails its subject-Experiencer counterpart in 43(b):

(43) (From Siloni 2009)

a. Dan hiršim et Dina. (Object-Experiencer)

Dan impressed ACC Dina

‘Dan impressed Dina.’

b. Dina. hitrašma mi-Dan. (Subject-Experiencer)

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<sup>14</sup> According to Pesetsky (1995), Cause and Subject-matter cannot be realized as arguments of the same verb as they are not ‘semantically distinct’. For further discussion of distinctness, see Pesetsky (1995) and Reinhart (2002, 2010).

Dina got+impressed from-Dan

Siloni (2009) shows that verbs like *hiršim* (*hidhim* ‘amaze’, *sime’ax* ‘make-happy’, *ye’eš* ‘discourage’ and others) constitute a set of verbs that are singled out by a cluster of additional properties that they don't share with other object-Experiencer verbs: they fail to passivize, do not pass Agenthood tests, and do not have a corresponding nominal.

According to Reinhart (2002, 2010), subject-Experiencer verbs, like unaccusatives, are derived from their transitive alternates via the lexical operation of decausativization, which removes the inputs' Cause theta role (as discussed in sections 2.3.3 and 2.4.2 above). That is, subject-Experiencer verbs are derived from their object-Experiencer counterparts by decausativization. Siloni (2009) adopts this view and suggests the following account for the special behavior of *hiršim* (impress) type object-Experiencers. According to her, object-Experiencer verbs like *hiršim* have a hidden Cause role, which cannot be realized in the syntax. Therefore, unlike other object-Experiencer verbs, their external argument is always interpreted as Subject-matter. Consequently, utterances like 43(a) above are semantically equivalent to their subject-Experiencer counterparts, such as the one in 43(b). In both, Dan is interpreted as the Subject-matter of Dina's impression, while the identity of the Cause is not mentioned: It can be Dan himself, a book he had written etc. With this type of Experiencer verbs, the causative eventuality can only be expressed periphrastically, as illustrated in (44):

- (44) Dan/ ha-sefer še Dan katav garam le-Dina lehitrašem mi-meno  
 Dan/the book that Dan wrote caused to-Dina to-be- impressed from-him  
 ‘Dan/the book Dan had written caused Dina to be impressed from him.’

This means that the causation denoting concepts corresponding to Experiencer verbs like *hitrašem* (get-impressed) are argued to be listed in the mental lexicon but never occur in the actual vocabulary, just like the causation denoting concepts corresponding to unaccusatives of type (ii) ((40)a)) (i.e. type II transitive concepts). Furthermore, viewing these verbs' Cause role as unable to be realized in the syntax also explains why they cannot take part in syntactic configurations like passivisation and Agenthood diagnostics (see Siloni 2009 for explanation of the additional properties these verbs show).

Henceforth I refer to this type of verbs as 'hidden-Cause Experiencer verbs'.

To summarize, hidden-Cause Experiencer verbs are two-place psychological verbs. In that respect, they are similar to type (iii) unaccusatives. However, while the former are argued to have an alternate with a Cause argument hidden in the mental lexicon, the causation denoting concept corresponding to the latter is argued to lack a lexical encoding altogether. For this reason, a comparison between these two types of verbs can determine whether or not the accessibility differences found in experiment 1 between type II and type III concepts follow from the fact that unaccusatives of type (iii) were two-place psychological verbs unlike unaccusatives of type (ii). Since hidden-Cause subject-Experiencer verbs and type (iii) unaccusatives are both two-place psychological verbs, any significant difference revealed by a comparison of speakers' performance in tasks involving them, would suggest that the results of experiment 1 cannot be attributed to these two factors. In addition, this comparison can provide further support for Siloni's analysis, since the GABLE hypothesis predicts that if hidden-Cause Experiencers are psychologically real, their

corresponding causation denoting concepts should be more accessible than type III transitive concepts.

### **3.3 Experiment 2**

The following experiment compared the accessibility levels of the causation denoting concepts corresponding to hidden Cause Experiencer verbs with the accessibility levels of causation denoting concepts corresponding to type (iii) unaccusatives (i.e. type III transitive concepts, which have no lexical representation at all).

#### **3.3.1 Participants**

Participants included 29 adult native Hebrew speakers, 11 male and 18 female, with an education level of 13 years or more. Participants' age ranged from 21 to 35 (mean age 24.16). None had any relevant prior linguistic education.

#### **3.3.2 Method**

##### Stimuli

The stimuli consisted of 6 hidden Cause subject-Experiencer verbs, the 6 unaccusatives of type (iii) used in experiment 1, and a group of control items consisting of 5 unaccusatives of type (i). For a full list of verbs used in this experiment see appendix C.

As described above, the characteristic that sets apart hidden Cause Experiencer verbs from other Experiencer verbs is that they never realize the Cause theta role. Thus, in this class, the argument in subject position cannot be interpreted as Cause, but only as Subject-matter. As a diagnostic for this set, I used purpose clauses.

Modification by a purpose clause has long been acknowledged as detecting Agenthood because such clauses can only modify verbs whose external argument is

interpreted as an Agent (Manzini 1983, Jeaggli 1986).<sup>15</sup> In our case, since (as shown in 2.3.3 above) the Cause role is unspecified for mental state it can be assigned to animates and inanimates. An animate argument bearing it is usually interpreted as Agent. An argument bearing the Subject-matter role, however, is not. Therefore, modification of object-Experiencer verbs by a purpose clause can be utilized to distinguish between verbs that allow the realization of the Cause role and verbs that do not; while the former ((45) a) would pass the Agenthood diagnostic, the latter ((45) b) would fail at it:

- (45) a. Dan hifxid 'et Dina kedey še-hi titen lo lexabek 'ota  
 Dan scared ACC Dina so that-she will-let to-him to-hug her  
 'Dan scared Dina so she will let him hug her.'
- a. \*Dan hiršim 'et Dina kedey še-hi titen lo lexabek 'ota  
 Dan impressed ACC Dina so that-she will-let to-him to-hug her

Given that, a separate group of 15 adult Hebrew speakers were asked to rate from 1 (least acceptable) to 5 (most acceptable) the acceptability of 23 sentences with a purpose clause modification. 10 of the sentences included object-Experiencer verbs likely to be hidden-Cause object-Experiencers, 7 likely to be 'regular' object-Experiencer verbs, and 6 filler sentences with agentive verbs. The object-Experiencer verbs for which the median ratings were 2 or less were viewed as hidden Cause Experiencer verbs. Thus, their subject-Experiencer counterparts were included in the experiment's stimuli. For example:

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<sup>15</sup> Although Williams (1985) argues that as the PRO subject of rational clauses is not controlled by the main clauses' external argument but by the event it describes, this configuration cannot be used to detect the existence of an implicit Agent (see Reinhart 2010 for further discussion).

(46) Raxel ye'aša 'et rut kedey še-hi tafsik lihiyot kazot optimit kol  
ha-zman

Raxel discouraged ACC Ruth so that-she will-stop to-be such optimistic all  
the-time

‘Rachel discouraged Ruth so she will stop being such an optimist all the time.’

(Median acceptability rating: 2)

### Design

Experiment 2 was similar in design to experiment 1. A very short story that established the status of an entity as the causer of an event was composed for each of the verbs. The events were labeled towards the end of the vignette, using a sentence with one of the verbs (‘the target sentence’<sup>16</sup>) and the very last sentence of the story described an outcome of the event (‘the outcome sentence’). Subjects were then asked to rate from 1 (least acceptable) to 7 (most acceptable) the extent to which they perceive the causer of the event to be ‘the executor of a specific action’ that resulted in whatever the ‘outcome sentence’ described. (47) brings a translated story, stimulus sentences, and task structured to test the accessibility of the causation denoting concepts parallel to the subject-Experiencer verb *hit'anyen* (‘get-interested’):

(47)

Joey never really cared about clothes. Most of his outfits consisted of jeans and T-shirts. Sometimes, when he was really not in the mood to think about which shirt to

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<sup>16</sup> This label is less specific than its equivalent in the design of experiment 1 (i.e. ‘the unaccusative sentence’), since in this experiment some of the stimuli verbs were unaccusatives and some were subject- Experiencer verbs.

wear, he went to work with the same shirt he used as a pajama. Therefore it was only natural that when his best friend Dave applied for fashion school, Joey thought it was a complete waste of time. However, as time went by, after Dave forced Joey to tag along to countless fashion shows and insisted on hearing his input regarding every design exercise he had to submit, Joey's attitude began to change.

Joey suddenly got **interested** in fashion. He now spends most of his paycheck on clothes.

On a scale of 1-7, how acceptable/conceivable for you is it to consider Dave to be the executor of **one specific action** that resulted in Joey spending most of his paycheck on clothes?

See appendix E for all stimuli sentences used in this experiment, their translation to English and a translated version of each context story.

### Procedure

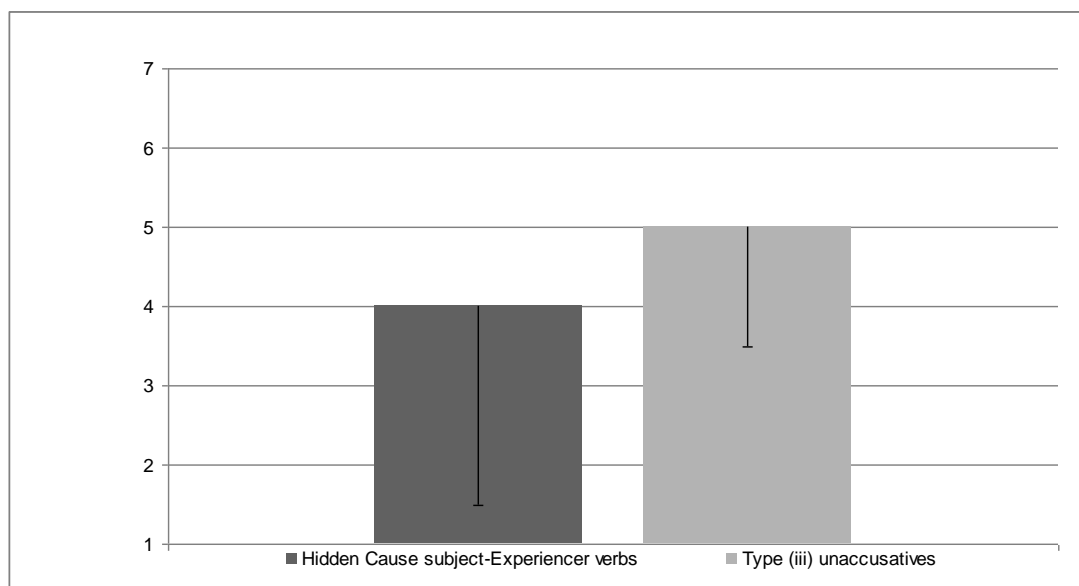
Similarly to the previous experiment, following a short practice session, stories and tasks were presented to participants using a PowerPoint slide show. The first slide included the first story and after pressing the ENTER key, participants encountered a separate slide containing the target sentence, the outcome sentence and the task. Participants then marked their judgments in an answer form. Once again, to further ensure that it is the transitive concept related to the relevant verb that was being rated, target verbs appeared in boldface and participants were instructed not to go back to the previous slide.

### 3.3.4 Results

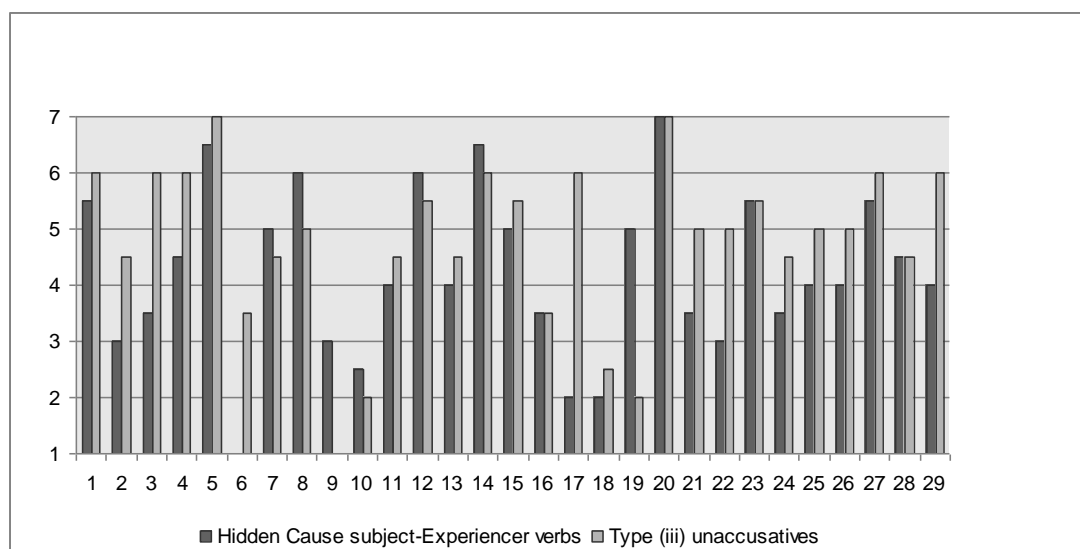
A Wilcoxon signed rank test found the median ratings provided for causers of eventualities described by hidden-Cause subject-Experiencer verbs to differ significantly from the median ratings provided for causers of eventualities described by type (iii) unaccusatives (two tailed:  $W(25) = -162$ ,  $p = 0.03$ ). The direction of this difference is unexpected: the ratings provided for type (iii) unaccusatives (median = 5, inter-quartile range = 1.5) were significantly higher than the ratings provided for hidden-Cause subject-Experiencer verbs (median = 4, inter-quartile range = 2.5).

Not surprisingly, Median ratings provided for control items (median = 6.5, inter-quartile range = 1.5) were significantly higher from those provided for both types of target verbs ( $p < 0.001$ ).

**Chart 3: Median ratings per verb type, experiment 2 (error bars represent inter-quartile range)**





**Chart 4: Median ratings per subject, experiment 2**

### 3.3.5 Discussion

Assuming the GABLE hypothesis, the accessibility pattern revealed in experiment 2 is rather puzzling. Causers of eventualities described by type (iii) unaccusatives, assumed not to have a transitive alternate in the mental lexicon at all were rated significantly higher than causers of events described by hidden Cause subject-Experiencer verbs, whose corresponding causation denoting concepts are argued to have a hidden lexical representation. However, a close inspection of these verbs and the task participants were asked to perform clarifies matters.

Type (iii) unaccusatives and hidden-Cause subject-Experiencer verbs are different with regard to the type of argument in their subject position, Theme vs. Experiencer, respectively. This is crucial when these verbs are set in the context of the current experimental design. Compare, for example, the contents of the final slides presented to participants in the task involving the type (iii) unaccusative *xamak* 'escape (the

mind of)') repeated in 48(a) and the task involving the hidden Cause subject-Experiencer verb *hit'anyen* 'get interested' repeated in 48(b):

- (48) a. The idea **escaped** Danny's mind. It was now completely empty.  
 How acceptable/conceivable for you is it to consider Danny's sister to be the executor of **one specific action** that resulted in the emptiness of his mind?
- b. Joey suddenly **got interested** in fashion. He now spends most of his paycheck on clothes.  
 How acceptable/conceivable for you is it to consider Dave to be the executor of **one specific action** that resulted in Joey spending most of his paycheck on clothes?

Notice that in 48(a) participants are asked to rate the extent to which Danny's sister is the causer of an idea escaping Danny's mind, while in 48(b) participants are asked to rate the extent to which Dave is the causer of Joey being interested in fashion. In 48(a), as in all other sentences involving type (iii) unaccusatives, the entity presented as most prominently affected by the causer is inanimate (e.g. 'the idea') while in 48(b), as in all other sentences involving hidden-Cause subject-Experiencer verbs, the entity presented as affected is human (e.g. 'Joey'). Considering this along with the fact that participants were asked to rate the extent to which the causer is the executor of the target event, the surprising pattern revealed in experiment 2 can be provided with an explanation. Causers established in the context as affecting inanimate objects were rated higher, while causers established as affecting humans were rated lower. The reason for this is that when the affected entity is human, it is more likely to share or to be viewed as sharing responsibility for the event taking place. As a result, the

causer's part in the execution of the event is rendered less perceptible. Therefore, when comparing hidden Cause subject-Experiencer verbs and type (iii) unaccusatives, the target sentences included in experiment 2 cannot be used to detect the existence of a hidden lexical representation, since the difference in the nature of the affected entity slants the results.

Nevertheless, although no conclusion regarding the psychological reality of a frozen Cause role in the lexical representation of hidden Cause Experiencer verbs can be drawn from this experiment, its results support the validity of this experimental design. First, the fact that the introduction of a human affected entity in the target sentence significantly influenced participants' performance demonstrates that it was the targeted verbal concept participants considered while completing the task and not one of the other verbal concepts they were exposed to during the experiment. Therefore, it confirms that the precautions taken to ensure that participants provide the required judgments (i.e. the separation of the context slide and the visual emphasis of the target verb) are indeed effective.

