THE REPRESENTATION OF LEXICAL CONCEPTS:

A PSYCHOLINGUISTIC INQUIRY

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ABSTRACT OF THE DISSERTATION

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The nature of the mental representation of concepts is central to cognitive science. Concepts are not only the elements of thought but the very elements upon which we build representations of natural language expressions (see Fodor, 1981). This dissertation investigates the nature of the representation of lexical concepts -- that is, concepts that are labeled by monomorphemic words. Virtually all theories of lexical-conceptual representation have assumed that lexical concepts are represented by their constitutive relations to other concepts (the so-called "primitives"), usually in the form of complex matrices specified at some cognitively abstract (or linguistically "deep") level of representation (see, e.g., Jackendoff, 1990; Hale & Keyser, 1992). Although this has been a pervasive assumption in the histories of linguistics and psychology, there have been very few attempts to investigate it experimentally -- and in all of them researchers have failed to provide support for the decompositional approach (e.g., Fodor, Garrett, Walker, & Parkes, 1980; Gergely & Bever, 1986). In this dissertation, the representation of lexical concepts was investigated in four sets of psycholinguistic experiments. The four sets relied on two comparisons between four verb classes: First, verbs that take sentential complements (e.g., *expect*) were compared with verbs

that take direct object (*persuade*); Second, Causatives (e.g., *kill*) were compared with "simple" Transitives (e.g., *kiss*). The first comparison was devised to test the experimental procedures while the second was the main comparison. The assumption was that there is a "shift" between superficial and deep syntactic relations of subject-verb-object triads in the Expect class (NP raising) but not in the Persuade class; the same shift, by hypothesis, occurs in the Causative class (if lexical causatives decompose), but not in the Transitive class (see Fodor et al., 1980). The experiments employed three types of visual masked priming techniques and two off-line word-relatedness judgement tasks. The results of the experiments all pointed in the same direction: They all attested to the reliability of the techniques and show that there is no difference between Causatives and other Transitives. These results are taken to support the view that lexical concepts are atomic mental representations.

[PAGES iv TO xv OMITTED]

PART I: THE ISSUES

1. Introduction

The study of the nature of the representation of lexical concepts has been playing a rather prominent role in the cognitive sciences arena lately. One of the main reasons is that some of the postulates that are taken to constitute the main tenets of the field (as the productivity and systematicity of mental representations; see Fodor & Pylyshyn, 1988), appear to have much to gain from the inquiry into the nature of the semantic representation of linguistic expressions. Moreover, concepts are said to be the very elements of thought, thus the elementary mental representations upon which cognitive processes occur. The contemporary appeal of lexical-conceptual representations can be seen in such major domains as linguistics (e.g., Jackendoff, 1983, 1990; Rappaport Hovav & Levin, 1998), computer science (e.g., Pustejovsky & Bergler, 1992), philosophy (e.g., Fodor, 1981; 1998), psychology (e.g., Smith & Medin, 1981; Murphy, 1991), and the neurosciences (e.g., Caramazza, Hillis, & Leek, 1994).

In linguistics, lexical concepts are taken to be represented as complex structures composed of semantic primitives and to be specified at a cognitively abstract (or linguistically "deep") level of representation.[1] Work along these lines has been carried out by the linguistic community under several labels and research programs, in the last decades --

[1] In principle, one might distinguish between lexical and phrasal concepts (Fodor, 1981). Roughly, *lexical* concepts are said to be those expressible by monomorphemic linguistic objects, while *phrasal* concepts would be those expressible by multimorphemic words or by more complex linguistic constructions. This distinction looks clear when one contrasts free morphemes (e.g., "dog", "kill") with compounds ("sightsee", "lunchroom"). But it can get blurry when one deals with bound morphemes. While one might consider "root+derivation" constructions (e.g., "grammar-*ian*") to be morphologically complex -- therefore phrasal concepts -- it is less clear whether inflectional affixes ("dog-*s*", "kill-*ed*") can have the same status. Throughout this dissertation, however, I refer to *lexical* concepts as those labeled by free morphemes (that is, truly monomorphemic expressions).

from "interpretive semantics" and "generative semantics" to "conceptual semantics" and "cognitive semantics".[2] In psychology, following a long tradition in philosophy, numerous paradigms have been proposed on the assumption that lexical items "have" meanings and that their meanings are "things in the head" which pick out properties of the world and represent them into complex concepts. The general hypothesis behind the cluster of psychological theories is that lexical items are pointers to conceptual categories or instances of categories -- the "structure" of concepts varying according to the particular model (e.g., list of features, nodes of a network, branches of a prototype tree, etc).

