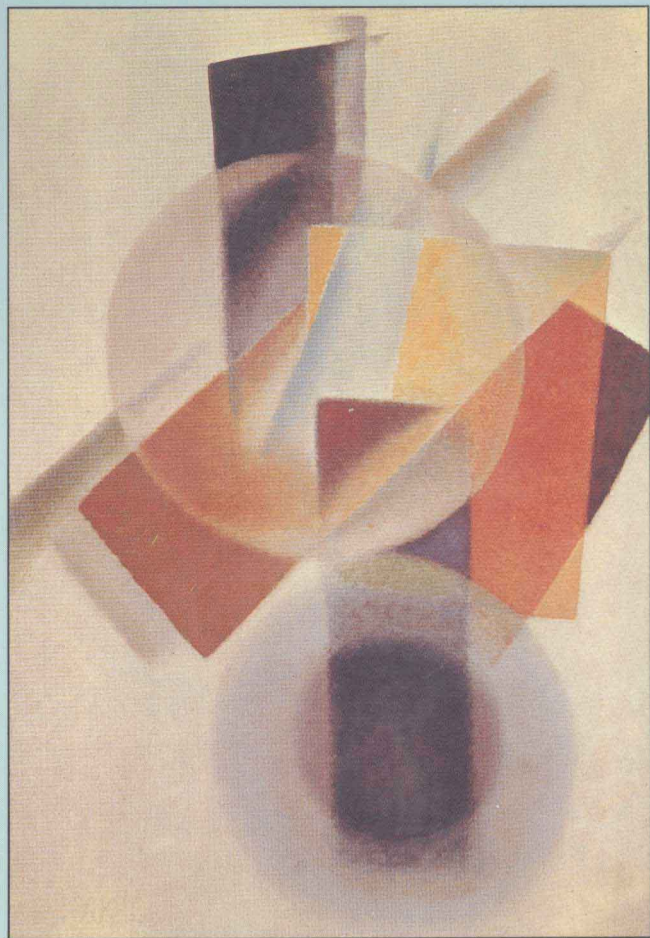
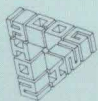


Lexical & Conceptual Semantics



Edited by Beth Levin and Steven Pinker



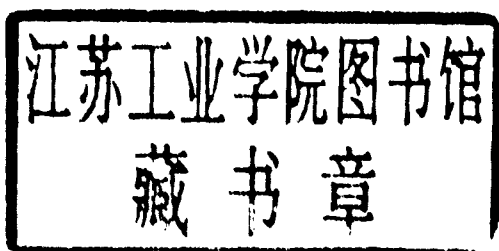
A COGNITION SPECIAL ISSUE



Lexical & Conceptual Semantics

Edited by

Beth Levin and Steven Pinker



BLACKWELL
Cambridge MA & Oxford UK

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Amsterdam, The Netherlands.

This edition published by Blackwell Publishers, 1992

238 Main Street
Cambridge, MA 02142

108 Cowley Road
Oxford, OX4 1JF, UK

Reprinted from *Cognition: International Journal of Cognitive Science*, Volume 41,
Numbers 1-3, 1991. Blackwell Publishers have exclusive licence to sell this English-
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Library of Congress Cataloging-in-Publication Data

A CIP catalog record for this book is available from the Library of Congress.

isbn: 1-55786-354-7

British Library Cataloging in Publication Data

A CIP catalog record for this book is available from the British Library.

Printed and bound in the United States of America.

This book is printed on acid-free paper.

Lexical & Conceptual Semantics



Cognition Special Issues

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Introduction*

Beth Levin

Department of Linguistics, Northwestern University.

Steven Pinker

Department of Brain and Cognitive Sciences, Massachusetts Institute of Technology.

It is the fate of those who dwell at the lower employments of life, to be rather driven by the fear of evil, than attracted by the prospect of good; to be exposed to censure, without hope of praise; to be disgraced by miscarriage, or punished for neglect, where success would have been without applause, and diligence without reward.

Among these unhappy mortals is the writer of dictionaries . . . (Preface, Samuel Johnson's Dictionary, 1755).