Second, the accessibility pattern revealed in experiment 2 shows a clear correspondence between participants' performance and aspects of causation relevant for the lexical encoding of causative verbs. Recall that this experimental design was employed to test the GABLE hypothesis' predictions under the assumption that the more accessible transitive concept (in this case, a causation denoting concept) is for speakers, the more prominent the role of the causer as the event's executer should be. Consequently, in cases where this concept is lexically encoded, the causer is predicted to be rated higher since according to GABLE, this concept is more accessible than a concept with no lexical encoding. The results of experiment 2 suggest that the connection between this design and the lexical encoding of causation denoting

concepts is even more direct. This is so since the contrast between causers affecting humans and causers affecting inanimate objects reveals that speakers' decisions are guided by the information these lexical entries encode. Neeleman & van de Koot (2011) view the lexical semantics of causative verbs as encoding the existence of a crucial contributing factor (CCF) that is held accountable for the event, a notion comparable with Reinhart's (2002, 2010) Cause theta role,. The results of experiment 2 show that the notion of CCF played a central role in determining speakers' performance, since when the prominent affected entity was human, thus likely to share accountability with the causer, the latter received a lower rating even though it was contextually established as the causer of the event. In other words, participants rated the likelihood of the entity established as causer to be the crucial contributing factor. Consequently, causers that affected [+human] entities were rated lower, since humans are more likely to be viewed as sharing accountability for the event taking place. The results of experiment 2 thus support the validity of this experimental design as a means of detecting the hidden existence of causative lexical entries.

Finally, even though both target conditions in experiment 2 were two-place psychological verbs, the accessibility of their corresponding transitive concepts were found to be significantly different. This suggests that these characteristics are not the ones that influence participants' performance in this experimental design. Nonetheless, the observed performance pattern does not rule out an alternative analysis: It is possible that the psychological element and argument structure of the target verbs are indeed relevant factors taken into account by participants while they complete of this task. However, since the involvement of a human Experiencer in the hidden Cause experiencer verbs condition was highly prominent, it lowered speakers' ratings for the involvement of the causer in these eventualities, thus triggering a

significantly different accessibility levels for the causation denoting concepts corresponding to the two target eventualities. To examine this hypothesis, an additional experiment was conducted.

### **3.4 Experiment 3**

Just like experiment 2, experiment 3 was designed to compare the accessibility levels of the causation denoting concepts corresponding to hidden-Cause Experiencer verbs with that of type III transitive concepts. Only this time, as detailed below, in order to prevent the involvement of a human Experiencer from interfering participants' assessment of the causer's role in the execution of the eventuality, Experiencer arguments appeared in object positions.<sup>17</sup>

#### **3.4.1 Participants**

Participants included 21 adult native Hebrew speakers, 3 male and 19 female, with an education level of 13 years or more. Participants' age ranged from 21 to 28 (mean age 24.9). None had any relevant prior linguistic education.

#### **3.4.2 Method**

##### Stimuli

The set of verbs used in this experiment was identical to the set of verbs used in experiment 2. Accordingly, it consisted of 6 hidden Cause Experiencer verbs, 6 unaccusatives of type (iii), and 5 type (i) unaccusative control items.

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<sup>17</sup>I thank Tal Siloni (P.C.) for suggesting this adjustment.

### Design and procedure

The design and procedure of this experiment were also identical to those of experiment 2, hence participants were presented with the same stories, target sentences and outcome sentences used in the previous experiment. The target sentences used for the hidden-Cause experiencer verbs condition were however slightly modified: instead of including the subject-Experiencer version of these verbs as was done in experiment 2, they included their object-Experiencer version. Consequently, human experiencer arguments were realized in object position in both the hidden-Cause experiencer condition and the type (iii) unaccusative condition. Hence, in this experiment the salience of the Experiencers' involvement in the described eventualities was balanced across these two conditions. This adjustment is demonstrated in (49):

(49)

- a. Target and outcome sentences, experiment (2):

Joey suddenly got **interested** in fashion. He now spends most of his paycheck on clothes.

- b. Target and outcome sentences, experiment (3):

Fashion suddenly **interested** Joey. He now spends most of his paycheck on clothes.

- c. Task (identical in both experiments):

On a scale of 1-7, how acceptable/conceivable for you is it to consider Dave to be the executor of **one specific action** that resulted in Joey spending most of his paycheck on clothes?

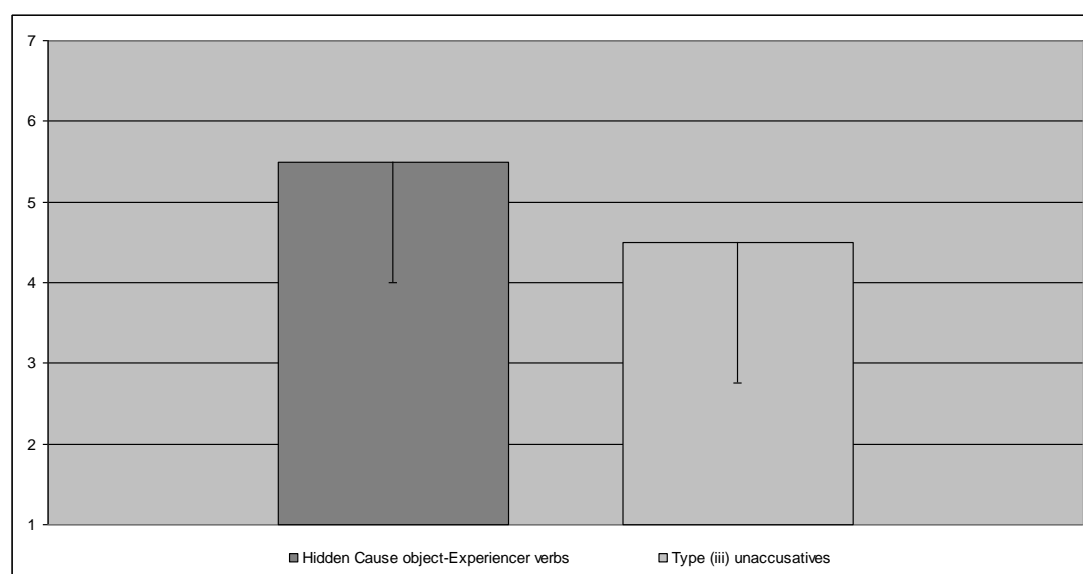
For a full list of object-Experiencer verbs used in this experiment see appendix D. For the stimuli sentences used in this experiment, their translation to English and a translated version of each context story see appendix E.

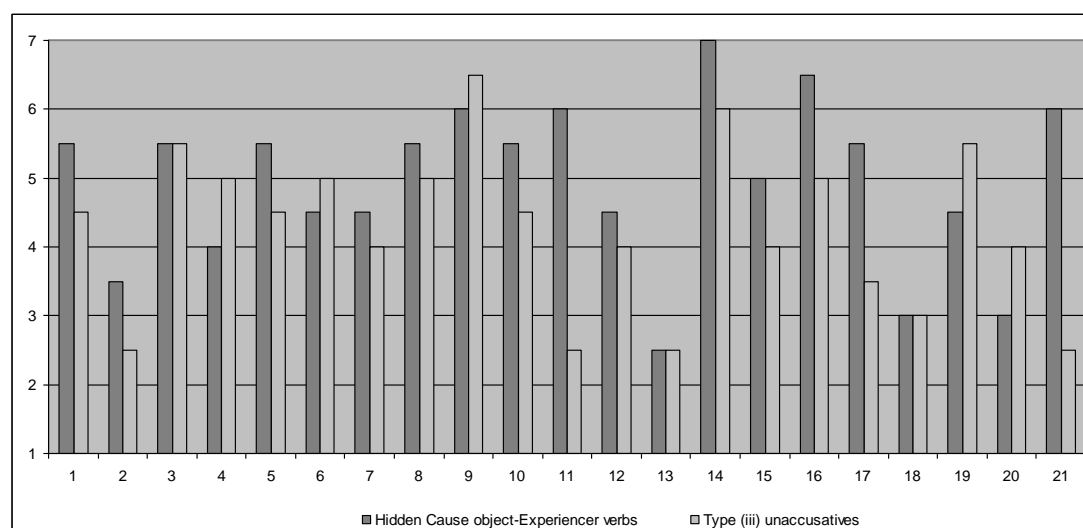
### 3.4.3 Results

A Wilcoxon signed rank test found the median ratings provided for causers of eventualities described by hidden-Cause object-Experiencer verbs (median = 5.5, inter-quartile range = 1.5) to be significantly higher than the median ratings provided for causers of eventualities described by type (iii) unaccusatives (median = 4.5 inter-quartile range = 1.75, two tailed:  $W(18) = 99$ ,  $p = 0.032$ ).

Median ratings provided for type (i) unaccusatives control items (median: 6.5, inter-quartile range=1.75) were again significantly higher from those provided for both types of target verbs ( $p < 0.001$ ).

**Chart 5: Median ratings per verb type, experiment 3 (error bars represent inter-quartile range)**



**Chart 6: Median ratings per subject, experiment 3**

### 3.4.4 Discussion

The performance pattern reported above clearly indicates that the adjusted design of experiment 3 managed to avoid the pitfalls of experiment 2. The accessibility patterns revealed in experiment 3 are consistent with the predictions of the GABLE hypothesis and with Siloni's (2009) analysis of hidden-Cause Experiencer verbs. The causation denoting concepts corresponding to hidden-Cause experiencer verbs, assumed to be encoded in the mental lexicon, were found to be significantly more accessible than the causation denoting concepts corresponding to type (iii) accusatives, for which there is no reason to assume lexical encoding. In addition, since both type of target predicates were two-place psychological verbs, the significantly different ratings they were given demonstrate once again that these two characteristics are not the ones taken into account by speakers when completing this experimental task.

Another issue that should be addressed here is the morpho-phonology of the hidden-Cause Experiencer verbs included in this experiment. As mentioned above, while experiment 2 included the subject-Experiencer diathesis of these eventualities, experiment 3 included the corresponding object-Experiencer diathesis. As the latter,



but not the former, possess verbal morpho-phonology associated with Hebrew causative verbs (namely, they occur with the CiCeC and the hiC.CiC verbal patterns), one may argue that the source of the high accessibility of causation denoting concepts corresponding to hidden-Cause Experiencer verbs observed in experiment 3 is their causative morpho-phonology.<sup>18</sup> However, an inspection of the sentential contexts in which these verbs appeared shows that this is an unlikely hypothesis.

Recall that participants were asked to grade the involvement of a third-party entity (established by the context as the causer) in the eventuality described by the object-Experiencer verb. Nevertheless, the fact that these verbs' morpho-phonology is associated with causatives cannot be viewed as responsible for the high rating the causer received. This is so since, as (50) demonstrates, the external argument's position of these verbs, where a Cause would appear if they were indeed causative verbs, was always occupied by the Subject-matter argument:

(50) **ofna** pit'om inyena et joey  
**fashion** suddenly interested ACC Joey

‘Fashion suddenly interested Joey.’

Task: On a scale of 1-7, how acceptable/conceivable for you is it to consider Dave to be the executor of **one specific action** that resulted in Joey spending most of his paycheck on clothes?

This means that if these object-Experiencer verbs had been perceived as causative, the causer (i.e. Dave), which does not appear in their external position (or any other argument position for that matter) would have received a lower rating as opposed to a

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<sup>18</sup> I thank Naama Friedmann (P.C) for bringing this issue to my attention.

higher one. This is so since the target sentences constituted a conspicuous reminder of the fact that, as shown in (51), the entity participants were asked to grade as causer cannot be realized as a syntactic argument of the target verbs:

- (51) \* dave-CAUSE. 'inyen            'et        joey (be-'ofna)  
        Dave-CAUSE. interested    ACC    Joey (in fashion)

The morpho-phonology of the Experiencer verbs is therefore not the source of the high ratings assigned to these eventualities. On the contrary, (50) and (51) demonstrate that, if anything, the causative morpho-phonology of the target verbs was prone to prompt the opposite slanting effect: as the participation of the causing entities in these eventuality could not be expressed using the given syntactic structures, speakers' inclination of grading the extent to which they caused these eventualities should have been reduced, rather than increased as observed.

### **3.5 Concluding discussion**

This chapter discussed the phenomenon of derivational gaps and compared two possible types of explanations for their emergence: ‘the nonexistence approach’ and ‘the hidden representation approach’. It was shown that the assumption of hidden lexical entries is falsifiable: that even though hidden lexical entries are not used in utterances, it is possible to tap into their psychological reality. According to the GABLE hypothesis, the lexical encoding of a concept has an effect on its accessibility

level. As a result, the existence of a hidden lexical entry can be revealed through the estimation of the accessibility level of the corresponding concept.

With regard to the case study at hand – gaps in the transitive-unaccusative alternation – GABLE predicts that if unaccusatives that idiosyncratically lack a transitive alternate in the vocabulary have a corresponding hidden (frozen) lexical entry, we should get a three-way distinction: transitive concepts related to unaccusatives with a transitive counterpart in a speaker's vocabulary will be more accessible than transitive concepts related to unaccusatives derived from frozen lexical entries, and that the latter will be more accessible than transitive concepts related to underived unaccusatives. In contrast, if the missing transitive alternates exist neither in the vocabulary nor hidden in the lexicon, then GABLE predicts a two-way distinction, between those that have an alternate and those that don't. The results of experiment 1 show a three-way distinction, thereby providing evidence in favor of the existence of frozen lexical entries, as suggested by Reinhart (2002, 2010) Horvath and Sioni (2008). The results of experiment 2 and 3 provide support for the validity of this experimental design, thus reinforcing the conclusions drawn from experiment 1 as well as bringing additional empirical support for the existence of hidden-Cause Experiencer verbs (Sioni 2009).

As to the GABLE hypothesis itself, it carries consequences also beyond the issue of gaps in the transitive-unaccusative alternation. It constitutes a step toward a better grasp of the linguistic encoding of concepts and the relation between abstract lexical representations and vocabulary items, a topic that can undoubtedly benefit from further crosslinguistic research involving other derivational alternations.

## Chapter 4: The psycholinguistics of derivational directionality

Now let us return to the issue of derivational directionality. As I have shown in chapter 2, analyses that view unaccusatives and their transitive alternates as derivationally related, characterize the directionality of this relationship in one of the following three ways:

- (a) Both alternates are derived from a common source (*root-based* approaches)
- (b) The transitive alternate is formed via an operation which takes the unaccusative as input (*unaccusative-to-transitive* approaches)
- (c) The unaccusative alternate is formed via an operation that takes the transitive as input (*transitive-to-unaccusative* approaches)

The study I present below was designed with the aim of gaining insight into what alternate speakers perceive as the basic diathesis; thus it aims to investigate which of the above approaches to the directionality of the derivation provides a psychologically real model.

### 4.1 ICE: hypothesis and rationale

The empirical examination of (a)-(c) above was guided by the following hypothesis:

(52) Input Contextual Effect (ICE):

Given a derivational relationship, the basic alternate serves as a better facilitator for the lexical retrieval of the derived alternate than vice versa.

According to the ICE hypothesis then if, the unaccusative *break* is the input for the derivational operation which creates the transitive *break*, a task requiring speakers to retrieve the transitive *break* (the derived alternate) after they were exposed to the unaccusative *break* (the basic alternate) should be easier than a task that calls for the

retrieval of the unaccusative after speakers encountered the transitive , i.e. the basic diathesis will be a better context for the retrieval of the derived diathesis than the derived diathesis would be for the retrieval of the basic one.

The rationale behind this hypothesis is that if indeed one diathesis is created through a linguistic procedure performed on the other, an order of presentation reflecting the configuration of this procedure will have a contextual effect observably greater than the contextual effect of mere semantic, phonological or derivational relatedness.

Derivational relationships between diatheses are a part of speakers' arsenal of linguistic mechanisms. As such, they are predicted to play a central role in the formation of new lexical items, the acquisition of these forms and most relevantly for our present purposes - their lexical storage and retrieval. A pair of diatheses presented to speakers in a manner which reflects the architecture of this relationship is therefore predicted to facilitate their performance in a linguistic task. In case this relationship is directional, providing speakers with the basic alternate as the context for the retrieval of the derived one will echo the relationship better than providing them with the derived alternate as the context for the retrieval of the basic one. In case this relationship is not directional, all other factors being equal, the two orders should yield the same performance pattern since none of them would constitute a better portrayal of this relationship.

## **4.2 Empirical support**

The implications of derivational relationships on lexical retrieval have long been the subject of many psycholinguistic studies aiming to tap the process of morphological decomposition upon lexical access (see McQueen and Cutler 1998 for a review). However, as these studies' object of interest is not derivational directionality, they

tend to target alternations for which directionality is not controversial and usually do not include a comparative evaluation of the facilitating effects brought about by basic and derived alternates. Nonetheless, this body of work turns out to provide empirical support for the ICE hypothesis.

