


GRAMMATICAL SEMANTICS

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EVIDENCE FOR STRUCTURE IN MEANING

EDITED BY
TARA MOHANAN & LIONEL WEE

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Introduction

K.P. MOHANAN, TARA MOHANAN, AND LIONEL WEE

1. The Research Program

Human languages repeatedly express certain meanings, such as those of time, space, causation, completion, intentionality, animacy, definiteness, positive and negative affect, and so on, in terms of affixes, prepositions, word order, various grammatical constructions, and other grammatical devices. However, such devices hardly ever express meanings such as those of race, beauty, colour, sin, and mortality. In English, for instance, the distinction between past and present events is often signaled by verbal affixes, and that between one and more than one object by nominal affixes. But verbal affixes do not signal the distinction between fast and slow events, nor do nominal affixes distinguish between red and blue objects.

The papers in this book are predicated on the assumption that it is fruitful to factor out those meanings that interact with the grammatical system of languages, and study their pattern of interaction. We refer to this research program, which seeks to explore grammatically relevant aspects of meaning, as GRAMMATICAL SEMANTICS.

Stated at this level of abstraction, there is nothing novel about the enterprise of pursuing meaning-grammar interaction. It is shared by a variety of current approaches to the study of meaning, for instance, in the exploration of semantic structure in the works of Dowty (1979, 1991), Jackendoff (1972, 1986, 1987, 1990), Pinker (1989), Pustejovsky (1991, 1995), Smith (1991), and so on. Other approaches that exhibit this research interest include the exploration of grammatically relevant discourse meanings in Engdahl (1986), Kiss (1995), Sells (1987), Vallduví (1992, 1995); the constructional approach to grammatically relevant meanings in Fillmore

The research program outlined in this chapter grew out of a unique situation where Alex Alsina, K. P. Mohanan, Tara Mohanan, Lionel Wee, and Geraint Wong were involved in collaboratively teaching undergraduate courses in semantics at NUS. Many of the ideas in the papers in this volume crystallized in the process of animated discussions and heated debates surrounding the courses. We gratefully acknowledge the students in these courses, who participated in the shaping of these ideas.

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(1988), Fillmore et al (1988), Goldberg (1995); the investigation of grammaticization in the works of Bybee (1984), Bybee et al (1994), Hopper and Thompson (1984), Traugott and Heine (1991); and the semantics of Croft (1991), Foley and Van Valin (1984), Talmy (1972, 1985), Wierzbicka (1988), among others.

A well-known example of the commitment to grammatical semantics is also found in the LF representation in Government Binding theory and its descendants, which seeks to express meanings that interact with syntactic structure: quantifier scope, scope of negation, coreference relations, and so on (Higginbotham 1983, 1985, Huang 1982, May 1977, 1985). This approach inquires into how syntactic structures govern semantic interpretation. The inquiry of how meanings govern syntactic structure is found in the large body of work that explores syntactically relevant verb meanings, for instance, Bierwisch (1986), Gruber (1965), Kiparsky (1987, 1997), Levin (1983, 1993), Levin and Rappaport Hovav (1992, 1995a, 1995b), Rappaport Hovav and Levin (1996, 1998), Simpson (1983), Tenny (1986), Wunderlich (1987, 1997), the work within the Lexical Mapping Theory in LFG (Levin 1986; Bresnan and Kanerva 1989, Bresnan and Moshi 1990, Alsina 1993, Bresnan 1996), as well as the various theories of lexical semantics inspired by the Projection Principle and couched in the vocabulary of syntax (Speas 1991, Hale and Keyser 1993).

The papers in this volume fall properly within the tradition of research on meaning in the works of Dowty and Jackendoff, the essence of which is perhaps best crystallized by Pinker as the Grammatically Relevant Subsystem Hypothesis (Pinker 1989). What is unique about these papers is the way the broad research program is further concretized with specific assumptions on the representation of meanings, and the empirical evidence that is brought to bear on these assumptions.

2. Related Research Programs

Before we go on to outline the details of the research program, it would be useful to contrast grammatical semantics with the research program of Montague Semantics and its offshoots. These formal approaches stem from the philosophical traditions of inquiry into meaning (Partee 1995), and view meaning as a relation between linguistic expressions and states of affairs in the world. As part of this relation, Montague Semantics (Montague 1973, Partee 1975, Dowty 1979, Halvorsen and Ladusaw 1979, Ladusaw 1979) is primarily concerned with the truthhood of sentences, which leads to issues of logical relationships between natural language sentences. For instance, given the truth of the propositions expressed by the English sentences

All mammals have central nervous systems.

All horses are mammals.

it is legitimate to conclude that the proposition expressed by the English sentence

Therefore, all horses have central nervous systems.

is also true. In the logician's terminology, the above combination of premises and conclusions forms a valid argument, that is, one in which the conclusion cannot be false if the premises are true. The reasoning involved in this inference is expressible in the formal language of classical predicate calculus. However, classical logic faces a difficulty when it comes to the formal expression of the reasoning in examples such as the following:

Xena killed Hercules.

Therefore Hercules is dead.

Predicate calculus by itself is insufficient to express the logical entailments involved in such sentences. This problem is solved by decomposing the propositional content of the sentences such that their logical relationships become transparent. This involves decomposing the meanings of the expressions *killed* and *dead*.

| <u>Linguistic expression</u> | <u>Meaning</u> |
|------------------------------|----------------|
|------------------------------|----------------|

| | |
|--------------------|---|
| <i>X killed Y.</i> | X acted, X caused an event, Y is not alive, ... |
|--------------------|---|

| | |
|-------------------|-----------------|
| <i>Y is dead.</i> | Y is not alive. |
|-------------------|-----------------|

Given that (i) the meaning of *X killed Y* includes the proposition that Y is not alive, and the meaning of *Y is dead* is that Y is not alive, we can infer *Y is dead* from *X killed Y*. This is the substance of the enterprise of Montague Semantics.