What is common to most approaches to lexical-conceptual representation is the thesis that concepts are complex mental entities, constituted either by yet more basic elements (e.g., conceptual primitives) or by their relation to other concepts (e.g., prototype trees). Most of the psychological evidence for the complexity of concept representation comes from experiments that show typicality effects in chronometric categorization tasks -- in which speed of categorization correlates negatively with the degree of similarity (or number of shared features) between an exemplar and a prototype -- thus suggesting that concepts are represented by sets of features in varied degrees of similarity to a prototypical exemplar of a category (see Smith, 1995, for a review). In linguistics, the evidence for lexical-conceptual complexity comes mostly from cross-linguistic data and distributional arguments on the syntactic and semantic attributes of classes of verbs.

Particularly concerning the linguistic data, it has been proposed that the semantic analysis of lexical items produce structural variables that are captured either at a linguistic-

[2] See, Katz & Postal (1964) for an account of the first approach, e.g., J. D. Fodor (1977) for a review of the second, Jackendoff (1983) for the foundations of the third, and Lakoff (1988) for a sample of the fourth.

conceptual (Jackendoff, 1990) or at a linguistic-syntactic level of representation (e.g., Baker, 1988; Hale & Keyser, 1992). That is, the surface form of a lexical concept is said to introduce "structural complexity" at diverse levels of linguistic description, often in the form of arrays of semantic primitives that occupy "branches" in the structural description that arises from the analysis of the linguistic expression. So, for instance, as some propose (e.g., Jackendoff, 1990), a lexical concept as such as [kill] (in "*x* kills *y*") is specified at a semantic level of representation as an expression of the form [*x* cause [*y* die]]. That is, what is essentially one proposition at one level of representation corresponds to a more complex, two-proposition expression at a different level.

This notion of "structural complexity" may be interpreted, according to psychological theories of the sorts identified with the Representational Theory of Mind (see Fodor, 1975; Fodor & Pylyshyn, 1988), in terms of computations over mental representations. That is, since cognitive processes are computational and since computations depend upon a representational system, the computation of complex representations is the manipulation of primitive and complex symbols in a "language of thought". The computational prediction that arises from the complexity of mental representations (concepts, in particular) can, thus, be simply stated in the following way: Given that computational resources are limited, if lexical concepts are complex mental representations, linguistic expressions that carry (complex) lexical concepts ought to take longer to compute than linguistic expressions that do not carry complex concepts.[3] If true, this means that psycholinguistic experiments *in*

[3] Of course, time for computing is only one possible measure of resources demand. But I will not dwell on these assumptions for now. I will only assert that this might be true of finite computational systems and that there has been an enormous amount of data accumulated in psycholinguistics and cognitive psychology relying on the assumption that cognitive complexity amounts to processing time. See Posner (1986) for a comprehensive treatment of this issue, and Pylyshyn (1984) on "weak" and "strong" equivalence between

principle ought to be able to detect those complexity effects -- if the experiments can tap structural distinctions between representations of distal stimuli. Also, experiments that rely on subjects' intuitions regarding semantic relations ought to be able to tap underlying, canonical representations of linguistic structure (see Levelt, 1970). Notwithstanding, so far no psycholinguistic evidence for the complexity of lexical concepts has been found, which can be interpreted as negative evidence for the decomposition of lexical concepts (Kintsch, 1974; Fodor, Fodor & Garrett, 1975; Fodor, Garrett, Walker, & Parker, 1980; Gergely & Bever, 1986). But despite its lack of experimental support,[4] most studies on lexical-conceptual representation still point to decompositional analyses -- which, one might argue, calls for yet more empirical research.

The work reported in this dissertation was designed to investigate some particular aspects concerning the assumption of decomposition of lexical concepts. More specifically, the so-called "causative" class of verbs is put to test by experiments that inquire into the reality of the complexity of their representation. The complexity issue follows from representational assumptions often posed by semantic analyses in terms of structural variables. The dissertation is organized as follows. In Section 2 some linguistic analyses of lexical-semantics are reviewed, particularly concerning the distributional arguments for the decomposition of causatives. That review will largely set the stage for the experiments

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cognitive theory and mental processes. As we will see later, the main experiments of this dissertation are controlled by independent comparisons between structural variables -- thus, they do not rely entirely on measurements of processing time.

[4] This issue will be further discussed later on. However, it should be said up front that, although native speaker's intuitions are "empirical", other sources of evidence (or *contra*-evidence) may prove at least equally informative. Since the product of psycholinguistic investigation is typically obtained over linguistic processing and since language processes are computations over (linguistic) representations, I assume that psycholinguistics is an inquiry on the nature of those representations.

reported later. Part II (Sections 3-7) is dedicated to a psycholinguistic investigation of structural complexity effects in lexical concepts -- focusing in particular on lexical causatives. Part III (Sections 8 and 9), brings the conclusion of the dissertation with a discussion on its main empirical achievements in the context of the dispute between decompositional and atomic theories of lexical-conceptual representation.