Stockall and Marantz (2006) conducted a psycholinguistic and neurolinguistic study which examined how the derivational relationship between English past tense irregular verbs (e.g. *gave*, *taught*, *swore*, *grew*, henceforth irregularVs) and their corresponding 'stems' (e.g. *give*, *teach*, *swear*, *grow*) affects their lexical retrieval. The psycholinguistic element of this study consisted of two visual-priming experiments in which participants were asked to complete a lexical decision task regarding a visually presented target word or non-word which followed a visually presented prime.

Importantly for our present purposes, in the first experiment the prime words were irregularVs and the target words were their corresponding stems (i.e., prime: *gave*, target: *give*) and in the second experiment the directionality of these items was reversed: the prime words were stems and the target words were irregularVs (i.e., prime: *give*, target: *gave*). In other words, in Stockall and Marantz's first experiment the verbs were presented in a derived-basic order while in the second experiment the order was inverted to basic-derived. This was done since the author's prediction was not borne out by the results of the first experiment. They expected irregularV targets to always facilitate faster RTs to their corresponding stems compared to control conditions. However, this only occurred with high overlap prime-target pairs (i.e. *gave-give*, *grew-grow*), while low orthographic overlap prime-target pairs (i.e. *taught-teach*, *swore-swear*) did not facilitate faster reaction times.

Interestingly, the reversal of directionality in the second experiment revealed a

different performance pattern: not only did the previously challenging low orthographic overlap pairs have suddenly significantly facilitated RTs compared to the control conditions, but also the facilitating effect for high overlap pairs was higher than the one observed in the previous experiment.

According to Stockall and Marantz, it could be that the reason irregularV (i.e. *taught*, *gave*) primes are not good facilitators for the retrieval of their corresponding stems (i.e. *teach*, *give*) is that an activation of this type of prime involves, in addition to an activation of the corresponding stem, the activation of the rule which creates the irregularV. This might mean that when the stem is later reactivated by the target, the system is inclined to also access this rule again, which results in longer RTs as a consequence of having to override this inclination.

In summary, Stockall and Marantz's study provides empirical evidence for the ICE hypothesis. It targeted an alternation (stem-irregularV) for which directionality is not at debate and revealed that, as stated by the ICE hypothesis and explained above, basic alternates are better facilitators for the lexical retrieval of derived ones than vice versa.<sup>19</sup>

### **4.3 The current experiments**

Assuming the ICE hypothesis then, given two derivationally related diatheses, a consistently superior efficiency of one diathesis to facilitate the lexical retrieval of the other can be seen as an indication that it is the basic one.

In the case of the transitive-unaccusative alternation, the three different views of directionality reviewed in chapter 2 make different predictions with regard to this hypothesis: If unaccusative-to-transitive theories provide the correct representation,

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<sup>19</sup> In section 4.7 I bring further independently motivated support for the ICE hypothesis.

we would expect the lexical retrieval of a transitive alternate after being provided with the unaccusative entry to be easier for speakers than the lexical retrieval of an unaccusative after being exposed to its transitive equivalent. If transitive-to-unaccusative approaches are on the right track, we would expect the opposite pattern to emerge. Finally, if root-based theories provide the correct model for the relationship between unaccusatives and their corresponding transitives, we would expect the two orders of presentation to pose an equal degree of difficulty.

To test these predictions, three cross-modal lexical priming experiments were conducted. In this type of design speakers are presented with an auditory prime word and afterwards with a target word or non-word, which appears on a computer screen. They are then required to complete a lexical decision task: press a certain key if the target string is a word, and another if it is a non-word. Accuracy and RT are recorded and analyzed. This particular type of priming technique is labeled “cross-modal” to indicate that the prime and the target are presented to the participant via two distinct modalities. Cross-modality has been shown to be efficient in detecting underlying structural relationships, rather than perceptual effects of orthographic factors (see Frost 2000b for a review of various priming techniques). As such, this methodology is extremely suitable for the purposes of the current study. In experiment 4, presented immediately below, a cross-modal lexical priming design was used to compare speakers' RT to transitive-unaccusative prime-target combinations (henceforth: TU) with their RT to unaccusative-transitive prime-target combinations (henceforth UT). The basic structure of the experimental design was inspired by the work of Frost et al (1997, 2000a, 2000b).<sup>20</sup>

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<sup>20</sup> I am extremely thankful to Michal Ben-Shachar (P.C.) who noticed that this design can be used to examine derivational directionality.



Note that the subject matter of this empirical examination is the structural relationships between abstract syntactic or lexical representations as opposed to structural relationships between morpho-phonological forms. Hence, in this context it is important to distinguish between semantic-thematic derivational relationships and morpho-phonological ones.

Morpho-phonologically speaking, Hebrew verbs are composed of consonantal roots and verbal patterns. Derivationally related diatheses share a root but very often differ with regard to the verbal patterns they are associated with. For example, the tri-consonantal root s.g.r combined with the niC.Car verbal pattern creates the unaccusative *nisgar* ‘close.unacc’, while the corresponding transitive consists of the same root combined with the CaCaC pattern creating *sagar* ‘close.trans.’ Consequently, in Hebrew, as opposed to English for example, the transitive-unaccusative alternation is often coded by overt morphology. Thus, in most cases there is an overt distinction between unaccusatives and their corresponding transitives even without a linguistic context.

Nevertheless, neither Hebrew unaccusatives nor their transitive equivalents are associated with one specific verbal pattern. As a result, in some alternations the unaccusative form contains a prefix while the transitive form does not (e.g. *saraf* – *ni-sraf* ‘burn.trans’ – ‘burn.unacc’), which renders the transitive phonologically lighter (henceforth: a ‘simplex’), while in others (e.g. *hi-kpi* - *kafa* ‘freeze .trans’ – ‘freeze.unacc’) the transitive form contains an additional prefix hence is phonologically heavier than the unaccusative form (henceforth: a ‘complex’). Therefore, as will be detailed below, it is necessary and actually possible to defuse the factor of morpho-phonology and exclude it from biasing speaker performance.

## 4.4 Experiment 4

### 4.4.1 Participants

The group of participants consisted of 36 adult native Hebrew speakers, 27 female and 9 male. Their ages ranged between 19 and 30 and their mean age was 24.52. All the participants had at least 13 years of education. None had any linguistic education concerning the subject matter of this study.

### 4.4.2 Method

#### Stimuli

The experiment included three conditions: an experimental condition, a phonological control condition and a non-word fillers condition. All verbs appeared in past tense, third person singular masculine, which is the citation form of Hebrew verbs.

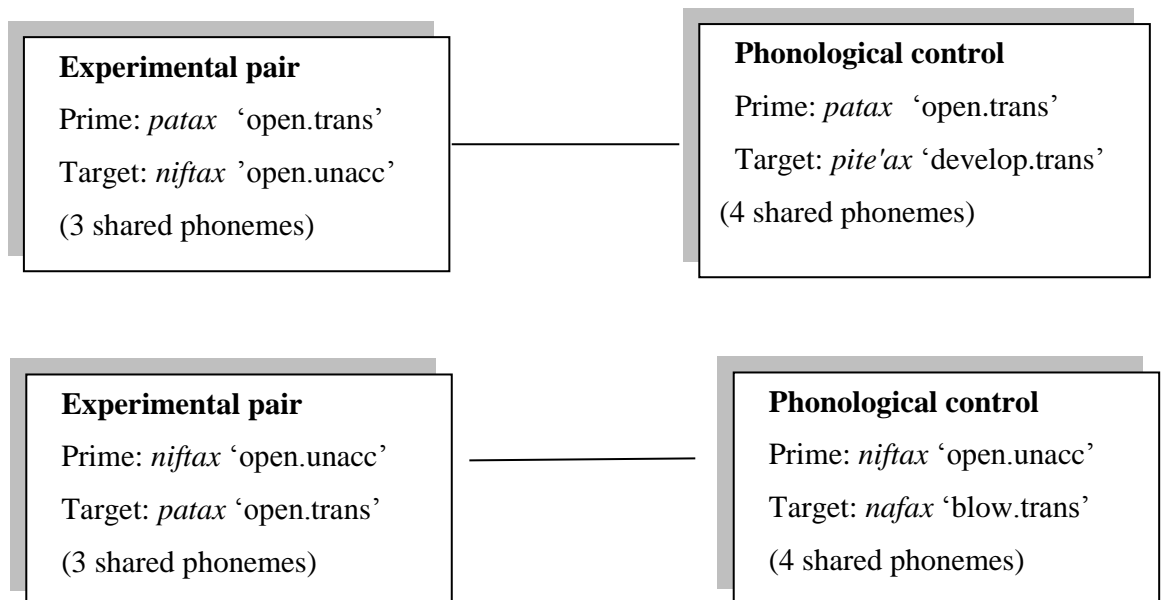
#### *The experimental condition:*

This condition consisted of 34 morphologically distinct pairs of unaccusative verbs and their transitive equivalents presented in either TU or UT prime-target combinations: 12 of these were simplex-complex transitive-unaccusative pairs, 12 were complex-simplex transitive-unaccusative pairs, and 10 consisted of either simplex-simplex or complex-complex transitive-unaccusative pairs (e.g., *kiba* ‘turn-off.trans’ *kava* ‘turn-off.unacc’; *hi-dlik* ‘light.trans’ *ni-dlak* ‘light.unacc’, respectively). Unaccusative verbs and their transitive counterparts did not differ in frequency of occurrence, which was determined based on Frost and Plaut's (2005) word frequency database for printed Hebrew (Wilcoxon signed rank test  $W(24) = -74, p = 0.3$ ). For the full list of stimulus items see appendix F.

#### *The phonological control condition:*

In order to enable a comparison between speakers' performance on pairs of verbs which exhibit a purely phonological relation to their performance on pairs of verbs

which exhibit a valence-changing derivational relationship, the experiment included 68 phonological control pairs. Each of these items corresponded to one of the experimental prime-target pairs and included the same prime verb as the matching experimental item. The targets were chosen to duplicate only the phonological relation between the experimental prime and target. Accordingly, control targets shared with the prime a similar number of phonemes as the experimental target did, but denoted an unrelated eventuality. Figure 6 demonstrates how phonological control items were chosen to match the TU and UT versions of the experimental stimulus pair denoting the eventuality of ‘opening’:

Figure 6<sup>21</sup>

<sup>21</sup> Notice that even though *patax* ‘open.trans’ and *piteax* ‘develop.trans’ share the consonantal root p.t.x, they each denote a different eventuality, whereas *patax* ‘open-trans’ and *niftax* ‘open-unacc’ both denote the eventuality of ‘opening’.

### *The non-word fillers condition*

The non-word fillers condition consisted of 68 randomly chosen Hebrew verbs paired with 68 non-words composed in the form of Hebrew verbs.

### Design

Each participant encountered 136 stimulus items, each consisting of a prime verb and a target verb: 17 experimental pairs in TU prime-target order; 17 experimental pairs in UT prime-target order; 17 unaccusative-phonological control prime-target pairs; 17 transitive-phonological control prime-target pairs; and 68 verb-non-word filler pairs.

In order to enable an analysis comparing speakers' performance per each type of prime-target combination, while guaranteeing that no participant encounters the same alternation twice, this experiment utilized a 2X2 Latin square design: participants were randomly divided into two groups of 18 members. The 17 TU experimental pairs presented to the first group were presented to the second group in UT order, and vice-versa. Phonological control stimulus items were presented to the group that did not encounter their corresponding experimental UT or TU stimulus items and ordered so that a control pair corresponding to a TU stimulus item was at least 10 items apart from the same pair presented in UT order, and vice versa.

### Procedure

The experiment was constructed and run using E-prime 2.0 (PST Inc.) and an HP mini 10.1 inch screen netbook. Auditory primes were recorded by a female voice using an iTalk recorder application (Griffin technology for iPhone and iPad) and were trimmed as well as cleaned from background noises using Pro-tools editing software.

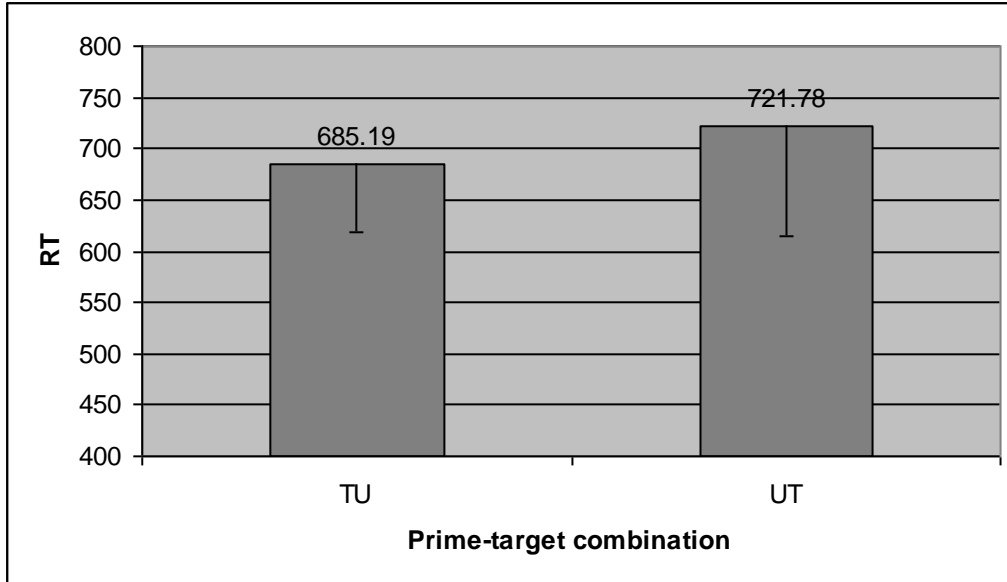
Participants were seated in a quiet room in front of the computer. They were

instructed to listen to the prime and then press 1 if the item appearing on the screen is a word and 0 if it is a non-word. The instructions given to each participant orally also appeared on the computer screen. Once the participant hit the Enter key to confirm that he or she had understood the instructions and was ready to begin, a practice session consisting of 11 prime-target pairs has commenced. The 136 quasi-randomly ordered experimental, control and filler prime-target pairs appeared right afterwards. Participants first heard the prime word while three asterisks appeared at the center of the screen. 750 ms after the offset of the auditory stimulus these symbols were replaced by the target string. Once the lexical decision was provided, the asterisks appeared again and the next auditory stimulus item has commenced.

#### **4.4.3 Results**

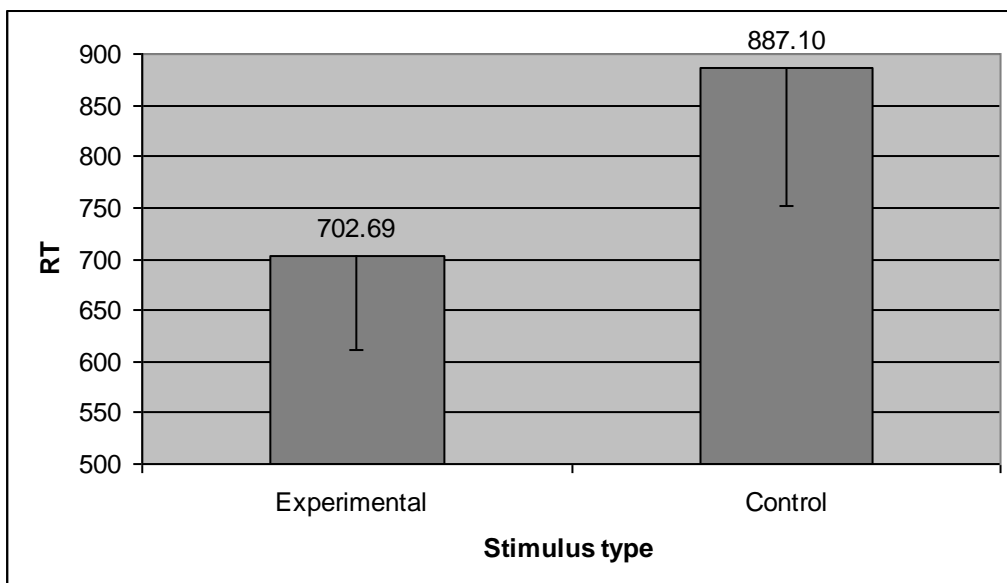
A t-test for correlated samples comparing average RTs in the case of transitive-unaccusative prime-target combinations with average RTs in the case of unaccusative-transitive prime-target combinations calculated by items revealed a faster performance when the prime was a transitive and the target was an unaccusative (TU mean = 685.19 ms, SD = 66.44 ms Vs. UT mean = 721.78 ms, SD = 106.89 ms;  $t(33) = 2.44$ ,  $p = 0.02$ ). A comparison of averages calculated by participants revealed the same pattern of performance (t-test for correlated samples  $t(35) = 2.64$ ,  $p = 0.012$ ).