Samuel Johnson's characterization of the lexicographer might apply equally well to the writer of mental dictionaries, those cognitive scientists who attempt to specify the mental representations underlying people's knowledge of word meanings. Research in lexical semantics, though enjoying waves of enthusiasm during the past 30 years, is often regarded as having met with limited success. Although a sense of excitement and progress accompanied the research efforts of the 1960s and early 1970s, including Katz and Fodor's (1963) semantic feature theory, Fillmore's (1968) case grammar, and the theory of generative semantics proposed by Lakoff (1971), McCawley (1973, 1979) and Ross (1972), shortly thereafter the research area fell on hard times, meeting a series of rebuffs both from linguists and psycholinguists. Efforts to constrain syntactic theories led some theoretical linguists to condemn the efforts of generative semanticists to construct a syntactic

*Supported by NSF Grant BNS-8919884 to the first author, and NIH Grant HD 18381 to the second author.

theory in which decompositional representations of word meaning served as the underlying syntactic representation. Meanwhile, Jerry Fodor and his collaborators (Fodor, 1981; Fodor, Fodor, & Garrett, 1975; Fodor, Garrett, Walker, & Parks, 1980) argued that evidence from the psychological laboratory showed that the mental representations of word meaning *had* no internal structure.

Theories of how word meanings are represented in general must be built on research on how particular word meanings are represented. But it is not easy to define a given word, so any attempt to do so becomes an easy target for by now familiar criticisms. If *bachelor* means “unmarried man”, why is the Pope not a bachelor? If we amend the definition to “unmarried man legally eligible for marriage”, what about a man who has been happily living for 7 years with a woman he has never officially married, or an illegal immigrant who expediently marries a native platonic friend, or a 17-year-old successful entrepreneur living in a penthouse apartment (examples from Winograd, 1976)? If *to paint* means “cause to be covered with paint”, why isn’t it *painting* when a paint factory explodes or when Michelangelo dips his brush into the can (Fodor, 1981)? These particular definitions can be patched up, but skeptics foresee a never-ending need for such patching with no real increase in watertightness. The whole enterprise then might seem to be at best tedious and at worst post hoc. Is it really scientifically fruitful to write a 50-page paper on the verb *bake*? And could there even be an answer to such seemingly academic questions as whether the verb means “to create a cake by cooking in dry heat in an oven” or “to cook by dry heat in an oven, resulting in the creation of a cake?” Inevitably one thinks of Johnson’s entry for *lexicographer*, which defines the term as “. . . a harmless drudge, that busies himself in . . . detailing the signification of words”, perhaps with doubts about the “harmless” part. As Johnson put it,

It appeared that the province allotted me was of all the regions of learning generally confessed to be the least delightful, that it was believed to produce neither fruits nor flowers, and that after a long and laborious cultivation, not even the barren laurel had been found upon it. (Johnson, 1747: 2).

Despite the early pessimism, there has been a resurgence of interest in lexical semantics over the last few years in both linguistics and psychology. The new blossoming was caused by several developments, both theoretical and practical.

Within theoretical linguistics, it is a response to the increased importance of the lexicon in many current linguistic frameworks (e.g., government-binding, lexical-functional grammar, head-driven phrase structure grammar; see Wasow, 1985). As part of the effort to constrain the power of syntactic rules, more and more facets of syntactic constructions were considered to reflect the properties of the lexical items in these constructions. This shift meant that many linguistic phenomena had to be explained in terms of argument structure – the representation of argument-taking properties of lexical items. And once argument structure began to be used to explain facts of sentence syntax, it became necessary in turn to explain properties of argument structure, leading inexorably to the detailed

examination of the meanings of predicates. The study of lexical semantics no longer divides the field, as it did during the interpretive semantics versus generative semantics debates of the 1970s, but is becoming a unifying focus. Insights regarding word meaning are being compiled eclectically from a variety of linguistic frameworks, current and past, and are incorporated in not too dissimilar ways in most modern linguistic theories.

The assumption underlying much of this current linguistic research – that syntactic properties of phrases reflect, in large part, the meanings of the words that head them – also provides a powerful new methodology for studying word meaning. Rather than relying exclusively on intuitions and judgments about aspects of verb meaning, researchers can exploit the fact that subtle differences in word meaning correlate with otherwise puzzling differences in the syntactic structures that the word can appear in. Why can you say *Chris cut at the bread* but not *Chris broke at the bread*? The answer, it turns out, depends on the fact that *cut* is a verb of motion, contact, and causation, while *break* is a verb of pure causation (Guerssel, Hale, Laughren, Levin, & White Eagle, 1985; Levin, 1985). This implies that motion, contact, and causation must be represented in the meanings of verbs in a format that the syntax can be sensitive to. When the technique of searching for syntax-relevant distinctions is applied to many words and many constructions, a small set of semantic elements tends to recur. Thus evidence from syntactic judgments provides us with a characterization of the scaffolding of semantic structures that verb meanings are built on. Interestingly, the set of elements picked out by this technique is in many instances similar to the set of elements that can be marked overtly by the morphology of some languages, that define the common thread between literal and quasi-metaphorical uses of a given verb, and that are needed to specify the meanings of hundreds or thousands of verbs in English and other languages (Jackendoff, 1990; Miller & Johnson-Laird, 1976; Pinker, 1989; Talmy, 1985). Such convergences increase confidence that the core content of semantic representations is beginning to be identified, and that researchers are not just indulging their intuitions about the best way to define a word.