2. The Representation of Lexical Concepts

In the short modern history of the field there have been many proposed candidates for the representation of concepts. Although the psychological and linguistic literatures on concepts are rather vast, there are about three models under which one can collapse most proposals: Definitions, prototypes, and theories (Fodor, 1994). Extensive critical reviews of those approaches have been done elsewhere, from various perspectives (e.g., Murphy, 1991; Fodor, 1994, 1998; Margolis, 1994; Hampton, 1993) and will not be pursued here. Instead, I will review some of the main arguments for linguistic analyses of lexical decomposition so as to paint the scenario for the psycholinguistic experiments reported in Part II. Although the motivation for the experiments comes largely from general assumptions on lexical-semantic decomposition, the linguistic background hypothesis on the distribution of causative verbs will be of more direct interest.

Virtually all linguistic theories of lexical-semantic representation are decompositional. But it seems that the fuzzy picture of psychological claims about semantic decomposition gains apparently more definite contours within the context of quite specific linguistic proposals concerning the representation of lexical meaning. The distinction rests primarily on empirical grounds: While psychological proposals in general rely on categorization norms but, nonetheless, are subject to experimental scrutiny, the tradition in linguistic literature is that empirical evidence comes mainly from native speakers' intuitions, cross-linguistic data, and distributional arguments regarding the behavior of lexical items across sentence contexts -- from which syntactic and semantic regularities of lexical representation can be derived. In this section, I present linguistic arguments for lexical decomposition, beginning with the foundations of the linguistic movement towards decompositionality and arriving at some current approaches on lexical causatives. This review is, in essence, pretty straightforward -- but it might be important for the understanding of the more empirical issues of later sections.

2.1 Lexical Decomposition: Some Background

It is well-known by now that, in the modern history of linguistics, lexical representations have had different explanatory roles, ranging from *none*, in the late 50's, to almost central to both syntactic and semantic descriptions, as in current approaches. In the prolegomena of the transformational-generative movement, the lexicon was regarded as the repository of language idiosyncrasies, and the semantic representation of lexical form was not considered part of linguistic analyses. It was almost taken for granted that lexical semantic representations were like dictionary entries, with no role to play in the representation of language structure, besides their obvious function of providing information regarding the meaning of words for specified positions once syntactic structures had been generated. But there was no grammatically relevant *lexical-semantic* information and even lexical-syntactic information was given in the form of rewritten rules for lexical insertion (e.g., V→*kill*). Only in *Aspects* (Chomsky, 1965) more context-sensitive rules of lexical insertion were incorporated into the theory in the form of matrices of "features" -- syntactic, semantic and phonological. The "deep structure" was generated from the features and lexical items would fill in structural positions according to the match between their own features and the features specified by the nonterminal categorical nodes. In this second phase, lexical items were often regarded as "complex symbols" (Chomsky, 1965, p. 82ff) of features.

The notion of "semantic feature" was developed in Katz and Fodor (1964) -- which was the first attempt to incorporate semantic theory into the new linguistic paradigm. Katz and Fodor's goal was to formulate the conditions on a semantic theory that would account for the meaning of linguistic expressions with their syntactic structural distinctions. Basically, they suggested that a semantic theory would have a system of "projection rules" and a dictionary. They proposed that the semantics of lexical items (the dictionary) could be captured by "semantic markers", together with "distinguishers" corresponding to different senses of a word (or "dictionary entry"). The set of semantic markers would constitute the decompositional representation of words in terms of a matrix of binary features.

The features approach appeared as a solution to what Katz and Fodor called "the projection problem", the problem of formulating "rules" that account for the speaker's ability to assign semantic representations to an arbitrary set of linguistic expressions drawn from the infinite set of expressions in the speaker's language. Arguably, the idea that, in order to account for the projection problem and to insure compositionality, one had to postulate sets of semantic primitives, was an attractive one. In principle, it complied with the recursiveness condition required by complex representations in finite systems, one of the tenets of the new linguistic paradigm. But despite some obvious advantages, the markers approach was criticized -- by, e.g., Bolinger (1967) -- mainly for its lack of ontological grounding. Bolinger showed that the distinguishers of the Katz-Fodor theory could also be captured by markers, and the markers themselves could be decomposed into yet other sets of markers -- virtually unconstrained -- leading to redundancy within lexical entries and thus jeopardizing the whole idea of having a finite primitive basis to account for recursiveness and compositionality.