**Chart 7: Average RT per prime-target combination (error bars represent standard deviation calculated by items)**



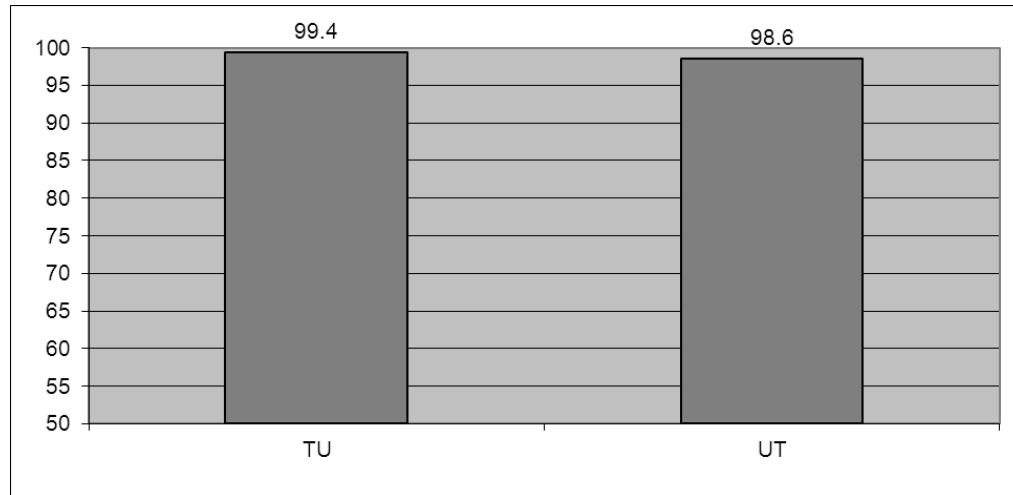
In addition, RTs for the experimental stimulus items were significantly faster than RTs for their matched phonological control pairs (experimental mean = 702.69 ms, SD = 91.9 ms Vs. control mean = 887.10 ms, SD = 135.2 ms, t-test for correlated samples:  $t(67) = 9.9$ ,  $p < 0.001$ ).

**Chart 8: average RT by stimulus type (error bars represent standard deviation calculated by items)**



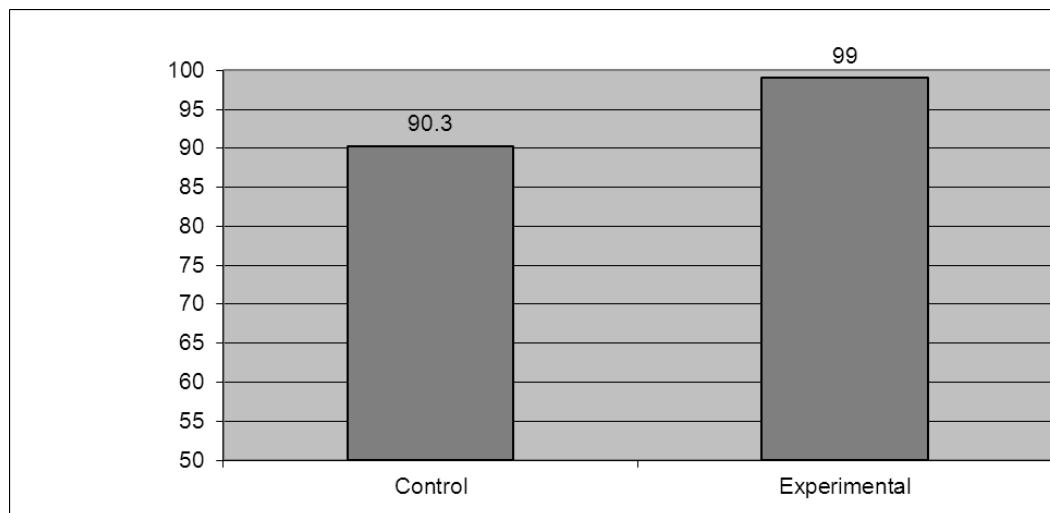
Finally, error rate for TU prime-target pairs was not significantly lower than error rate for UT prime-target pairs (TU mean= 0.6%, SD=1.6% vs. UT mean= 1.4% , SD = 2.7% ; t-test for correlated samples  $t(35) = 1.8$  ,  $p = 0.17$ ).

**Chart 9: average percentage of accuracy per prime-target combination**



Error rate for the phonological control pairs was significantly higher than the error rates for both levels of the experimental condition (control mean = 9.9% , SD = 6.6%; t-test for correlated samples TU vs. control:  $t(35) = 8.02$  ,  $p < 0.001$  , UT vs. control:  $t(35) = 7.85$  ,  $p < 0.001$ ).

**Chart 10: average percentage of accuracy by stimulus type**







entailment relation; specifically, that speakers found it easier to retrieve unaccusative targets after transitive primes were accessed because the retrieval of the transitive prime (e.g. *gilgel*- ‘roll.trans’) activated the truth conditional semantics associated with the proposition containing this verb (e.g. X rolled Y, which entails that Y rolled) and that this has consequently resulted in facilitating the retrieval of the corresponding unaccusative (e.g. *hitgalgel*- ‘roll.unacc’). In contrast, in the reverse prime- target combinations the unaccusative prime had no such facilitation effect for the retrieval of the corresponding transitive since the truth of the unaccusative proposition does not entail the truth of the corresponding transitive one.

In order to examine the potential relevance of this relationship for this particular task, a follow-up experiment examined pairs of verbs that exhibit the entailment relationship described above but are not derivationally related.<sup>22</sup> If semantic entailment is indeed relevant for speakers' performance in a lexical decision task, they are predicted to perform better when the entailing verb is the prime and the entailed verb is the target. Hence, Experiment 5 compared speakers' performance with entailing-entailed prime-target pairs to their performance with entailed-entailing prime-target pairs.

## **4.5 Experiment 5**

### **4.5.1 Participants**

The group of participants consisted of 30 adult native Hebrew speakers, 22 female and 8 male. Their ages ranged between 20 and 43 and their mean age was 27.16. Participants' level of education and familiarity with linguistic theory was identical to

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<sup>22</sup> I thank Tal Siloni (P.C) for noting that semantic entailment should be excluded as an underlying factor and suggesting that this empirical examination be conducted.

that of the group of participants in experiment 4.

#### **4.5.2 Method**

##### Stimuli

Participants were presented with three types of stimulus items: an experimental condition, a control condition and a non-word fillers condition.

##### *The experimental condition*

The experimental condition consisted of 34 pairs of transitive verbs and their corresponding semantically entailed but not derivationally related intransitives presented to participants in both entailing-entailed ( $\rightarrow$ ) and entailed-entailing ( $\leftarrow$ ) orders. The pairs were chosen based on a pretest performed on 10 savvy speakers who were given a list of 49 pairs exhibiting these defining properties. Only pairs that were also judged as exhibiting this type of semantic entailment by 9 or more of the speakers were included in this experiment. Morpho-phonologically speaking, each member of a pair was associated with a distinct consonantal root. In addition, in each pair, at least one verb had a corresponding derivationally related transitive or intransitive alternate associated with the same consonantal root. This means that none of the pairs can be seen as an etymologically unrelated semantic equivalent which replaces the transitive/intransitive equivalent of a verb or ‘blocks’ it from occurring in the mental lexicon (for a discussion of the various aspects of this phenomenon, see Aronoff 1976, Parsons 1990 and Embick & Marantz 2008).

Two examples, whose English translation also exhibits the defining properties mentioned above, are *cinen* ‘chilled.trans’-*hitkarer* ‘cooled.intrans’ and *hidgish* ‘emphasized’ *balat* - ‘got-prominent’.

Finally, in this case as well, morpho-phonological complexity and frequency of occurrence were balanced between entailing and entailed verbs ( $W(24) = 87, p =$

0.215). For the full list of stimulus items see appendix G.

#### *The control condition*

The control condition consisted of 34 randomly chosen semantically and derivationally non-related transitive and intransitive verbs.

#### *The non-word fillers condition*

The non-word fillers condition consisted of the same non-word stimulus items used in experiment 4.

#### Design

Each participant encountered 136 stimulus items, each consisting of a prime verb and a target verb. The stimuli for each group included 17 experimental pairs in entailing-entailed prime-target order; 17 experimental pairs in entailed-entailing prime-target order; 34 control prime-target pairs; and 68 verb-non-word filler pairs.

As in experiment 4, a 2X2 Latin square design was utilized: participants were randomly divided into 2 groups of 15 and the 17 experimental pairs presented to the first group in entailing-entailed order were presented to the second group in entailed-entailing order, and vice-versa. Since there was no specific correspondence between control and experimental items, both groups of participants were presented with the same control items.

#### Procedure

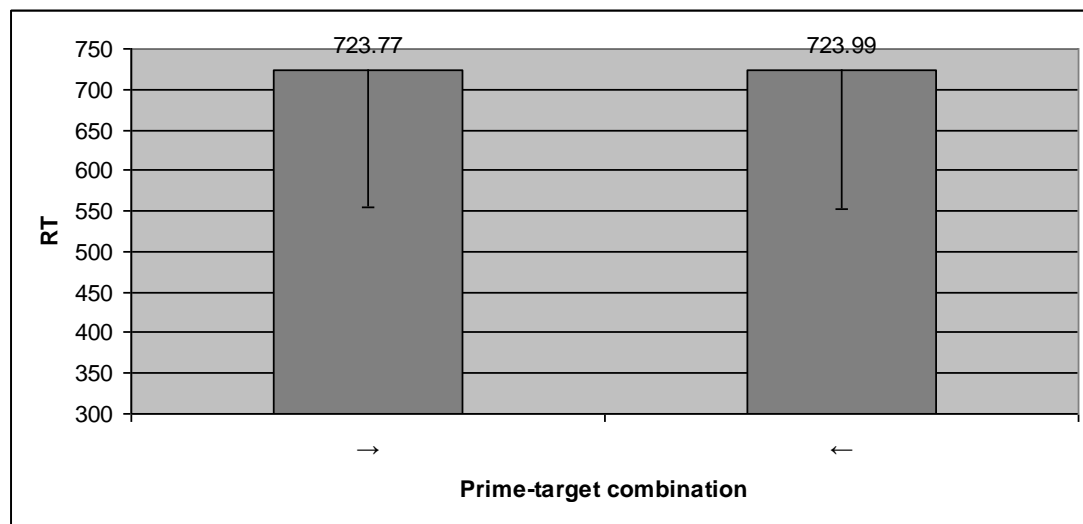
The Procedure was identical to that of experiment 4.

#### **4.5.3 Results**

A t-test for correlated samples comparing average RTs for entailing-entailed prime-target combinations with average RTs for entailed-entailing prime-target combinations calculated by items did not find participants' performance to be

significantly different (entailing-entailed mean = 723.77 ms, SD = 169.67 ms Vs. entailed-entailing mean = 723.99 ms, SD = 170.66 ms,  $t(33) = 0.008$ ,  $p = 0.99$ ). A comparison of averages calculated by participants revealed the same pattern of performance (t-test for correlated samples  $t(29) = 0.013$ ,  $p = 0.98$ ).

**Chart 11: average RT by prime-target combination (error bars represent standard deviation calculated by items)**

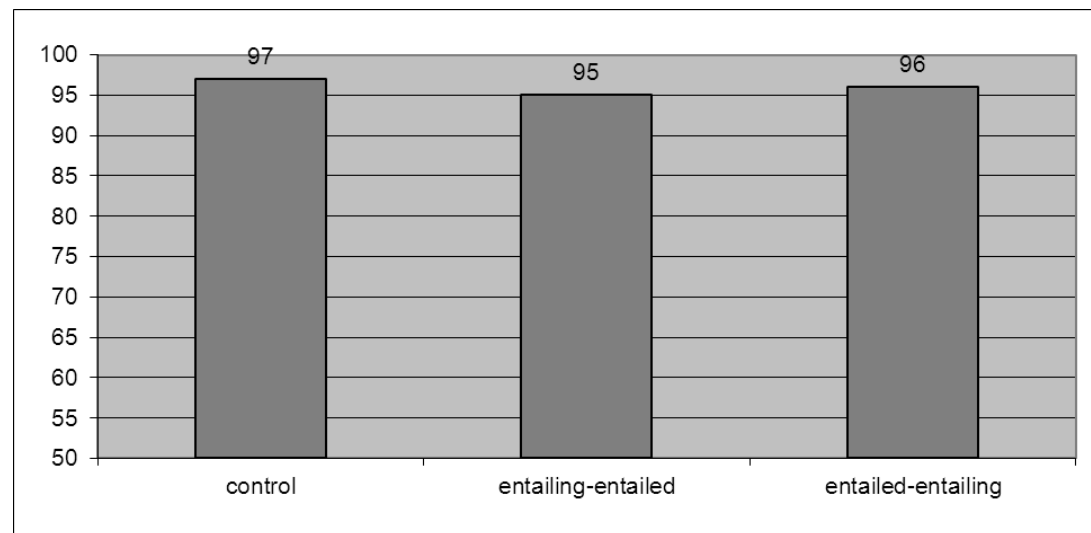


In addition, no significant difference was found between average RTs for experimental items and average RTs for control items (experimental mean = 723.88 ms, SD = 163.42 ms vs. control mean = 707.06 ms, SD = 128.43 ms, t-test for correlated samples  $t(29) = 1.32$ ,  $p = 0.2$ ).

Finally, error rate for entailing-entailed pairs was not significantly different than error rate for entailed-entailing pairs (entailing-entailed mean = 5 %, SD = 6% entailed-entailing mean = 4% , SD = 5%, t-test for correlated samples  $t(29) = 0.81$  ,  $p = 0.42$ ). A comparison between error rate for control items and error rate for both

levels of the experimental condition revealed the difference between them to be non-significant as well (control mean = 3% , SD = 3% ; t-test for correlated samples entailing-entailed vs. control:  $t(29) = 1.52$  ,  $p = 0.14$  , entailed-entailing vs. control:  $t(29) = 0.68$  ,  $p = 0.5$ ).

**Chart 12: average percentage of accuracy by stimulus type**



#### **4.5.4. Discussion**

The comparison between entailed-entailing and entailing-entailed prime-target pairs conducted in experiment 5 revealed no significant difference between speakers' performance for the two types of stimuli. As this experiment was designed to isolate the variable of semantic entailment, the almost identical RT patterns for both levels of this variable suggest that semantic entailment is irrelevant for cross modal lexical priming and can therefore be excluded as an underlying factor that might have influenced speakers' performance in experiment 4.

#### **4.6 Experiment 6**

As detailed in 4.2 above, the experimental items in experiment 4 were chosen in a

manner that controlled their morpho-phonology and frequency of occurrence. However in order to unequivocally rule out the target verbs' morpho-phonology, frequency of occurrence or argument structure (number of arguments) as intervening underlying factors, an additional experiment was designed and conducted.<sup>23</sup>

As detailed immediately below, in experiment 6 participants were presented with the same target words included in experiment 4 without being exposed to a prime beforehand.

#### ***4.6.1 Participants***

The group of participants consisted of 30 adult native Hebrew speakers, 16 female and 14 male. Their ages ranged between 23 and 40 and their mean age was 29.53. Participants' level of education and familiarity with linguistic theory was identical to that of the group of participants in experiment 4 and 5.

#### ***4.6.2 Method***

##### Stimuli

Stimuli consisted of the 34 transitive verbs and their corresponding unaccusatives used in experiment 4, as well as the 68 non-words and the 68 phonological controls included in experiment 4, functioning in the current experiment as filler items. For the full list of transitives and unaccusatives items see appendix H.

##### Design

Each participant encountered 136 words: 17 unaccusative verbs; 17 transitive verbs; 34 existing filler verbs and 68 non-words.

Once again, participants were randomly divided into two groups of 15 members, each presented with a different set of items. The composition of each set maintained the following rule: the eventualities presented to group 1 in the transitive diathesis

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<sup>23</sup> I thank Orna Peleg (P.C) for calling my attention to the necessity of this examination.

were presented to group 2 in the unaccusative diathesis and vice versa.