The development within computer science of computational and statistical techniques that can be applied to on-line text corpora and machine-readable dictionaries adds powerful new tools to the toolkit available for the study of lexical representation (e.g., Boguraev, 1991; Boguraev & Briscoe, 1989; Byrd, Calzolari, Chodorow, Klavans, & Neff, 1987; Church, Gale, Hanks, Hindle, & Moon, to appear; Church & Hanks, 1989; Zernik, 1991; among many others). These technologies, by providing access to large amounts of data and allowing for the semi-automatic verification of hypotheses, are already showing great promise, and may soon lead to even more striking results. The study of lexical semantics might also repay the favor to computer science. The development of natural language-understanding systems depends on the availability of large-scale comprehensive lexicons. Current systems face what has sometimes been called a

“lexical bottleneck” (Byrd, 1989) – limitations in system performance attributable to the inadequacy of their lexicons. In the past, the lexicons of natural language-processing systems were created with the technological requirements of a system in mind (especially in terms of the ability to support inference), regardless of their fidelity to the human mental lexicon. But it is hard to believe that such systems would not profit from insights about how the human mind represents word meaning and maps it onto grammar (Levin, 1991; Pustejovsky & Boguraev, to appear). After all, that’s where the words and grammar come from.

Psychology, too, cannot afford to do without a theory of lexical semantics. Fodor (1975, 1981; Fodor et al., 1980) points out the harsh but inexorable logic. According to the computational theory of mind, the primitive (nondecomposed) mental symbols are the innate ones. If people know 50,000 word meanings, and if most of these cannot be decomposed into finer-grained elements, then people must have close to 50,000 primitive concepts, and they must be innate. And Fodor, after assessing the contemporary relevant evidence, concluded that most word meanings are *not* decomposable – therefore, he suggested, we must start living with the implications of this fact for the richness of the innate human conceptual repertoire, including such counterintuitive corollaries as that the concept *car* is innate. Whether or not one agrees with Fodor’s assessment of the evidence, the importance of understanding the extent to which word meanings decompose cannot be denied, for such investigation provides crucial evidence about the innate stuff out of which concepts are made. Current evidence that there is some linguistically relevant internal structure to verb meaning has provided an intriguing set of candidates for basic conceptual elements, reviewed in Jackendoff (1990) and Pinker (1989). How much of a speaker’s vocabulary can be *exhaustively* captured in terms of these elements is, of course, an open question.

Lexical semantics has also come to play an increasingly central role in the study of language acquisition. Infants do not know the grammar of the particular language community they are born into, but they do have some understanding of the conceptual world that the surrounding language users are expressing. Since concepts are in turn intimately tied to the meanings of words, the child’s semantic machinery might play an important role in allowing him or her to break into the rest of the language system, a hypothesis sometimes called “semantic bootstrapping” (see Pinker, 1984). At the same time the semantic representations of particular words, especially verbs, vary from language to language and must themselves be acquired, and the acquisition of verb meaning has become a lively topic in developmental psycholinguistic research (Bowerman, 1989; Clark, 1982; Gentner, 1982; Gleitman, 1990).

The impetus for this special issue of *Cognition* is the revival of interest and research on lexical and conceptual semantics. The issue presents a range of representative recent studies that approach lexical and conceptual semantics from

the perspectives of both theoretical linguistics and psycholinguistics. The authors of the papers in this volume come from a variety of backgrounds and bring different perspectives to bear on the common goal of developing a theory of word meaning and explaining our ability to use and understand words. Like other areas in cognitive science the study of word meaning has only benefited from being approached by researchers from various fields. The fruits of the resulting cross-fertilization are evident in the papers in this volume, which together cover a wide range of current research issues in lexical and conceptual semantics. Three of the papers in this volume are primarily from a psycholinguistic perspective and three primarily from a linguistic perspective. Two of the psycholinguistic studies focus on child language acquisition, while the third explores a model of lexical organization that is supported by experimental and theoretical work.