The notion of semantic feature, however, did not go away. Other types of semantic primitives were adopted by the different approaches that followed the initial attempt to propose universal principles for semantic representation. The role of lexical representations, then, became a major arena of dispute over linguistic levels of representation and their explanatory power, splitting the linguistic movement between Generativists and Interpretativists. Despite their differences concerning the levels of linguistic representation, both camps were in favor of some type of lexical decomposition at a level of representation different from surface structure. One of the generative semanticists' main disagreement with the interpretive approach turned on the nature of the semantic interpretation. Lakoff (1976), for instance, argued that the Katz-Fodor theory (and the Katz-Postal theory; see Katz & Postal, 1964) could not account for the semantic similarities between versions (a) and (b) of the sentences in (1) and (2) (from Lakoff, 1976: 45):

(1) a. I like the book

b. The book pleases me

(2) a. I fear John

b. John scares me

While their readings denote the same semantic relations, the grammatical subject of (a) is the grammatical object of (b) in both cases. By the same token, Lakoff argued for the breakdown of the distinguishers into further primitives to account for parallel readings in sentences like (3a-c).

(3) a. John enraged Bill

b. John made Bill very angry

c. John made Bill become very angry

The general conclusion, for Lakoff, was that an interpretive mechanism that relied on phrase markers could not capture the meaning of synonymous sentences whose tree structures were different. The generative semanticists's proposal was, then, to generate surface structures including lexical items directly from semantic structures, given rules that would raise and lexicalize complex predicates.

Although this is not the appropriate place for an in-depth evaluation of the arguments of the linguistic "war" between interpretive and generative semantics (see, e.g., Newmeyer, 1980; J. D. Fodor, 1977), this historical sketch might give us enough background for a better appraisal of dispute over the representation of causatives, presented below.

Nowadays, lexical semantics is at full speed towards fine-grained analyses of the representation of lexical meanings, with proposals ranging from a plain specification of argument positions[5] -- with or without thematic labels -- to more complex matrices of conceptual primitives. Since much of the discussion and empirical data focus on the causative class of verbs, and since the experiments reported in Part II are motivated by some structural variables assigned to causatives, in the next sections I will address some past and present assumptions specifically concerning the distribution of lexical causatives.

2.2 The Representation of Causatives

The analysis of causative verbs became one of the paradigm cases in the dispute over the power of transformations and levels of analyses in linguistic theory. Generative semanticists were the first to break up deep syntactic tree structures to account for the putative meaning of lexical items. For causatives, Lakoff (1976) proposed that -- as in (1)

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[5] The specification of arguments and their structural configurations does not per se entail semantic decomposition since argument structures are fundamentally lexical-syntactic representations.

and (2) above -- grammatical subjects and objects in sentences (3a-c) and (4a-c) were different, but their underlying semantic relations could be captured by readings like the ones represented in (5a-c).

(3) a. The desk moved

b. John suffocated

c. The water boiled

(4) a. I moved the desk

b. I suffocated John

c. I boiled the water

(5) a. I did something (pushed the desk), causing the desk to move

b. I did something (pumped air out of John's bedroom) causing John to suffocate

c. I did something (reduced the air pressure), causing the water to boil

In (5), Lakoff claimed, the grammatical subjects of (4) appear as the semantic subjects of *did something* and *cause*. This assumption was further explored by McCawley (1972). In the classical *kill* example, given in (6), the surface (6a) would be represented by an underlying semantic structure like the one depicted in (6b) (see McCawley, 1972: 158).

(6) a. John killed Mary

b. [CAUSE John [BECOME NOT ALIVE Mary]]

He proposed that two main processes were going on in the transformation of the complex semantic expression CAUSE BECOME NOT ALIVE into the surface structure *kill*: Predicate-raising and lexicalization. That is, transformations would successively raise predicates and adjoin them next to the immediate higher ones, which would then be lexicalized into *kill* at surface structure. What is important to note regarding McCawley's proposal is that CAUSE and other predicates are taken to be semantic primitives that form complex structures underlying simple morphologically unmarked forms as *kill*.

This proposal in fact was supposed to account for certain semantic relations -- as synonymy and entailment -- between sentences such as (7a) and (7b-d), thus allegedly providing a powerful tool for the analysis of semantic phenomena.

(7) a. John killed Mary

b. John caused Mary to die

c. Mary is dead

d. Mary died

But Fodor (1970) developed three arguments to show that sentences as (7a) and (7b) are not distributionally symmetrical, thus that there is no derivation relation between them. The first was based on the distribution of *do so*. He argued that *do so* replaces the matrix verb phrase *caused Mary to die* in (8a) and the proposition *Mary die* in (8b). However, *do so* can be inserted in (8c) but not in (8d).