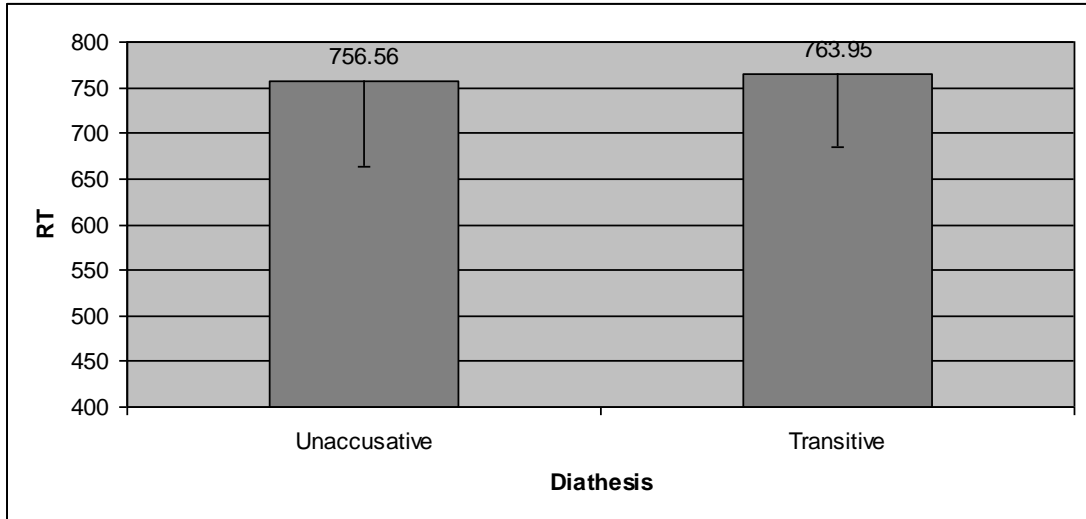
### Procedure

The words and non-words were presented to speakers one after the other in the same order they were presented in experiment 4. Each item was separated from the next by a 3 second pause during which three asterisks appeared at the center of the screen. Participants were instructed to read the word that appear on the screen and press 1 if it exists and 0 if it does not. All other procedural details were identical to those of experiment 4 presented in 4.4.2 above.

### **4.6.3 Results**

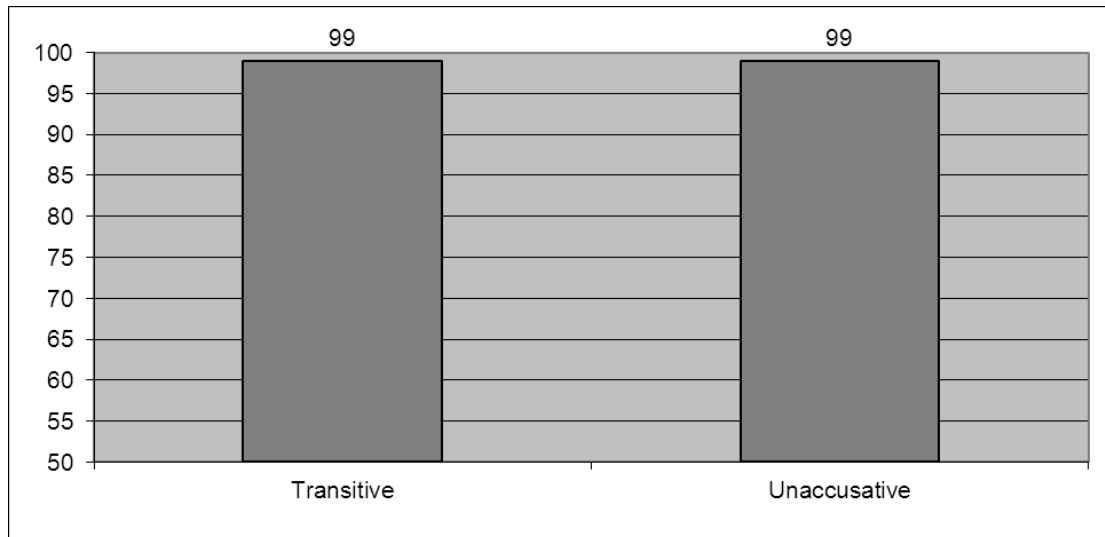
A t-test for correlated samples comparing average RTs for the transitive and unaccusative verbs calculated by items did not find performance to be significantly different (unaccusative mean = 756.60 ms, SD = 92.41 ms Vs. transitive mean = 763.95 ms, SD = 78.9 ms,  $t(33) = 0.36$ ,  $p = 0.72$ ). A comparison of averages calculated by participants revealed the same pattern of performance (t-test for correlated samples  $t(29) = 0.61$ ,  $p = 0.545$ ).

**Chart 13: average RT by stimulus type (error bars represent standard deviation calculated by items)**



Finally, error rate for transitive items was not significantly different than error rate for unaccusative items (unaccusative = 1 %, SD = 0.7%, transitive = 1% , SD = 0.6%, t-test for correlated samples  $t(29) = 0.46$  ,  $p = 0.65$ ).

**Chart 14: average percentage of accuracy by stimulus type**



#### 4.6.4 Discussion

The experimental condition of the current experiment consisted of the transitive and



the unaccusative verbs included in experiment 4. It was designed to compare speakers' RT in a lexical decision task in which the target word is an unaccusative verb to their RT in a lexical decision task in which the target word is the corresponding transitive. In contrast with experiment 4, in the current experiment participants did not listen to a prime word prior to the appearance of the target word on the screen. As reported above, an analysis of their performance reveals that, in contrast with the performance pattern observed in experiment 4, RTs to unaccusative targets were not significantly different from RTs to transitive targets.

This performance pattern indicates that the significantly shorter RTs in the case of transitive-unaccusative prime-target pairs observed in experiment 4 is not a reflection of the target's idiosyncratic features, or number of arguments (1 vs. 2), but due to the relationship between the transitive prime and the unaccusative target.

#### **4.7 Concluding Discussion**

Given the results of experiment 5 and 6, the performance pattern revealed in experiment 4 is a clear indication that transitive primes facilitate the lexical retrieval of their corresponding unaccusatives better than unaccusative primes facilitate the lexical retrieval of their corresponding transitives.

According to the ICE hypothesis, the significantly shorter RT in the lexical decision task with transitive-unaccusative prime-target combination is due to its resemblance to the mental representation of the systematic relationship between these two diatheses. This mental representation, the results of experiment 4 suggest, defines the transitive verbs as the derivationally basic alternates from which unaccusative verbs are derived. Therefore, this performance pattern is consistent with transitive-to-unaccusative analyses and inconsistent both with unaccusative-to-transitive and with

root-based analyses.

In addition, the significant difference found between the overall performance with pairs consisting of corresponding unaccusative and transitive verbs in both orders of presentation and pairs of verbs for which the relationship is purely phonological, or purely involves semantic entailment, provides new empirical evidence to reinforce the view that the relationship between unaccusatives and their transitive alternates is more than a result of phonological resemblance or entailment relation. This finding is a clear indication for the existence of a structural relationship between the abstract representations of these verbs, thus demonstrating psychological reality for the assumption of a derivational relationship between the transitive and the unaccusative diatheses.

#### ***4.7.1 Against an alternative interpretation***

As detailed above, under the assumption of the ICE hypothesis, the performance patterns observed in experiment 4-6, suggest that unaccusative verbs are derived from their transitive counterparts. However, there is also an alternative way of interpreting these findings, which stems from a hypothesis I label here the ‘Output Hypothesis’:

(54) The Output Hypothesis:

Given a derivational relationship, the derived alternate would serve as a better facilitator for the lexical retrieval of the basic alternate than vice versa.

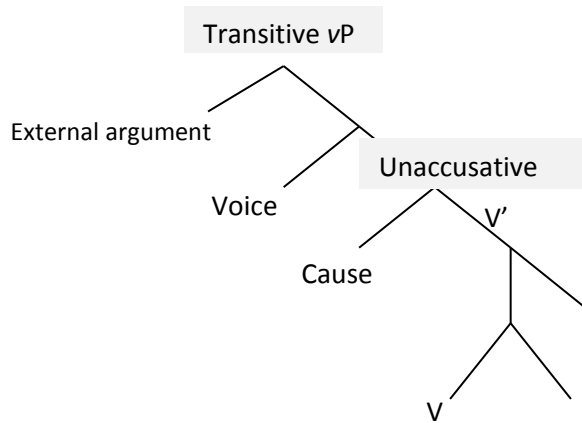
Similarly to ICE, The Output Hypothesis assumes that derivational relationships are reflected in speakers' perception, but postulates the opposite facilitation effect. It suggests that basic alternates are accessed during the computation of their derived counterparts. Hence that previous retrieval of a derived alternate would render the

basic alternate highly accessible. Consequently, under the assumption of the Output Hypothesis, the fact that transitives were found to be better facilitators for the retrieval of their unaccusative counterparts than unaccusatives were for the facilitation of transitives, constitutes evidence that unaccusatives are the basic alternates from which transitives are derived; hence the observed performance pattern would be interpreted as consistent with unaccusative-to-transitive approaches. There are however two reasons for rejecting this analysis of the results.

First is the existence of direct empirical evidence which contradicts the Output Hypothesis itself. Recall that the study by Stockall and Marantz (2006) presented in the beginning of this chapter targeted an alternation for which directionality is not at debate, namely the derivational relationship between verb stems and their corresponding past forms, and found that basic alternates are better at facilitating the lexical retrieval of their derived alternates than vice versa. As these findings are inconsistent with the Output Hypothesis they constitute a reason to abandon it.

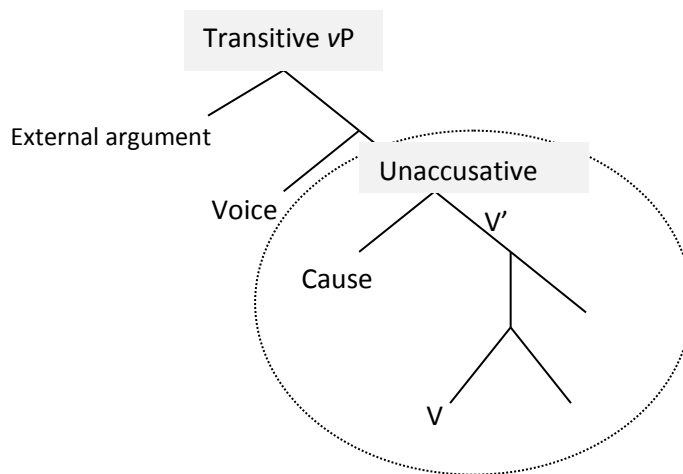
Furthermore, as I explain immediately below, an Output-Hypothesis based reinterpretation of the current study's findings as consistent with unaccusative-to-transitive directionality would have to involve the ad-hoc assumption of an unknown processing mechanism.

As mentioned in chapter 2, unaccusative-to-transitive approaches analyze the derivational relationship between transitives and unaccusatives as reflecting the fact that the unaccusative VP is embedded under the transitive *v*P. Figure 7 illustrates this structural relationship:



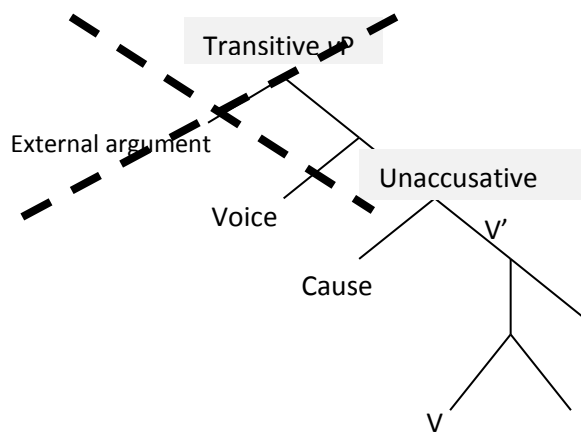
**Figure 7**

An analysis of the current study's results which assumes this type of derivation as well as the Output Hypothesis would suggest that transitives were observed to be better facilitators than unaccusatives since their lexical retrieval required the computation of the embedded unaccusative tree fragment. As a result, once the transitive alternate had been retrieved, the syntactic structure essential for the retrieval of the unaccusative was already formed, thus rendering the retrieval of the unaccusative verb a shorter process which, as illustrated in figure 8, only required the extraction of an already computed structural fragment:



**Figure 8**

However, suggesting that this type of fragment extraction can take place requires the premise that it can be utilized for the retrieval of the unaccusative verb. This would entail the assumption of a processing mechanism which, as demonstrated in figure 9 below, is capable of removing the top of the structure to reveal the ready-made representation of the unaccusative form.



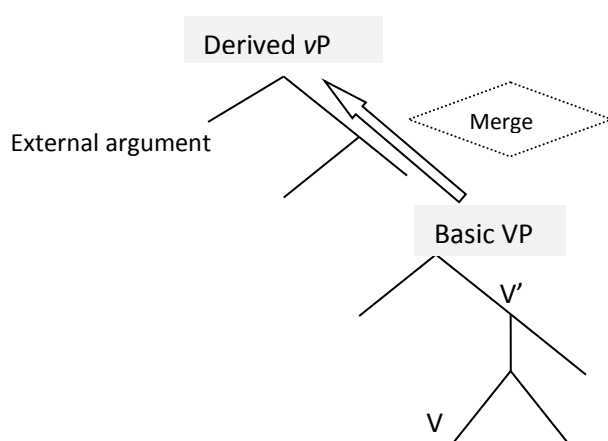
**Figure 9**

The assumption of this type of mechanism would be empirically unjustified and ad-hoc. Moreover, viewing such a process as facilitating speakers' performance, rather than inhibiting it, would be incompatible with the processing difficulties speakers are recurrently observed to experience when required to perform structural reanalysis (Frazier & Rayner 1982; Frazier 1987; Pritchett 1988, 1992; Ferreira & Clifton 1986; Ferreira & Henderson 1991; Altmann, Garnham & Dennis 1992, among many others). The plausible prediction would be, then, that an activation of the structure-disassembling mechanism demonstrated above would inhibit speakers' performance with transitive-unaccusative prime-target orders. As this is evidently inconsistent with the performance pattern observed in experiment 4, the assumption of this

mechanism should be discarded.

The ICE hypothesis, on the other hand, states that the retrieval of the basic alternate would be a better facilitator for the retrieval of the derived one than vice versa. In the context of the unaccusative-to-transitive view, this means that, as demonstrated in figure 10 below, after the syntactic structure associated with the basic alternate prime have been computed, a retrieval of the derived alternate target would not have to involve a computation of its syntactic representation ‘from scratch’. It would only require a completion of the derivation, namely the merging of additional functional head(s) on top of the already computed structure.

Therefore, as opposed to the ad-hoc extraction mechanism described above, the assumption of the ICE hypothesis together with unaccusative-to-transitive directionality would merely require assuming the mechanism of (external) merge (Chomsky 1995, 2000, 2001, 2013), a basic structure-building operation that takes computed structures and combines them with other elements into new ones:



**Figure 10**

The ICE hypothesis is therefore compatible, in principle, with the unaccusative-to-transitive view, whereas the Output Hypothesis is not. Hence the Output Hypothesis considered above cannot be used to determine the validity of proposed unaccusative-to-transitive approaches, while the ICE hypothesis is indeed suitable for this purpose.

#### **4.7.2 Future research**

As shown above, there are theoretical and empirical justifications for the assumption of the ICE hypothesis. Nevertheless, an experiment testing speakers' performance with regard to verbal alternations for which directionality is not at debate can provide further testing and validation for the assumption of ICE. If, in such a case, speakers' performance pattern turns out to indicate that basic-derived prime-target combinations result in faster RTs than derived-basic combinations, the assumption of the ICE hypothesis will receive additional support.

Suitable stimuli for such an examination would be the derivational relationships between transitive verbs and their corresponding reflexives and verbal passives demonstrated in (55) a-c:

- (55) a. ha-'ima      **hilbiša**      'et      ha-yalda      (Transitive)  
          the-mother   dressed      ACC   the-girl  
          'The mother dressed the girl.'
- b. ha-yalda      **hulbeša**      (al yedey ha-'ima)      (Verbal passive)  
          the-girl      was-dressed      (by      the-mother)  
          'The girl was dressed by the mother.'
- c. ha-yalda      **hitlabša**      (Reflexive)  
          the-girl      dressed  
          'The girl dressed.'

Theorists that address these alternations are in agreement that the transitive verb is the basic alternate from which the other diatheses are derived (Grimshaw 1990; Kratzer 2000; Reinhart & Siloni 2004; Chierchia 2004; Koontz-Garboden 2009 among others). Accordingly, if basic alternates are indeed better facilitators than derived alternate, transitives (e.g. *hilbiša*) should be observed to be better facilitators for the retrieval of their corresponding verbal passives (*hulbeša*) and reflexives (*hitlabša*) than vice versa.

## **Chapter 5: Methodological implications**

Apart from providing a glimpse into speakers' perception of the transitive-unaccusative alternation, the six experiments presented and discussed above constitute an exhaustive case-study demonstrating how the attributes of a derivational relationship can be psycholinguistically examined.

Experiments 1-3 constitute an examination of an alternation's *regularity* specifically designed to tap into the perception of sporadic derivational gaps. Guided by the GABLE hypothesis, which states that the accessibility of a concept should reflect its lexical encoding, they reveal the hidden representation of lexical entries corresponding to sporadic derivational gaps by measuring the accessibility of the corresponding concepts. The results of this empirical examination demonstrate that hidden lexical representations are traceable, hence that hidden lexical entries are not unfalsifiable theoretical constructs.