Jackendoff's paper introduces the notion of "conceptual semantics" – a characterization of the conceptual elements by which a person understands words and sentences, to be distinguished from much of formal linguistic semantics which characterize the abstract relation between words and sentences and the external world. This approach is illustrated by means of an investigation of the meanings of words for objects, events, and their parts. The study uncovers unexpected and uncanny grammatical parallels between nouns and verbs, related, presumably, to some underlying conceptual parallel between things and events. Pustejovsky's paper, although focusing on verbs, looks at how verbs come together with nouns, adverbs, and prepositional phrases in determining certain facets of the compositional meaning of a sentence in a model that he calls "the generative lexicon". Lexical aspect – the inherent temporal structure of an event, a facet of word meaning that has recently been shown to be extremely important in explaining properties of words – figures in Pustejovsky's and Jackendoff's papers and to a lesser extent in some of the other papers. Choi and Bowerman's paper studies the development of the meanings of verbs signifying motion with respect to particular directions, objects, and parts, and the relation between these language-specific lexical semantic structures and nonlinguistic conceptual structure. The study, which compares English and Korean-speaking children, documents children's striking ability to acquire the language-particular nuances of word meaning quickly, while demonstrating the importance of cross-linguistic research to our understanding of development of word meaning.

The next two papers also investigate verbs of motion, focusing on a subclass of motion verbs that has figured prominently in recent research within linguistics on lexical semantics and its relation to syntax. Levin and Rappaport Hovav present a linguistic investigation of *clear/wipe* verbs, and Gropen, Pinker, Hollander, and Goldberg study the acquisition of their semantic inverses, the *spray/load* verbs. Both studies show how an appropriate representation of word meaning can be used to predict syntactic behavior, and, in the case of children, misbehavior.

Finally, Miller and Fellbaum discuss a large-scale computational investigation

of lexical organization that centers around the semantic relations between words, rather than the semantic components within words. Their paper presents a sample of the discoveries that their group have made while working on this project, with intriguing implications for how words in different grammatical categories are mentally organized and how they develop in the course of language history.

We hope that this collection of papers will bring the new work on lexical semantics to the attention of a broad range of cognitive scientists, and will serve as a framework from which future integrations can proceed.

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Parts and boundaries*

Ray Jackendoff

Brandeis University.

Within the framework of Conceptual Semantics, a family of conceptual features and functions is developed that accounts for phenomena in the semantics of noun phrases such as the mass-count distinction, plurality, the partitive construction (a leg of the table), the constitutive construction (a house of wood), the “Universal Packager” (three coffees), and boundary words such as end, edge, and crust. Using the strong formal parallelism between noun phrase semantics and event structure that is a hallmark of the Conceptual Semantics approach, the features and functions of the NP system are applied to a wide range of problems in event structure, for example the analysis of the Vendler classes, the meaning of the progressive, the “imperfective paradox”, and “aktionsarten” such as the syntactically unexpressed sense of repetition in The light flashed until dawn.

Crucial to the analysis is that these features and functions can be expressed in syntactic structure either by being part of lexical conceptual structure, or by use of a morphological affix, or by being associated with the meaning of a construction such as N of NP or nominal compounding. Alternatively, they may remain unexpressed altogether, being introduced into the conceptual structure of a phrase by “rules of construal”. This shows that lexical semantics and phrasal semantics interpenetrate deeply, and that there is no strict one-to-one correspondence between syntactic and semantic structures. In addition, the analysis provides further evidence that natural language semantics must be based on a psychological view of meaning – it must be concerned with how language users are constructed to understand and schematize the world.

*This research was supported in part by NSF Grants IST 84-20073 and IRI 88-08286 to Brandeis University. I am grateful to Steven Pinker, Paul Bloom, and three anonymous referees for useful comments on earlier versions of this paper.

1. The framework

Given the many different opinions on what semantics is supposed to be about, I had better begin by situating this study in the overall enterprise of which it forms a part. A convenient starting point is Chomsky's (1986) distinction between two broad views of language. One, *E-language* or "externalized language", sees language as an external artifact, existing independently of speakers. The other, *I-language* or "internalized language", sees language as a set of mental principles that account for linguistic understanding and use. From the standpoint of psychology, the latter view is of greater interest.