(8) a. John caused Mary to die and it surprised me that he did so

b. John caused Mary to die and it surprised me that she did so

c. John killed Mary and it surprised me that he did so

d. *John killed Mary and it surprised me that she did so

The second of Fodor's arguments was based on the distribution of time adverbials. While, as in (9a), the event that ultimately led to Bill's death on Sunday could have happened on Saturday, *kill* in (9b) allows only for one adverb because *kill*, but not *cause to die*, points to one event.

(9) a. John caused Bill to die on Sunday by stabbing him on Saturday

b. *John killed Bill on Sunday by stabbing him on Saturday

Fodor's third argument concerns the distribution of instrumental adverbs. In (10a), he argues, there is an ambiguity concerning the actual swallower of the tongue that is not preserved in (10b).

(10) a. John caused Bill to die by swallowing his tongue

b. John killed Bill by swallowing his tongue

The argument is that, in order for both Bill and John be considered the swallowers in the ambiguous reading, it is necessary that they both be possible subjects of the instrumental adverb and the verb it modifies; but this can only happen in (10a).

What is patent across the linguistic arguments against lexical decomposition is that when one surface verb is decomposed into a two predicate structure in the underlying representation, distributional arguments do not hold. If (7a) and (7b) were represented by the same underlying representation (6b), their properties would be the same. But, apparently, they are not.

Despite those early distributional arguments against the decomposition of lexical causatives, there has been a surge of linguistic theories relying on virtually the same set of postulates that guided the initial decompositional approaches. In the reminder of this section, I will mention three of those approaches --- and my strategy will be as follows: Thought I intend to review -- rather briefly -- the literature on causatives, the idea is simply to set the stage for the experiments that will be reported later. The reason for not going into the details of these approaches here is that there is an obvious gap between specific linguistic proposals and empirical predictions in terms of the experimental variables one can play with. A gap that cannot be closed -- though, I believe, it can be narrowed -- by the approach taken in the present research.

The first current approach that I would like to mention is Jackendoff's (1990; 1993) conceptual semantics. For Jackendoff, causative verbs (or events) are represented according to two functions, CAUSE and AFF. The first specifies a "thematic tier", the second specifies an "action tier". On the "action tier", the function AFF can be distinguished according to whether the actor or the patient is affected by the event. So, for instance, in (12a), John, the actor, is the one affected, while in (12b), the patient John is affected.

(12) a. John tried to leave

b. John received a book

Besides, a distinction is made on whether the causative event is "successful" (CS^{+}=CAUSE), "unsuccessful" (CS^{-}), or has an "undetermined" outcome (CS^{u}).[6] The functions CS and AFF and their features can have any combination, supposedly capturing a wide range of classes of causative events. Thus, following Jackendoff's rendering of the conceptual structure of diverse types of causative constructions, we can have (13a), for instance, in which some of the many features and primitives are set to represent (13b).

(13) a. $\begin{bmatrix} CS^{+} ([_{Thing}\text{John}], [_{Event}GO_{Poss} ([_{Thing}\text{Book}],[_{Path}TO] [_{Thing}\text{Bill}])]) \\ AFF^{+} ([\text{John}],[\text{Bill}]) \end{bmatrix}_{Event}$

b. John gave Bill a book

In sum, the decomposition of a causative event, in Jackendoff's theory, can go on and on by the introduction of multiple function tiers, field features, distinctive features and so forth. The combination of multiple features and levels is supposed to account for the

[6] The AFF function is also distinguished by features that indicate if the patient is "positively affected" (e.g., *help*=AFF^{+}), "negatively affected" (e.g., *impede*=AFF^{-}), or if there is a relation of "non-opposition" between actor and patient (e.g., *let*=AFF^{o}).

polysemic nature of concepts; thus, by adjusting the features the same basic matrix can account for the multiple contexts in which a lexical item can participate. But it seems that all boil down to a definitional approach to lexical concepts -- an approach according to which many features are set to account for the meaning of a surface lexical expression in terms of a more complex conceptual matrix that decomposes one predicate into many. And this leads us again to the ontological problems raised by the introduction of *ad hoc* predicates at the semantic level. Jackendoff's analyses do not solve the ontological problem of the two event structure derived from one surface verb. On a closer look, Jackendoff's multiple tiers, affectedness and successfulness features, field features and so on, seem to be notational variants of the generative semanticist's tree structures with the type of features proposed by the Katz-Fodor theory. Ontological problems are alike: Neither can the generative semanticists give an account of the primitive expressions, nor can the Katz-Fodor theory ground their features in a vocabulary of primitive representations. Jackendoff, nonetheless, incorporates both. Thus, despite its centrality in current approaches to lexical decomposition, a theory like Jackendoff's still has to give an account of the problems that plagued its predecessors.