Experiments 4-6 constitute a psycholinguistic examination of an alternations' *directionality*. Similarly to the previous series of experiments, they too are designed to test the predictions of a general hypothesis, namely the ICE hypothesis, which states that a derived alternate is a better facilitator for the lexical retrieval of the basic



alternate than vice versa. Accordingly, experiments 4-6 used a cross-modal lexical priming technique to compare the facilitating effects of alternating diatheses and demonstrate that derivational directionality can be psycholinguistically examined.

With regard to the specific derivational relationship at hand, both these empirical examinations revealed interesting findings: the results of experiments 1-3 suggest, on a par with Reinhart (2002, 2010), Horvath and Siloni (2008) and Siloni (2009), that transitive counterparts of one-place unaccusatives and the causative diathesis of Hebrew experiencer verbs are lexically represented even when they lack a corresponding vocabulary item. The results of experiments 4-6 suggest, on a par with transitive-to-unaccusative approaches, that Hebrew transitive verbs are basic and their unaccusative counterparts are derived.

These performance patterns are an indication that the GABLE hypothesis and the ICE hypothesis, as well as the methodologies developed and elaborated to test their predictions, can provide a basis for further fruitful psycholinguistic examinations, whether studying how speakers of other languages perceive the transitive-unaccusative alternation or settling theoretical debates concerning the nature of further derivational relationships.

## References

- Alexiadou, Artemis, Elena Anagnostopoulou & Martin Everaert (2004). 'Introduction'. In A. Alexiadou, E. Anagnostopoulou & M. Everaert. (eds.), *The unaccusativity puzzle*. Oxford: Oxford University Press.
- Alexiadou, Artemis, Elena Anagnostopoulou & Florian Schäfer (2006). 'The properties of Anticausatives Crosslinguistically'. In M. Frascarelli (ed.), *Phases of Interpretation*. Berlin: Mouton.
- Altmann, Gerry T.M., Alan Garnham and Yvette Dennis (1992). 'Avoiding the garden path: Eye movements in context'. *Journal of Memory and Language* 31:5, pp. 685–712.
- Anderson, Stephen R. (1992). *A-Morphous Morphology*. Cambridge University Press: Cambridge.
- Arad, Maya (2005). *Roots and Patterns: Hebrew Morpho-syntax*. Dordrecht: Springer.
- Aronoff, Mark (1976). *Word formation in generative grammar*. Cambridge, Mass: MIT Press.
- Belletti, Adriana & Luigi Rizzi (1981). 'The Syntax of "ne": Some Theoretical Implications'. *The Linguistic Review* 1, pp. 117-154.
- Belletti, Adriana & Luigi Rizzi (1988). 'Psych-verbs and Theta Theory'. *Natural Language and Linguistic Theory* 6:291-352.
- Borer, Hagit & Yosef Grodzinsky (1986). 'Syntactic cliticization and lexical cliticization: the case of Hebrew dative clitics'. In H. Borer (ed.), *The syntax of pronominal clitics, Syntax and semantics* 19, 175-217. Academic Press, New York
- Borer, Hagit (1994). 'The projection of arguments'. In E. Benedicto & J. Runner (eds.), *Functional Projections*. GLSA: Amherst, Mass.

- Borer, Hagit (2003) 'Exo-skeletal vs. endo-skeletal explanations: syntactic projections and the lexicon'. In j. Moore & M. Polinsky (eds.), *The nature of explanation in linguistic theory*. CSLI Publications: Stanford.
- Burzio, Luigi (1986). *Italian syntax*. Reidel: Dordrecht.
- Chierchia, Gennaro (2004 written in 1989). 'A Semantics for Unaccusatives and its Syntactic Consequences'. In A. Alexiadou, E. Anagnostopoulou, and M. Everaert, (eds.), *The Unaccusativity Puzzle: Explorations of the Syntax-Lexicon Interface*. Oxford University Press: Oxford.
- Chomsky, Noam (1970). 'Remarks on Nominalization'. In R. A. Jacobs and P. S. Rosenbaum (eds.), *Readings in English Transformational Grammar*. Blaisdell: Waltham, MA.
- Chomsky, Noam (1981). *Lectures on Government and Binding*. Foris: Dordrecht.
- Chomsky, Noam (1995). *The minimalist program*. MIT Press: Cambridge, Massachusetts/London.
- Chomsky, Noam (2000). 'Minimalist inquiries: the Framework'. In R. Martin, D. Michaels & J. Uriagereka (eds.), *Minimalist inquiries: the framework Step by Step: Essays on Minimalist Syntax in Honor of Howard Lasnik*. MIT Press: Cambridge, MA.
- Chomsky, Noam (2001). 'Derivation by phase'. In M. Kenstowicz (ed.), *Ken Hale: A life in language*. MIT Press: Cambridge: MA.
- Chomsky, Noam (2013). 'Problems of projection'. *Lingua* 130: 33-49
- Doron, Edit (2003). 'Agency and Voice: the Semantics of the Semitic templates'. *Natural Language Semantics* 11 (1): 1-67.
- Embick, David & Alec Marantz (2008). 'Architecture and Blocking'. *Linguistic inquiry* 39 (1): 1-53.

- Ferreira, Frenanda & Charles Clifton (1986). 'The independence of syntactic processing'. *Journal of Memory and Language* 25, pp. 348–368.
- Ferreira, Frenanda & John M. Hendereson (1991). 'The use of verb subcategorization information in syntactic parsing'. In G.B. Simpson (Ed.). *Understanding Word and Sentence*, North-Holland: Amsterdam, pp. 305–330.
- Fodor, Jerry (1975). *The Language of Thought*. Harvard University Press: Cambridge, MA.
- Frazier, Lyn & Keith Rayner (1982). 'Making and correcting errors during sentence comprehension: Eye movements in the analysis of structurally ambiguous sentences'. *Cognitive Psychology* 14. pp. 178–210.
- Frazier, Lyn (1987). 'Sentence processing'. In M. Coltheart (ed.). *Attention and Performance XII*. Erlbaum: Hillsdale, NJ.
- Friedmann, Naama, Gina Taranto, Lewis P. Shapiro, & David Swinney (2008). 'The leaf fell (the leaf): the online processing of unaccusatives'. *Linguistic Inquiry*. 39: 355-377.
- Frost Ram, Kenneth I. Forster & Avital Deutsch (1997). 'What can we learn from the morphology of Hebrew: A masked priming investigation of morphological representation'. *Journal of Experimental Psychology: Learning, Memory, & Cognition* 23: 829-856.
- Frost, Ram, Avital Deutsch & Kenneth I. Forster (2000a). 'Decomposing morphologically complex words in a nonlinear morphology'. *Journal of Experimental Psychology: Learning, Memory, & Cognition* 26: 751-765.
- Frost, Ram, Avital Deutsch, Orna Gilboa, Michal Tannenbaum & William Marslen-Wilson (2000b). 'Morphological priming: Dissociation of phonological, semantic, and morphological factors'. *Memory & Cognition* 8, pp.1277-1288.
- Frost, Ram & Dave Plaut (2005). 'The word-frequency database for printed Hebrew'.  
<http://word-freq.mscc.huji.ac.il/index>.

- Grimshaw, Jane (1990). *Argument Structure*. Cambridge, MA: MIT Press.
- Halle, Morris (1973). 'Prolegomena to theory of word formation'. *Linguistic Inquiry* 4: 3-16.
- Halle, Morris & Alec Marantz (1993). 'Distributed Morphology and the pieces of inflection'.  
In K. Hale and S.J Keyser (eds.), *The view from Building 20: Essays in linguistics in honor of Sylvain Bromberger*. MIT Press: Cambridge, MA.
- Harley, Heidi (1995). *Subjects, Events, and Licensing*. Doctoral dissertation, MIT
- Horvath, Julia. & Tal Siloni (2008) 'Active Lexicon: Adjectival and Verbal Passives'. In G. Danon, S. Armon-Lotem, and S. Rothstein (eds.), *Generative Approaches to Hebrew Linguistics*. John Benjamins Publishers: Amsterdam.
- Horvath, Julia & Tal Siloni (2011). 'Causatives across Components'. *Natural Language and Linguistic Theory*. 29:3, 657-704.
- Horvath, Julia & Tal Siloni (to appear). 'The Thematic Phase and the Architecture of Grammar'. in M. Everaert, M. Marelj, E. Reuland, and T. Siloni, (eds.), *Concepts, Syntax and their Interface*. MIT Press: Cambridge, MA.
- Jackendoff, Ray (1975). 'Morphological and Semantic Regularities in the Lexicon'. *Language* 51, pp. 639-67.
- Jaeggli, Osvaldo A. (1986). 'Passive'. *Linguistic Inquiry* 17- 4, pp. 587-622.
- Kay, Paul & Willett Kempton (1984). 'What is the Sapir-Whorf-Hypothesis?'. *American Anthropologist* 86, 65-79.
- Koontz-Garboden, Andrew (2009). 'Anticausativization'. *Natural Language and Linguistic Theory* 27.
- Kratzer, Angelika (2000). 'Building statives'. *Berkeley Linguistic Society* 26: 385-399.
- Kratzer, Angelika (2004). 'Building resultatives'. In C.Maien-born and A. Willstein-Leisten (eds.), *Event arguments in syntax, semantics, and discourse*. Tbingen: Niemey.
- Lee, Jiyeon & Cynthia K. Thompson (2011). 'Real-time production of unergative

and unaccusative sentences in normal and agrammatic speakers: An eyetracking study’.

*APHASIOLOGY* 25 (6-7): 813-825.

Levin, Beth. & Malka Rappaport (1995). *Unaccusativity at the syntax-lexical semantics interface*. MIT Press: Cambridge, MA.

Manzini, Rita (1983). ‘On Control and Control Theory’. *Linguistic Inquiry* 14, 421-467.

Marantz, Alec (1997). ‘No escape from syntax: don’t try morphological analysis in the privacy of your own lexicon’. In Dimitriadis, A. & L. Siegel (eds.), *Proceedings of the 21st Annual Penn Linguistics Colloquium*. University of Pennsylvania; Philadelphia.

Marantz, Alec (2007). ‘Phases and words’. In S.H. Choe (ed.), *Phases in the theory of grammar*, Dong In: Seoul.

Meltzer, Aya & Tal Siloni (2013). ‘Unaccusativity in Hebrew’. *Encyclopedia of Hebrew Languages and Linguistics*. Brill.

McQueen, James M., & Ann Cutler, A. (1998). ‘Morphology in word recognition’. In A. Spencer and A.M. Zwicky (eds.). *Handbook of morphology*. Blackwell Publishers: Oxford.

Neeleman, Ad & Hans Van de Koot (2011). ‘The linguistic Expression of Causation’. In M. Everaert, M. Marelj and T. Siloni (eds), *The Theta System: Argument Structure at the Interface*. Oxford University Press.

Parsons, Terence. (1990). *Events in the semantics of English: a study in subatomic semantics*. MIT Press: Cambridge, MA.

Perlmutter, David. M. (1978). ‘Impersonal passives and the Unaccusative Hypothesis’. *Proceedings of the 4th Annual Meeting of the Berkeley Linguistics Society*. UC, Berkeley, pp. 157–189.

Pesetsky, David (1982). *Paths and Categories*. PhD Dissertation, MIT.

- Pesetsky, David (1995). *Zero Syntax: Experiencers and Cascades*. Cambridge MA: MIT Press.
- Pinker, Steven (1994). *The language instinct: the new science of language and mind*. Penguin Science.
- Pritchett, Bradley L. (1988). 'Garden Path Phenomena and the Grammatical Basis of Language Processing'. *Language* 64: 3, pp. 539-576.
- Pritchett, Bradley L. (1992). *Grammatical competence and parsing performance*. Chicago: Chicago University Press.
- Ramchand, Gillian C. (2006). 'Verb meaning and the lexicon: A first phase syntax'. Ms., Universitetet i Tromsø.
- Rappaport-Hovav, Malka & Beth Levin. (2011). 'Lexicon uniformity and the causative alternation'. In Everart, Martin, M. Marelj & T. Siloni, (eds), *The Theta system: Argument structure at the interface*. Oxford University Press: Oxford.
- Reinhart, Tanya (1991). 'Lexical properties of ergativity'. Lecture presented at the conference on Lexical Structure, Utrecht.
- Reinhart, Tanya (1996). 'Syntactic Effects of Lexical Operations: Reflexives and Unaccusatives'. *OTS Working papers in Linguistics*, TL-97-002, University of Utrecht.
- Reinhart, Tanya (2000). 'The theta system: syntactic realization of verbal concepts'. *OTS working papers in linguistics*, TL-00-01, University of Utrecht.
- Reinhart, Tanya (2002). 'The Theta System: an Overview'. *Theoretical Linguistics* 28, pp. 229-290.
- Reinhart, Tanya & Tal Siloni (2003). 'Thematic Arity Operations and Parametric Variations'. Ms. UiL-OTS and Tel-Aviv University.

- Reinhart, Tanya & Tal Siloni (2004). 'Against the unaccusative analysis of reflexives'. In A. Alexiadou, E. Anagnostopoulou, and M. Everaert (Eds.), *The Unaccusativity Puzzle: Explorations of the Syntax–Lexicon Interface*. Oxford University Press: Oxford.
- Reinhart, Tanya & Tal Siloni (2005). 'The lexicon-syntax parameter: reflexivization and other arity operations'. *Linguistic Inquiry* 36, pp. 389-436.
- Reinhart, Tanya (2010). 'The Theta System: Unaccusative and Experiencer Derivations'. Ms. Revised by Tal Siloni.
- Shetreet, Einat, Naama Friedmann & Uri Hadar (2010). 'The neural correlates of linguistic distinctions: Unaccusative and unergative verbs'. *Journal of Cognitive Neuroscience*.
- Shlonsky, Ur (1997). *Clause structure and word order in Hebrew and Arabic: An essay in comparative Semitic syntax*. Oxford University press: New York.
- Siloni, Tal (2002), 'Active Lexicon'. *Theoretical Linguistics* 28: 383-400.
- Siloni, Tal (2009). 'Systematic Gaps in Nominalization: Active Lexicon'. Lecture presented at the conference on atoms and laws of the Noun Phrase, Utrecht.
- Sorace, Antonella (1995). 'Acquiring linking rules and argument structures in a second language: The unaccusative/unergative distinction'. *The current state of interlanguage*, pages 153-175.
- Sorace, Antonella (2000). 'Gradients in Auxiliary Selection with Intransitive Verbs'. *Language* 76(4):859-890.
- Sperber, Dan & Deirdre Wilson (1997). 'The mapping between the mental and the public lexicon'. In P. Carruthers & J. Boucher (eds.). *Thought and language*. CUP: Cambridge.
- Schäfer, Florian (2009). 'The Causative Alternation'. *Language and Linguistics Compass* 3.
- Stockall, Linnaea & Alec Marantz (2006). 'A single route, full decomposition model of morphological complexity: MEG evidence'. *The Mental Lexicon* 1(1): 85- 123.



Van Valin, Robert .D. Jr (1990). 'Semantic parameters of split intransitivity'. *Language* 66(2):221-60.

Williams, Edwin (1985). 'PRO and the subject of NP'. *Natural Language and Linguistic Theory* 3:3, 297–315.

Wolff, Phillip (2003). 'Direct Causation in the Linguistic Coding and Individuation of Causal Events.' *Cognition* 88:1- 48.

## Appendix A: verbs used in the experiment 1

Type (i) Unaccusative                      Transitive (Cause external theta role)

<i>hitkavec</i> ‘shrank’	<i>kivec</i>
<i>nafal</i> ‘fell’	<i>hipil</i>
<i>hitkamet</i> ‘got wrinkled’	<i>kimet</i>
<i>hitlalex</i> ‘got dirty’	<i>lixlex</i>
<i>nigmar</i> ‘was finished’	<i>gamar</i>
<i>nišbar</i> ‘broke’	<i>šavar</i>
<i>nisraf</i> ‘got burnt’	<i>saraf</i>
<i>nirtav</i> ‘got wet’	<i>hirtiv</i>
<i>hitrofef</i> ‘loosen’	<i>rofef</i>

Type(ii) unaccusatives                      Adjectival Passive

<i>hirkiv</i> ‘got rotten’	<i>rakuv</i>
<i>kamaš</i> ‘withered’	<i>kamuš</i>
<i>naval</i> ‘wilted’	<i>navul</i>
<i>daha</i> ‘faded’	<i>dahuy</i>
<i>hexmic</i> ‘turned sour’	<i>xamuc</i>
<i>hexlid</i> ‘became rusty’	<i>xalud</i>

Type (iii) unaccusatives

<i>medaber</i> ( <i>‘el</i> )	‘appeals (to)’
<i>mešane</i> ( <i>le</i> )	‘matters (to)’
<i>xamak</i> ( <i>me</i> )	‘escapes from’

<i>xaser (le)</i>	‘misses (to)’
<i>xore (le)</i>	‘unpleasing (to)’
<i>maca xen (be-einey)</i>	‘appeals (to the eyes of)’

## Appendix B: type (i)-(iii) stories, unaccusative sentences and outcome sentences<sup>24</sup>

Type (i)

*hitkavec* ‘shrank’

Causer: the laundress

Most of Helen's clothes are made of very delicate fabrics that will be ruined if washed not according to directions. When she hired a new laundress she gave her a short lecture about it and hoped for the best. Yesterday, while Helen was getting ready to go out to the mayor's ball, she took her angora sweater out of the closet and spread it on her bed. She was horrified when she saw what had happened to it.

ha-sudar      hitkavec. ha-koveset tefutar      ‘ad      ha-boker  
the-sweater      shrank. the-laundress will-be-fired      until      the-morning

‘The sweater shrank. The laundress will be fired by morning.’