One can approach semantics, the theory of linguistic meaning, from either of these views. For the most part, standard versions of truth-conditional semantics are concerned with the relation of language to the world independent of speakers, that is, *E-semantics*. By contrast, this study (along with Jackendoff 1983, 1990) is an inquiry into the principles of mental representation that support thought – that is, it belongs to a theory of *I-semantics*, which in principle should be more compatible than an E-semantic theory with the concerns of both psychology and generative grammar.

The basic hypothesis underlying Conceptual Semantics, the particular version of I-semantics pursued here, is that there is a form of mental representation called *conceptual structure* that is common to all natural languages and that serves as the "syntax of thought".¹ Conceptual structure is envisioned as a computational form that encodes human understanding of the world.² Rules of inference, pragmatics, and heuristics can all be thought of as principles that license the formation of new conceptual structures on the basis of existing ones. Since conceptual structure serves as the form of linguistic meaning, there must also be a set of *correspondence rules* that relate it to syntactic representations, which permit the expression of meaning. In addition, since the conceptualization of the world must be related to perception and action, conceptual structure must be linked by further sets of correspondence rules to the mental representations proprietary to the perceptual systems and to the production of action. The overall layout of the theory is shown in Figure 1.

Accordingly, the goal of Conceptual Semantics is to articulate each of the

¹I use this term to distinguish my notion of conceptual structure from Fodor's (1975) "Language of Thought"; the latter carries with it the property of intentionality, from which I wish to distance myself. See Jackendoff (1990, 1991) for discussion.

²However, conceptual structure is not the only form of representation available to encode one's understanding of the world. Aspects of the world that are understood spatially are encoded in another central representation whose properties resemble Marr's (1982) 3D model structure (see Jackendoff, 1987b; Jackendoff & Landau, 1991 for discussion, as well as section 5); there may well be other central representations as well, for instance a "body representation" that encodes the position and state of the body. What distinguishes conceptual structure from these others is its *algebraic* character – its being formalized in terms of features and functions – and its capacity to encode abstractions.

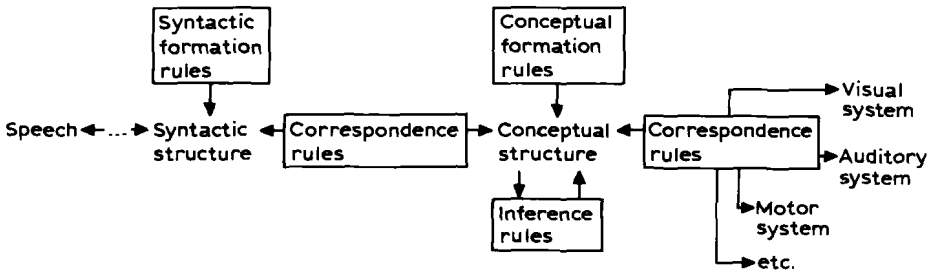


Fig. 1.

systems of principles in Figure 1: (a) the formation rules for conceptual structure, that is, the primitives and principles of combination that collectively generate the infinite class of possible concepts – both lexical concepts (word meanings) and phrasal concepts (including sentential concepts or *propositions*); (b) the rules of inference, pragmatics, and heuristics; (c) the correspondence rules between conceptual structure and the other representations with which it interacts. None of these goals, of course, can be pursued in isolation; they are intimately interdependent. The present study will touch on all of them to varying degrees.

The main issue, however, will be the primitives and principles of combination for a particular conceptual domain, that dealing with parts and boundaries. These are to be universal: they define what there is for language to express, and they do not depend on the vehicle of expression. We will also be concerned with the correspondence rules that determine the translation from conceptual structure into syntactic and morphological structure of English. Such rules are of the form “Such-and-such a configuration in conceptual structure corresponds to such-and-such a syntactic configuration.” They thus must contain two structural descriptions, one for each of the levels being placed in correspondence. Since the syntactic side of the correspondence is in part language-particular, it is to be expected that the correspondence rules will also be language-particular, though undoubtedly constrained by principles of Universal Grammar that pertain to the correspondence rule component.

Within this framework, a lexical item can be seen as a correspondence between well-formed fragments of phonological, syntactic, and conceptual structure. Hence the lexicon is conceived of as part of the correspondence rule component. The leading questions of lexical semantics then come to be framed as: (a) What fragments of conceptual structure can be encoded in lexical items (of, say, English)? (b) When lexical items are combined syntactically, how are they correspondingly combined in conceptual structure, and what principles license these correspondences?

When one claims that conceptual structure can be described in terms of primitives and principles of combination, and in particular that lexical items can