The situation is not much different in other current approaches -- though the level at which lexical items decompose appears (or is claimed) to be different from the level in which decomposition takes place in Jackendoff's theory.[7] In Hale and Keyser (1992), for instance, the assumption is that lexical complexity unfolds (or is projected) at syntactic deep structure.

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[7] Actually, researchers do not agree on how many levels of lexical representation there are. For Jackendoff (1990), for instance, there is no motivation for argument structure since conceptual structure captures those structural properties. For Grimshaw (1990), Hale and Keyser (1992), and Rapaport-Hovav and Levin (1998), for instance, there are two levels, predicate-argument structure (PAS) and lexical-conceptual structure (LCS), properties of the former being derived from the latter.

They propose, for instance that surface denominal verbs as *shelve* in (14a), are decomposed in syntax into the structurally complex *put on the shelf* as in (14b) via rules that cyclically combine ("incorporate" or "conflate") the PP locative (*on the shelf*) with an "empty" causative (*put*) to form the derived verb.

(14) a. John shelved his books

b. John PUT ON THE SHELF his books

Here the case appears to be close to the asymmetry of *kill* and *cause to die* as put forth by Fodor (1970). As Fodor and Lepore (1997) have recently suggested, Hale and Keyser's analysis does not escape from scope ambiguity tests showing that, e.g., (14a) and (14b) are not symmetrical and, thus, that *shelve* and *PUT ON THE SHELF* are not derivationally related.

Rappaport-Hovav and Levin (1998) are in a position intermediary between full-blown conceptual structures such as Jackendoff's and deep, lexically-driven syntactic structure decomposition as in Hale and Keyser (1992). Rappaport-Hovav and Levin view causatives quite explicitly as decompositional structures represented by what they call "event structures" which are syntactically encoded via linking rules. So, in their notation, a representation of (15a) would have the complex event structure in (15b),

(15) a. John killed Mary

b. [[John ACT] CAUSE [BECOME [Mary <*dead*>]]]

in which we have a basic "semantic template" plus "idiosyncratic information" (*dead*). The idiosyncratic information, actually, is what determines the difference between verbs that supposedly have the same template, as in the case of *kill* in (15b) and, e.g., *break* in (16), both being "externally caused state" verbs.

(16) a. John broke the vase

b. [[John ACT] CAUSE [BECOME [vase <*broken*>]]]

What is interesting -- not to say redundant -- is that, the same types of concerns raised in the context of the generative semantics and decompositional accounts therein can be raised against Rappaport and Hovav's approach: The problem of the primitives' ontology, the asymmetrical distributions of lexical causatives (e.g., *kill*) and their periphrastic counterparts (e.g., *cause to die*), and the impossibility of definitions. It appears that those issues are rarely, if ever, faced by advocates of the lexical-decomposition approach.[8]

If it is possible to summarize the theories briefly discussed above -- particularly in the context of their relation to the present research --, it seems that a common assumption for them is that there is a level of representation in which causative verbs represent causative events by structurally or syntactically complex predicates. That is, causative verbs that are morphologically *unmarked* incorporate (or lexicalize) structures that are, nonetheless, visible to other levels of representation -- particularly deep structure syntax and "conceptual structure". I will take those general assumptions to constitute the scenario against which the present empirical study is conceived.

I will assume (roughly taking the position championed by Chomsky, 1986) two basic levels of syntactic representation for linguistic expressions, one being the surface representation (which is similar to its utterance form) and a second, deep representation, at which syntactic atoms are represented according to their canonical positions (viz., the original locus of surface-moved elements). Besides, I take it that there is a level of logical

[8] In Section 5 I will return to some of the analyses proposed by Rappaport and Levin. There I investigate event and argument structure properties of the verbs used in the experiments reported in Sections 3 and 4. In Section 10, an alternative to lexical decomposition is discussed.

form (LF) at which scope relations, quantification and the general logical structure of the sentence is represented. The deep structure is input to this logical form, thus, the deep structure is supposed to provide all the elements for the semantic relations captured by LF. The experiments reported below are designed to focus on the supposed *deep syntactic representation* of a CAUSE function -- a function that takes structural scope over the causative event labeled by the surface causative verb. The problem, as it stands now, is to examine the supposed symmetry between a superficial lexical item and its deeper, two-clause structure representation as generally proposed in lexical semantics.[9] So, to the experiments.