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<sup>24</sup> Other than some of the characters' names, changed for the benefit of non Hebrew speaking readers, stimuli sentences are cited exactly as they appeared in the experiment.

*nafal* ‘fell’

Causer: Mary

John and Mary are twins. They are a bit similar and a bit different. John, for example, is a clumsy boy who always drops stuff and Mary is not clumsy at all. In fact, teasing John about his clumsiness is Mary’s very annoying habit. Last week they were on their way to Grandma’s house for a holiday dinner. John carried the cake and his sister Mary carried a glass dish that contained some fish. The dish was cold, slippery and heavy. Mary felt how it began to slip out of her grip.

ha-magaš    nafal   ‘al    ha-midraxa.   john   samax le’ida

šel mary

the-dish    fell    on    the-sidewalk.   John   happy to-the-failure-of

of Mary

‘The dish fell on the sidewalk. John gloated.’

*hitkamet* ‘got wrinkled’

Causer: Berta

Albert is not a very demanding husband. He is pleased with his wife, Berta, and has come to terms with most of her habits. There is only one thing that drives him crazy: the way she arranges her blouses in her closet after he is done with ironing them. She seems to never be able to keep them ironed!

Today, after he was working over the iron board for almost two hours she very inconsiderably shoved them in the closet again.

ha-xulcot    hitkamtū.    albert    hirgiš ke’ilu    kol    ‘avodato    hayta  
 lašav  
 the-blouses    got-wrinkled. Albert    felt    like    all    his-work    was    in-  
 vain

‘The blouses got wrinkled. Albert felt as if all his work was in vain.’

*hitlaxlex* 'got dirty'

Causer: the sack of coal

Hanan was a sweet and very helpful little boy. He also liked wearing his Sunday shirts on weekdays, a habit he used to hide from his mother - so she won't get upset. One day, while walking in the meadow, he ran into an old man carrying a sack of coal. The sack seemed really heavy and it was apparent that the old man is suffering, so young Hanan offered him a hand. While they continued walking, the sack of coal touched his Sunday shirt more than once but Hanan didn't pay attention. When he returned home, Hanan looked at the mirror and was horrified by what he saw.

xulcat          ha- šabat          šel          hanan hitlaxlexa          legamrey.          Ima          šel  
hanan tix'as  
shirt-of          the- šabat          of          Hanan got-dirty          completely.          mother of  
Hanan will-be-angry

'Hanan's Sunday shirt got completely dirty. His mother will be upset.'

*nigmar* ‘was finished’

Causer: grandpa Hans

Grandpa Hans has a sweet tooth. Nevertheless, he tries to keep his gluttony under control, since this is what his nanny taught him when he was a little boy in Vienna and also to make sure that his pantry will always contain sweet treats for when his grandchildren come for a visit. They really like it when their grandpa Hans gives them a treat and cannot wait for this part of their visit. Yesterday though, fifteen minutes prior to his granddaughter Ruthie’s arrival, grandpa Hans finished his afternoon nap and woke up with a very strong craving for something sweet in his mouth. He opened the last packet of chocolate waffles he had in the pantry and ate until he was satisfied.

ha-vaflim    nigmeru.    lo    niš’ar ‘af    mamatak    bišvil    rooti  
 the-waffles    got-finished.    not    left    none    weet    for    Ruthie

‘The waffles were finished. There were no sweets left for Ruthie.’



*nišbar* ‘broke’

Causer: Moe

Joshua was quite a lazy fellow. He always felt that he had no reason to work hard and invest in his future, since he was promised he will get his grandfather’s ancient Chinese vase, worth millions of dollars, when he turns 18. This vase was supposed to enable him to get by without working a day in his life. After his 18th birthday party, Joshua was spending some time alone in his room with his vase, caressing it and contemplating his bright future. But then the door suddenly opened and his cousin Moe jumped on top of him and gave him a bear hug.

ha-kad nišbar. yehošu’a      yictarex      la’avod      le-mixyato kmo kulam.  
 the-vase      broke.      Joshua      will-have      to-work for-his-living like  
 everybody

‘The vase broke. Joshua will have to work for a living like everyone else.’

*nisraf* ‘got burnt’

Causer: Jamey

Jamey and his uncle, Oliver, really enjoy preparing breakfast together. Their specialties are omelet, salad and bread with cream cheese. Every Wednesday morning they cook these delicacies while dancing to Polka music.

Yesterday, Oliver was dancing while Jamey, who was in charge of preparing the omelets, was watching him. Uncle Oliver was dancing very enthusiastically and Jamey enjoyed watching so much that he forgot to turn down the heat when he was supposed to.

ha-xavitot    nisrefu.        jeimi    ve-‘oliver        ne’elcu lehistapek    be-lexem  
ve-salat.

the-omelets    got-burnt.        Jamey and-Oliver    had    to-settle        in-bread  
and-salad

‘The omelets got burnt. Jamey and Oliver had to make do with bread and salad.’

*nirtav* ‘got wet’

Causer: Ramon

Gizmo is an extremely cute creature. He is furry, happy and enjoys cuddling. When Tommy got Gizmo, he was told that there was only one rule he must keep while taking care of it: he must never ever allow Gizmo to get wet. If gizmo will ever get wet it will turn from a sweet furry creature to a disgusting green monster. For that reason, Tommy always made sure Gizmo stays dry. One day, while Tommy was sitting on the windowsill reading a book, his bully friend from school, Ramon, showed up under his window and smirked: “that’s a very nice hamster you got there Tommy”. “And how are you today, Ramon?” polite Tommy replied. But Ramon didn’t answer - he took something out of his pocket and threw it at Tommy. It was a water bomb.

gizmo nirtav. ‘im šaxar hu yahafox le-miflecet yeruka

Gizmo got-wet. with dawn he will-turn to-monster green

‘Gizmo got wet. He will turn into a green monster by dawn.’

*hitrofef* ‘loosen’

Causer: Mom

Rona had been an activist ever since she was a little girl. She used to make noisy little protests against the evils of the world as young as five years old. Recently, she heard that an old tree in her neighborhood is about to be uprooted and decided she cannot let it happen.

The day the town’s gardener was supposed to arrive and have his way with the tree, Rona asked her mother to tie her to the old tree really tight- so there will be no way she could be detached from it. Used to her daughter’s shenanigans, Rona’s mother agreed to her request and tied her to the tree. However, a few minutes later, her mother pretended she was checking the tie but was actually making sure it wasn’t very tight. When the Gardner arrived, he very easily disconnected Rona from the tree and started working.

ha-kešer      hitrofef.      rona    ka’asa.

the-tie      loosened.      Rona was-angry,

‘The tie loosened. Rona was upset.’

Type (ii)

*hirkiv* ‘got rotten’

Causer: Dad

On his way back from school the boy bought two mangos, just ripe enough for him to enjoy. However, when he woke up the next morning, expecting to have them for breakfast, he was up for a very big disappointment. It turned out that his father took the mangos out of the fridge to make room for the pie he had baked. They were sitting there, very close to the window, all through that hot summer night.

ha-peirot	hirkivu	legamrey.	ha-yeled	haya	‘acuv me’od
the-fruit	got-rotten	completely.	the-boy	was	sad very

‘The fruit got completely rotten. The boy was very sad.’

*kamaš* ‘withered’

Causer: Grandma

Valentino was desperately in love with Alejandra. When he found out she was a big fan of basil, he decided to buy her a present- a little plant of this herb to grow in the kitchen. He then asked his grandmother to keep the plant at her apartment until he brings Alejandra for a visit. Unfortunately though, since Valentino’s Grandma’s Bridge championship took place that same week, she was very busy and didn’t water the plant as often as she should have.

ha-cemax	kamaš.	valentino	šakal	lasim	kec	le-xayav.
the-plant	withered.	Valentino	considered	to-put	end	to-his-life

‘The plant withered. Valentino considered ending his life.’

*naval* ‘wilted’

Causer: Andréa

Brandon was very developed for his age, so when he fell in love with his old teacher Andréa she fell in love right back. However, even though they loved each other very much, Andréa’s sense of moral didn’t allow her to let it go too far. That was why they decided their relationship would only include the following ritual: every Friday Brandon would bring flowers to class, and as a symbol of their love- Andréa would make sure they will stay fresh until Wednesday.

Last Friday, when school was over, Andréa turned on the water to fill up the flower vase while talking with a stressed student about her grade. The student was very upset and Andréa, trying to be as helpful as she can, failed to pay attention to the fact that the vase wasn’t positioned under the water flow. She then put the flowers in the empty vase and went home.

be-yom      rišon    ha-praxim      kavv navlu.    brendon      hivxin      be-  
 kax    ve-mirer      bivxi  
 in-day      first    the-flowers    already withered. Brandon    noticed    in-that  
 and-embitered      in-cry

‘The flowers were already withered by Sunday. Brandon noticed it and sobbed.’

*daha* ‘faded’

Causer: the sun

Carrie really liked her bright green blouse and absolutely adored her intense color. For her, every day she wasn't wearing this blouse might as well never happened. Yesterday, at about noon, after wearing her beloved blouse for seven straight days, she had no choice but to wash it. When it was finally clean, she carefully hanged it to dry in the sun. At five o'clock in the afternoon Carrie opened the window to check the status of her beloved blouse.

ha-xulca      dahata legamrey.      kerī    palta      klala    ‘asisit  
the-blouse    faded                    completely.    Carrie discharged    curse    juicy

‘The blouse has completely faded. Carry cursed.’



*hexmic* ‘turned sour’

Causer: Willow’s son

Willow is unable to start her day without her Latte. If she doesn’t have a sip of this drink the moment she wakes up- her entire day is ruined. This morning, when she got out of bed and waddled her way to the kitchen she noticed a carton of milk on the kitchen counter. Right away, she realized that her teenage son forgot to put the milk back in the fridge after he made himself a bowl of cereal the night before. Desperate, she raised the carton and sniffed its contents.

ha-xalav	hexmic.	wilo	‘ibda	‘et	šalvata.
the-milk	turned-sour.	Willow	lost	ACC	her serenity

‘The milk turned sour. Willow lost her temper.’

*hexlid* ‘became rusty’

Causer: the dampness

We have been planning this trip for weeks: from purchasing the state of the art mountain bikes to making all the smallest decisions regarding our route. The night of our planned departure, we went down to the basement and immediately felt how damp it was down there, so we weren't surprised to find out what had happened to our new bikes that we had stored there.

ha-‘ofanayim hexlidu. eize ba’asa!  
 the-bikes got-rusty. what bummer !

‘The bikes got rusty. What a bummer!’

Type (iii)

*medaber* ('el) 'appeals (to)'

Causer: Lucie's friend

Lucie has never really liked the genre of young Hebrew poetry. She never got why her friends loved it so much, which made her feel detached from them. However, things changed the day her friend brought her a little booklet by an unknown tormented poet. Lucie fell right in love. She eagerly read each and every poem in the booklet and when she was done asked her friend for more Young Hebrew poetry.

hayom, šira 'iveit ce'ira me'od      medaberet el lucie. axšav hi kavv lo margiša  
menuteket me-xavereyha

today, poetry Hebrew young very      appeals      to-Lucie. Now she yet not feels  
detached from-her-friends

'Today, young Hebrew poetry appeals to Lucie. She doesn't feel detached from her friends anymore.'

*mešane (le)* ‘matters (to)’

Causer: Yossi's Grandpa

Yossi never saw himself as a prejudice person. He always thought he was the kind of person that will never judge someone by his place of residence, how much money he makes or his ethnic origins. But at one point in his life he realized he wasn't as enlightened as he believed himself to be. It happened after a period of time during which his grandfather taught him how to play Bridge. Every one of these lessons was opened with a five minutes speech by his grandfather, explaining how wrong it is to be living in a kibbutz- grandpa hated socialism!

After a while of listening to this, Yossi notice that when the sweet girl he was flirting with at a party told him she lives in a kibbutz, he didn't like her anymore.

pit'om mekom he-megurim mešane le-yosi. hu kvar lo na'or kefi  
 še-haya pa'am  
 suddenly place of residence matters to-Yossi. he anymore not enlightened as  
 that-was once

‘Suddenly, one's place of residence matter to Yossi. He is not as enlightened as he used to be.’

*xamak (me)*                    ‘escapes from ’

Causer: Danny's sister

Danny was very happy; he was elected chairman of the prom's decoration committee. He was excited about the chance to finally express his creative side. Unfortunately, as the date approached, Danny found it very difficult to come up with a good enough decorating idea. It was about two days before prom night when Danny made himself sit in his room and think really hard. After sitting there for nearly two hours, it seemed to him that this method might be working and that an idea should pop up very soon. But – alas! in the exact moment he felt an idea getting structured in his mind, his sister shouted from the other room: “Danny, would you be a dear and make me a sandwich?”

ha-ra'ayon xamak    me-dani.    dani    hirgiš še-ha-mo'ax    šelo    reyK  
 legamrey,  
 the-idea escaped    from-Danny.    Danny    felt    that-the-mind    of-him    empty  
 completely

‘The idea escaped Danny's mind. It was now completely empty.’

*xaser (le)* 'misses (to)'

Causer: Rick's mom

Alice and Rick were neighbors for 24 years. They had a pretty close friendship. They didn't see each other that often, but when they did, they always had a lot of fun together. At the end of that period of time, Alice left her parent's apartments while Rick stayed with his folks. At first, Alice's leaving didn't have an effect on him, but when his mother told him that Alice's Mom misses her, Rick started reminiscing the good times he had with Alice.

'axšav            alice    xasera le-rick.            hu margiš boded.

now                alice missing to-rick.            he is- feeling lonely

'Now, Rick misses Alice. He's feeling lonely.'

*xore (le)* ‘unpleasing (to)’

Causer: Dana's co-workers

Dana always viewed herself to have a very developed sense of feminist awareness. But recently, she was so preoccupied with work, that she hasn't noticed what was going on around her. It was only after her co-workers turned her attention to it that she noticed how the new regional manager is harassing quite a few of the female employees. When she did, a feeling of disgust started rising within her.

hintahaguto šel ha-menahel ha-xadaš me'od xarta le-dana. hi  
 lo yaxla lehit'apek melihit'amet 'ito panim 'el panim  
 the-behavior of the-manager the-new very was-unpleasing to-Dana. She  
 not could to-resist from-to-confront him face to face

‘The new manger’s behavior was very unpleasing to Dana. She couldn’t resist confronting him face to face.’

*maca xen (be-einey)* ‘appeals (to the eyes of)’

Causer: Victoria

The known Ballet teacher, Madam Sonya, never really liked the way her pupil Annie was moving her body. Indeed, Annie is slender, graceful and accurate, but Madam Sonya always thought that she's too mechanical at performing her routines. However, Madam Sonya's opinion of Annie quickly changed when her own guru, Madam Victoria, saw Annie dance and complimented her style.

pit'om          signon          ha-rikud          šel annie          moce-xen          be'eyney  
 sonia. hi hafxa 'ota la-balerina ha-rašit ba-lehaka  
 Suddenly          style-of          the-dancing          of Annie          appeals          to-the-eyes-of  
 Sonia. She turned her to-the ballerina the-main in-the-group

‘Suddenly, Annie’s dance style appeals to Sonia. She made her Prima Ballerina’.