[9] If we find that CAUSE is in fact a primitive function, that is, if we find that lexical causatives do engender a complexity effect by introducing a new clause in the underlying representation of causative constructions, the effect should encompass all types of lexical causatives, independent of the particular analysis proposed in the literature. The null hypothesis is that causatives concepts (viz., causative verbs) are just like other concepts (just like other verbs in their transitivity properties).

[PAGES 20 TO 140 OMITTED]

10. Theoretical Implications

Although my main concern in this dissertation has been to test -- with diverse experimental paradigms -- the assumption of lexical decomposition, it is only natural to ask which theory, if not decompositional ones, can account for the patterns of distribution of certain lexical concepts. Take the so-called causative/inchoative alternation as an example. Usually, as we have seen in Section 2, this alternation is at the basis of claims for the decompositional analysis of causatives. The assumption is that the alternation occurs because the representation of the transitive *boil* in (34a) and the intransitive *boil* in (34b) can both be captured by something like the template in (34c).

(34) a. John boiled the water

b. The water boiled

c. $\text{BOIL}_{\text{TRANSITIVE}} \rightarrow [x \text{ CAUSE } [y \text{ BOIL}_{\text{INTRANSITIVE}}]]$

That is, the assumption is that the underlying representation of the transitive *boil* is the causative event of which the intransitive *boil* is a sub-event. I will not attend to details or variations of this approach here (see Section 2), but this is a pervasive claim and it is taken to be one of the most enduring distributional evidences for the causative decomposition hypothesis. So, *in passing*, I will propose a theory to account for this phenomenon -- theory which will be sketchy (though hardly new) but obviously not inconsistent with the experimental evidence reported in previous sections.

The theory I propose to account for phenomena such as the causative/inchoative alternation relies heavily on the notion that lexical-conceptual representation and, by assumption, conceptual relatedness can be captured by sets of meaning postulates derived from atomic concepts.[18] Certainly meaning postulates are not new in semantics and psycholinguistics (see Carnap, 1956, and others),[19] but they have been largely overlooked by much of the lexical semantics community lately. The reasons for this are far beyond the scope of this short section.

I begin by assuming that a lexical item is represented by its "mentalese translation" (Fodor, 1975) together with a specification of its argument structure. In (35), for example, the lexical item *boil* is taken to be represented by the *mentalese* morpheme or conceptual atom BOIL. And since *boil* has both transitive and intransitive uses, I assume that it has two argument structures associated to it.

(35) *boil* = BOIL {(*x*, *y*) or (*y*)}

I further assume that for each lexical concept *X*, there is a set of meaning postulates that constitute the inferential domain of *X*.[20] This notion of inferential domain can be illustrated by the meaning postulates in (36) -- in which (36c) symbolizes that there are indefinitely

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[18] Many researchers working in the Montague Semantics framework (e.g., Partee, 1995) have also defended the view that word meaning is best captured by meaning postulates. It should be noted that meaning postulates and semantic decomposition are not incompatible. Lakoff (1972) and Dowty (1979), for instance, have proposed (much in the tradition of Generative Semantics) analyses in which meaning postulates and lexical decomposition are part of the same system of semantic representation. I will skip the details of their approach but take that the atomicity thesis is independently motivated by the impossibility of definitions (not to mention the empirical evidence against them; see the next note and references therein) and by the problem that conceptual fuzziness poses for the view that conceptual representation should be compositional to account for the systematicity and productivity of thought.

[19] See J.D. Fodor et al., 1975, and Fodor et al., 1980 (and also the experiments in Part II). In fact meaning postulates are not directly *supported* by those psycholinguistic studies. What they suggest is that lexical concepts do not decompose, thus that concepts must be atomic. And if lexical concepts are atomic, meaning postulates might be the strongest candidates for capturing the entailments of conceptual atoms and expressions.

[20] I take the *inferential domain* of concept *X* to be the set *A* of inferences that are *caused* by *X* and also the subset *B* of inferences that are caused by *Y* but of whose entailments *X* takes part (see below). I assume (see Fodor, 1975) that indefinitely many inferences can be drawn from linguistic expression in the course of language comprehension. But since the language comprehension system is, by assumption, continually feeding the inferential capacities, the set of inferences caused by *X* is constrained by the demands of the particular situation or system.

many properties that can be inferred from X (that is, *caused* by X).[21]

(36) a. $\forall x, \forall y\ [\mathrm{BOIL}(x, y)] \rightarrow [\mathrm{BOIL}(y)]$

b. $\forall y\ [\mathrm{BOIL}(y)] \rightarrow [100^{\circ}\mathrm{C}(y)]$

c. $(\forall x[P(x)] \rightarrow [Q(x)])_n$

In addition, I assume that any conceptual relation can be represented in terms of entailments which are obtained in a system of derivations between concepts and other conceptual expressions. I assume that sets of meaning postulates thus determine the entailments of X (a lexical or phrasal concept) such that for any X, if X causes A (A:{a, b, c, ...n}), A is taken to be the set of inferences in the domain of X.[22] In this case, the assumption is that the set of inferences associated with X capture many cases of conceptual relations such as hyponymy, synonymy, meronymy, opposition, etc. (see Cruse, 1986). Notice that the same sort of proposal can be made for the representation of pseudo-alternation pairs like *kill*/*die*, as represented in (37).

(37) $\forall x, \forall y\ [\mathrm{KILL}(x, y)] \rightarrow [\mathrm{DIE}(y)]$

There are three related observations to be made regarding the nature of these inferences. First, since I assume that the elements (or the "nonlogical" elements, as says Carnap) of the meaning postulates are atomic representations, this theory distances itself from inferential-role theories (see, e.g., Block, 1986) for which the *contents* of expressions are determined by the inferences in which the expressions and their constituents enter. Second, it is

[21] For simplicity, I will refrain from employing modal operators.

[22] I will avoid at all costs getting into a discussion of the analytic/syntectic distinction. I assume that all inferences that X causes are valid (*lato sensu*) inferences. In this sense, I will not propose any form of "hierarchy" of meaning postulates, but it is plausible to assume that for some cases (such as the causative and inchoative uses of verbs) the inferences such as the one in (36) may play a prominent role among others inferences (that is, it is taken to be a "logical" entailment).

important to distinguish the present theory from decompositional theories (e.g., Rappaport Hovav & Levin, 1998): Here the set *A* (or *B* or *C*) is a set of *inferences* or meaning postulates, not a set of primitive conceptual elements or features of a template. This is not simply a case of notational difference because of what follows. Third, I assume that the inferences in *A* are causally connected to *X* but are not *X-content*-constitutive. That is, although *X* causes *A*, the inferences constitutive of *A* are not where *X* gets its content from.[23] What *A* does is to determine the epistemic conditions by virtue of which *X* and *Y* are related -- where *X* causes *A*, *Y* causes *B*, and *A* and *B* are said to have some of the same meaning postulates (i.e., $A \cap B$).

This approach to conceptual or lexical-semantic representation, thus, appears to account for the distribution of causative verbs (as well as other lexical concepts) by assuming that lexical representations are atomic and lexical relations are obtained via sets of meaning postulates. This approach appears to be powerful enough to account for the representation of lexical concepts without the perils of the infinite regress to which semantic decomposition can lead. An important distinction between this "atomic+meaning postulate" approach and the theories briefly reviewed in Section 2 is the cognitive level at which lexical concepts are represented. Contrary to the decompositional theories, I do not assume a lexically-specific (or linguistically-specific) level of semantic representation. Rather I assume that all lexical concepts and all lexical-conceptual inferences are central operations over linguistic outputs (see also note 16).

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[23] Where *X* gets its content from is not a matter to be solved here. I will rather side with Fodor (1990) and assume that "'*X*' means *X*". The point is that, given a lexical item (or an object, or an event), its token corresponds to a mentalese symbol *X*.

Certainly the main implications of the results of this research rely on their contribution to the study of the representation of lexical concepts, particularly concerning the representation of causative verbs. For many years, those verbs have been the center of arguments concerning the levels of linguistic representation. Despite their centrality, all evidence for the decomposition of causatives have been gathered around distributional arguments. But the very few psycholinguistic studies that investigated the representation of those verbs have not confirmed the linguistic hypotheses concerning the complexity of their supposedly deeper representation. The results reported here point in the same direction as those reported elsewhere (Fodor et al., 1980) concerning the representation of lexical causatives: They do not appear to be more complex than other transitive verbs. All experimental evidence suggest that lexical causatives do not decompose.

The results of this study point, in sum, to the center of the dispute between theories of conceptual representation, hence to theories about the nature of mental representations. If, as the data suggest, lexical concepts are not structured mental representations, they point to an atomistic theory of concepts (Fodor, 1981). According to this theory, concepts that are labeled by monomorphemic lexical items form the basic vocabulary of mental representations. From those elementary representations, more complex representations can be built following syntactic principles that are sensitive to the semantics of their constitutive parts (see Fodor & Pylyshyn, 1988). Thus, in essence, those elementary mental representations ought to be entailments of the more complex representations of which they are constitutive parts. If lexical concepts (as causatives) do not show signs of being more complex than their surface forms, they turn out to be very natural candidates for the role of elementary mental representations.

[PAGES 146 TO 148 OMITTED]

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