## Appendix C: verbs used in the experiment 2

### Hidden Cause subject-Experiencer verbs

<i>hit'anyen</i>	‘got interested’
<i>tama</i>	‘was amazed’/‘wondered’
<i>hicta'er</i>	‘was sorry’
<i>nidlak</i>	‘got turned-on’
<i>hitrageš</i>	‘got excited’
<i>hitya'eš</i>	‘got discouraged’

### Type (iii) unaccusatives

<i>medaber ('el)</i>	‘appeals (to)’
<i>mešane (le)</i>	‘matters (to)’
<i>xamak (me)</i>	‘escapes from’
<i>xaser (le)</i>	‘misses (to)’
<i>xore (le)</i>	‘unpleasing (to)’
<i>maca xen (be-einey)</i>	‘appeals (to the eyes of)’

### Control items

<i>nafal</i>	‘fell’
<i>hitkamet</i>	‘got wrinkled’
<i>nigmar</i>	‘was finished’
<i>nišbar</i>	‘broke’
<i>nisraf</i>	‘got burnt’

**Appendix D: object-Experiencer verbs used in the experiment 3**

<i>'inyen</i>	'interested'
<i>hitmiha</i>	'amazed'
<i>ce'er</i>	'made- sorry'
<i>hidlik</i>	'turned-on'
<i>rigeš</i>	'excited'
<i>ye'eš</i>	'discouraged'

## Appendix E: hidden-Cause Experiencer stories and stimuli sentences

*hit'anyen* 'got interested'

Causer: Dave

Joey never really cared about clothes. Most of his outfits consisted of jeans and T-shirts. Sometimes, when he was really not in the mood to think about which shirt to wear, he went to work with the same shirt he used as a pajama. Therefore it was only natural that when his best friend Dave applied for fashion school, Joey thought it was a complete waste of time. However, as time went by, after Dave forced Joey to tag along to countless fashion shows and insisted on hearing his input regarding every design exercise he had to submit, Joey's attitude began to change.

Experiment 2:

pit'om            joey    hit'anyen            beofna.            hu bizbez 'et    rov            maskorto

'al bgadim

suddenly        Joey    got-intersted    in-fashion.        he spent ACC most-of            his-

paycheck on clothes

'Joey suddenly got interested in fashion. He now spends most of his paycheck on clothes.'

Experiment 3:

pit'om ofna 'inyena 'et joey. hu bizbez 'et rov  
 maskorto 'al bgadim  
 Suddenlyt fashion interested ACC Joey. he spent ACC most-of his-  
 paycheck on clothes

'Fashion suddenly interested Joey. He now spends most of his paycheck on clothes.'

*tama* 'was amazed'/'wondered'

Causer: Sara

Mattie's firms have been buzzing with rumors for a while now. Ever since management changed, the people working on his floor were constantly discussing its weird policy and wondering about the CEO's real motives.

Until recently, Mattie didn't pay attention to the rumors and believed there is nothing to worry about. But after he had lunch with his friend Sara, who was recently promoted to be vice president of the company, he changed his mind. They were sharing a tray of sushi when Sara indiscreetly told him about some of the secret documents she stumbled upon.

## Experiment 2:

Mati tama 'al mediniyut ha-hanhala. le-maxarat hu hitxil le-'ayen be-  
 medorey ha-drušim

Mattie was-amazed of policy-of the-management. On-the-next-day he started to-view in-sections-of the-wanted

‘Mattie was amazed by the management’s policy. He started browsing wanted ads the next day.’

Experiment 3:

Mediniyut ha-hanhala hetmiha ‘et mati. le-maxarat hu hitxil le-‘ayen be-medorey ha-drušim

the-policy-of the-,anagment amazed ACC Mattie. On-the-next-day he started to-view in-sections-of the-wanted

‘The management’s policy amazed Mattie. He started browsing wanted ads the next day.’

*hicta’er* ‘was sorry’

Causer: Jodie’s look

Moses was always proud of his little girl Jodie. He especially took pride in her social awareness and how much she cared about the environment. For that reason, when she told him she would like to join to an environmental movement he encouraged her to do so.

Nevertheless, he himself found it a little difficult to be considerate of the environment. For example, during the month of June, the same month declared as ‘fighting loitering drivers month’ by Jodie’s group, he carelessly threw a candy

wrapper out of the car window while he was driving her there. Only when his eyes met Jodie's reproachful look in the rear view mirror did he realized what he had done.

#### Experiment 2:

moses hicta'er 'al še-hišlix lixlux. ke-picuy hu hexlit lehictaref le-sayeret aixut ha-sviva

Moses was-sorry on that-he-threw garbage. as-compensation he decided to-join to-patrol quality-of the-environment.

'Moses was sorry for loitering. To compensate, he decided to join an environmental patrol.'

#### Experiment 3:

ha-'uvda še-hu hišlix lixlux ce'are 'et moses. ke-picuy hu hexlit lehictaref le-sayeret aixut ha-sviva

the-fact that-he threw garbage made-sorry ACC moses. as-compensation he decided to-join to-patrol quality-of the-environment.

'The fact he had loitered made Moses sorry. To compensate, he decided to join an environmental patrol.'

*nidlak* 'got turned-on'

Causer: Hanna's aunt

Hanna never knew what she would like to do when she grows up. She didn't worry about it though- she was always a very good student and graduated high school with honors.

The summer after graduation she visited her aunt 'Sima golden fingers', who managed a very successful chain of auto shops, for a month. To pay back for the warm hospitality she worked as a secretary in one of her aunt's auto shops and watched how she works her magic on old motors.

Experiment 2:

hanna nidleka 'al mexona'ut rexev.                      Kše-tihiye gdola hi roca la'avod be-  
musax murše

Hanna got-turned-on at mechnics-of auto. When-she-will-be big she wants to-work  
at-auto-shop certified

'Hanna got turned on by auto mechanics. She wants to work at a certified auto shop  
when she grows up.'

Experiment 3

mexona'ut rexev hidlika 'et hanna.                      Kše-tihiye gdola hi roca la'avod be-  
musax murše

mechanics-of auto turned-on ACC Hanna. When-she-will-be big she wants to-work at-  
auto-shop certified

‘Auto mechanics turned Hanna on. She wants to work at a certified auto shop when  
she grows up’

*hitrageš* ‘got excited’

Causer: The news about the baby

Gary took pride at the fact that no matter how touching the plot of a movie is- it will  
never make him cry. When he and his emotional friend Andy watched a movie  
together he always stifled a smile when Andy shed tears during a moving scene. But  
after he and his wife received the news that they were expecting a child, something  
had changed.

It was during movie-night with Andy when a smiling baby appeared on the screen and  
Gary felt his cheeks are getting wet. He then realized that, for the first time in his life,  
a movie made him cry.

Experiment 2:

gary hitrageš                      me-ha-seret.    axšav gam hu tipus emocyonali

Gary got-excited                  from-the-movie. now also he type emotional

‘Gary got excited from the movie. Now he, too, is the emotional type. ’

Experiment 3:

Ha-seret rigeš ‘et gary.    axšav gam hu tipus ‘emocyonali

The-movie excited Gary. now also he type emotional



‘The movie excited Gary. Now he, too, is the emotional type.’

*hitya'eš* ‘got discouraged’

Causer: The listings on the website

Country-girl Galit always knew that once she was ready to move out of her parent’s house, the only city she will be willing to consider would be glamorous Tel-Aviv. Once she was done with school, she worked full time at the town near her village for two whole years and saved every penny until she managed to accumulate an amount of money she believed would enable her to move out. She then went on-line and very happily started looking for her dream Tel-Aviv apartment. She was appalled from what she found there: all the listings offered extremely disappointing apartments and the rent was triple what she could afford!

Experiment 2

Galit hitya'aša            me-lexapes dira            be-tel 'aviv.    hi    hirgiša    še-le'olam    lo  
tece me-beyt horeha

Galit got-discouraged from-to-look apartment in-Tel Aviv. she felt that-never not get-  
out from-house-of her-parents

‘Galit got-discouraged from looking for an apartment in Tel Aviv. She felt as if she will never move out of her parent’s home.’

## Experiment 3:

tahalix          xipus          dira be-tel aviv          ye'eš 'et galit. hi hirgiša še-  
le'olam lo tece me-beyt horeha

the-process-of looking-for aptment in-Tel Aviv discouraged ACC Galit. she felt that-  
never not get-out from-house-of her-parents

'The process of looking for an apartment in Tel Aviv discouraged Galit. She felt as if  
she will never move out of her parent's home.'

## Appendix F: verbs used in experiment 4

### Experimental condition

	Transitive	Unaccusative	No. of shared phonemes (SP)	Translation
simplex-complex	rikex	hitrakex	5	softened
	ximem	hitxamem	5	heated
	kerer	hitkarer	4	cooled
	lixlex	hitlaxlex	4	soiled
	saraf	nisraf	4	burned
	motet	hitmotet	4	collapsed
	kimet	hitkamet	5	wrinkled
	patax	niftax	3	opened
	saxaf	nisxaf	4	swept
	cinen	hictanen	5	chilled
	šavar	nišbar	3	broke
	pizer	hitpazer	5	scattered
	complex-simplex	hicmiax	camax	4
hir'id		ra'ad	3	trembled
hifriax		parax	3	blossomed /blew
hikpi		kafa	1	froze
hitbia		tava	2	drowned
hinbit		navat	2	sprouted
hizrim		zaram	2	poured/flowed
he'if		af	2	flew
higbir		gavar	2	rose
hiv'ir		ba'ar	1	burnt

				(arson)
	heni'a	na	2	moved
	hirtit	ratat	2	vibrated
simplex-simplex	kiba	kava	2	turned-off
	šikex	šaxax	3	alleviated
	hidlik	nidlak	4	turned-on
complex-complex	hixšil	nixšal	3	tripped
	he'erim	ne'eram	4	stacked
	hifsik	nifsak	4	stopped
	hirtiv	nirtav	4	made/got-wet
	he'elim	ne'elam	4	made/ vanished
	hixxid	nixxad	3	made/got- extinct
	hixliš	nexlaš	3	weakened

Average: 3.265

## Phonological control condition

prime	target	SP	Experimental SP/ control SP	prime	target	SP	Experimental SP/ control SP
hitrakex	tarak 'slammed'	4	1.25	rikex	nikrax 'got-wrapped'	3	1.6666667
hitxamem	tixem 'delimited'	4	1.25	ximem	nitxam 'delimited'	3	1.6666667
hitkarer	kiter 'griped'	5	0.8	kerer	herik 'emptied'	3	1.3333333
lixlex	hitxalxel 'shuddered'	4	1	hitlaxlex	xilxel 'seeped'	4	1
saraf	nifras 'spread'	4	1	nisraf	našar 'fell'	3	1.3333333
motet	hemit 'killed'	3	1.333333	hitmotet	timtem 'soddened/muddled'	4	1
kimet	hemtik 'sweetened'	5	1	hitkamet	katam 'sniped'	4	1.25
patax	pite'ax 'developed'	4	0.75	niftax	nafax 'blew'	4	0.75
nisxaf	nise'ax 'formulated'	5	0.8	saxaf	hexsif 'made/became- silver'	3	1.3333333
hictanen	henec 'buded'	4	1.25	cinen	hitnocec 'glittered'	4	1.25
šavar	biser 'announced'	1	3	nišbar	našav 'blew'	3	1
hitpazer	pirez	5	1	pizer	hefriz	4	1.25

	‘demilitarized’				‘exaggerated’		
hicmiax	maxac	4	1	camax	hexmic	3	1.3333333
	‘smite’				‘made-sour’ ‘missed’		
hir'id	hera	2	1.5	ra'ad	he'edir	2	1.5
	‘worsened’				‘glorified’		
hifriax	hefer	3	1	parax	rixef	2	1.5
	‘violated’				‘hovered’		
hikpi	paka	2	0.5	kafa	hifki'a	3	0.3333333
	‘burst’				‘expropriated’		
tava	hiv'it	2	1	hitbia	hibit	4	0.5
	‘terrified’				‘looked’		
hinbit	heniv	2	1	navat	nitev	3	0.6666667
	‘yielded’				‘directed’		
hizrim	ramaz	2	1	zaram	nirmaz	4	0.5
	‘hinted’				‘got/was hinted’		
af	hofi'a	2	1	he'if	afa	2	1
	‘appeared’				‘baked’		
gavar	hivrig	3	0.666667	higbir	higiv	3	0.6666667
	‘screwed’				‘responded’		
hiv'ir	hebi'a	2	0.5	ba'ar	her'iv	2	0.5
	‘expressed’				‘starved’		
na	ne'ena	2	1	heni'a	ana	3	0.6666667
	‘got-answered’				‘answered’		
ratat	hetir	2	1	hirtit	yiret	3	0.6666667
	‘allowed’				‘intercepted/shot-down’		
kiba	baka	3	0.666667	kava	nikva	3	0.6666667

	‘got-cleaved’				‘pooled’		
šaxax	ninšax	3	1	šikex	xašak	4	0.75
	‘got-bitten’				‘desired’		
hidlik	nilkad	4	1	nidlak	hiklid	4	1
	‘got-trapped’				‘rusted’		
nixšal	nixeš	3	1	hixšil	hexiš	4	0.75
	‘guessed’				‘speed-up’		
ne'eram	hitna'er	4	1	he'erim	hi'ir	4	1
	‘shaked-off’				‘waked’		
nifsak	fiksés	4	1	hifsik	hikif	4	1
	‘faxed’				‘orbited’		
hirtiv	hitiv	4	1	nirtav	viter	4	1
	‘made-well’				‘gave-up’		
he'elim	ho'il	4	1	ne'elam	hil'im	4	1
	‘availed’				‘made-vanish’		
hixxid	nidxa	3	1	nixxad	hidi'ax/hedi'ax	3	1
	‘rejected’				‘rinsed’/‘dismissed’		
nexlaš	hišlix	3	1	hixliš	hexil	4	0.75
	‘tossed’				‘implemented’		
	Average	3.265	1.04			3.35	0.99

## Appendix G: verbs used in experiment 5

### Experimental condition

	Transitive		Intransitive	
complex-simplex	hix'is	‘angered’	ragaz	‘got-angry’
	hitbi'a	‘drowned’	šaka	‘drowned’
	hištik	‘silenced’	nadam	‘got-silent’
	he'if	‘flew’	na	‘moved’
	hiv'it	‘scared’/‘frightened’	yara	‘feared’
	hicit	‘burned’ (arson)	ba'ar	‘burned’
	herkid	‘made-dance’	zaz	‘moved’
	hexliš	‘weakened’	rafa	‘got-limp’
	hidgiš	‘emphasized’	balat	‘got-prominent’
	hirgiz	‘annoyed’	ka'as	‘got-angry’
	heni'a	‘moved’	zaz	‘moved’
complex-complex	hidhim	‘amazed’	hitrashem	‘got-impressed’
	hirgiz	‘annoyed’	hit'acben	‘got-irritated’
	higšim	‘realized’/‘fulfilled’	hitmameš	‘realized’
	he'ir	‘waked’	hikic	‘wakened’
	hirgil	‘habituated’	histagel	‘habituated’
	hitiš	‘exhausted’/‘tired’	hit'ayef	‘got-tired’
	hitmiha	‘surprisingly astounded’	hitpale	‘wondered’
	hiv'ir	‘burned’ (arson)	hitlahet	‘heated’
	hifxit	‘lessened’	hitma'et	‘diminished’
hishpric	‘sprayed’	nitaz	‘got-sprayed’	



simplex-simplex	cimcem	‘reduced’	paxat	‘decreased’
	šamat	‘dropped’	nafal	‘fell’

## Control condition

Prime	Target
hixnis	patar
hivlig	hitromem
piter	hitlabeš
hiflig	bara
hexlif	histaben
pina	nislax
patax	hitxalef
hivtiax	axal
pica	amad
kilel	higniv
gila	nirtav
hinif	hevi
bilbel	yašav
hisbir	hitga'age'a
pileg	halax
hikdiš	hista'er
liben	histapek
xalaf	hexdir
hisntaxrer	hitmid
ganav	hicmid
rac	hoši'a

hitlahev	pizer
hitpana	rikex
hitgareš	hisgir
hitkarev	himci
mica	hishki'ax
hitmaked	ina
hitrageš	ciyec
parax	hicmi
xava	naval
gar	himit
paca	hexmi
nam	hivrig
yaraš	hirdim

## Appendix H: verbs used in experiment 6

### Experimental condition

	Transitive	unaccusative	Translation
simplex-complex	rikex	hitrakex	softened
	ximem	hitxamem	heated
	kerer	hitkarer	cooled
	lixlex	hitlaxlex	soiled
	saraf	nisraf	burned
	motet	hitmotet	collapsed
	kimet	hitkamet	got-wrinkled
	patax	niftax	opened
	saxaf	nisxaf	swept
	cinen	hictanen	chilled
	šavar	nišbar	broke
	pizer	hitpazer	scattered
complex-simplex	hicmiax	camax	grew
	hir'id	ra'ad	trembled
	hifriax	parax	blossomed/blew
	hikpi	kafa	froze
	hitbia	tava	drowned
	hinbit	navat	sprouted
	hizrim	zaram	poured/flowed
	he'if	af	flew
	higbir	gavar	rose
	hiv'ir	ba'ar	burned(arson)
	heni'a	na	moved
	hirtit	ratat	vibrated

simplex-simplex	kiba	kava	turned-off
	šikex	šaxax	alleviated
	hidlik	nidlak	turned-on
complex-complex	hixšil	nixšal	tripped
	he'erim	ne'eram	stacked
	hifsik	nifsak	stop
	hirtiv	nirtav	got-wet
	he'elim	ne'elam	vanished
	hixxid	nixxad	got-extinct
	hixliš	nexlaš	weakened