Montague Semantics views the meaning of a sentence as the set of propositions it expresses about the world (or possible worlds). Following this philosophical tradition of looking at meaning in terms of reference, Situation Semantics (Barwise and Perry 1983) incorporates aspects of the context of the speech situation into the study of meaning. In Situation Semantics, evaluating the truth of a sentence requires locating it in the situation in which it is uttered. Thus, to determine if the sentence, *I see that book on the table now*, calls for determining the referents of *I*, *that*, and *now*, which cannot be done without reference to the speech event. The role of the situation in determining the truthhood of sentences is the central thesis of Situation Semantics. We may therefore view this research program as a natural extension of Montague Semantics.

Another extension of this tradition is the semantics component of LFG, proposed in Halvorsen (1983), Dalrymple et al (1993), and Halvorsen and Kaplan (1995) among others. The attempt here is to build a formalism that maps f-structure representations in LFG to representations of meaning.

To see the difference between the logician's approach to semantics and the approach we would like to pursue in grammatical semantics, consider the meanings of the following sentences:

- (1) a. John murdered Bill.
- b. John killed Bill.

The sentences in (1a) and (1b) share the entailments in (2a-c). (1a) carries the additional entailment in (2d), which is absent in (1b):

- (2) a. John did something to Bill.
- b. John caused something to happen.
- c. Bill underwent a change of state.
- d. John did something illegal.

If it is true that John murdered Bill, then it is true that Bill underwent a change of state and that John did something illegal. A logician would naturally be inclined to favor a framework in which (2d) is deducible from (1a), but not from (1b). Hence it is important that (1a) and (1b) have distinct semantic representations.

In contrast, grammatical semantics seeks to express entailments (2a-c), as these meanings enter into the language internal structural patterns of distribution and alternation, but not entailment (2d), since the distinction between legal and illegal actions is not signaled by grammatical devices in any human language. For the purposes of grammatical semantics, therefore, (1a) and (1b) will have identical semantic representations.

Now consider another set of examples:

- (3) a. Jane gave that lovely book to May.
- b. Jane gave May that lovely book.
- c. That lovely book, Jane gave to May.
- d. That lovely book was given to May by Jane.
- e. It was Jane who gave that lovely book to May.

These sentences are truth conditionally equivalent: if one of them is true, the others cannot be false. Hence, a logician would not be interested in the meaning differences between these sentences. The philosopher's approach to meaning would therefore include these meaning differences as part of pragmatics, discourse, or information packaging (Engdahl 1986, Hendriks 1994, Rooth 1985, Vallduvi 1992, 1995). In contrast, these meanings are central to the pursuit of grammatical semantics, as they are signaled by the grammatical devices of dative shift, topicalization, passive, and clefting.

The philosopher's approach to the study of meaning is driven by questions of the truthhood of sentences and the validity of the inferences we can make from them. In contrast, grammatical semantics aims to capture grammatically relevant aspects of the meaning of linguistic expressions. Thus, grammatical semantics is not an alternative to Montague Semantics

or Situation Semantics. Rather, these are mutually enriching perspectives that pursue different aspects of meaning, with a partial overlap.

3. The Implementation of the Program

Let us proceed to concretize the idea of exploring meanings that interact with the grammatical system. A methodological assumption that linguists have made in phonology, morphology, and syntax is that representations of linguistic expressions are constructed out of a universal inventory of representational units. Thus, phonological representations of particular linguistic expressions are built out of inventories of distinctive features and prosodic units. Syntactic representations are built out of inventories of syntactic categories, functions, and features. Likewise, we may assume that the semantic representations of morphemes, words, and sentences are built out of a *universal inventory of semantic units*. Following this path, we adopt the assumptions stated in (4):

- (4) a. Meanings that interact with the grammatical system of a language must be expressed in terms of Grammatical Semantic representations.
- b. Grammatical Semantic representations are constructed out of a universal inventory of atomic semantic units.

These assumptions are not new, or unique to the program of grammatical semantics. Researchers like Pinker (1989) have articulated the same goal of the search for a universal inventory of units of semantic representations that interact with grammatical semantics. Chomsky (1975:233) expresses this idea as follows:

“Even if the semantic content of a lexical item is not fully specified by the grammar, there might still be some analytic connections. Thus, it has been plausibly suggested that such lexical properties as abstract “cause”, “becoming”, “agency”, and “goal” are drawn from a universal set of semantic markers, available for semantic representation in the lexicon.”

A natural way of incorporating this insight into the GB tradition would be to include “cause”, “become”, “agency”, and so on as part of LF, and allow LF representations of morphemes in the lexicon. However, since the vocabulary of LF is that of grammatical categories rather than that of semantic constructs, the idea of universal semantic markers is not found in LF representations.

It must be pointed out that not all versions of the broad program of grammatical semantics are committed to the exploration of meaning in terms of representations built out of a universal inventory. Researchers like Traugott, Talmy, Hopper and Thompson investigate the meanings expressed by the grammatical system, and hence pursue the program of grammatical semantics; they are not, however, committed to the representational program in (4). In this volume, the papers by Alsina, Mohanan and Mohanan, and Wong are committed to (4), but not the one by Wee.

The program outlined above involves a systematic exclusion of the meanings of lexical morphemes which do not interact with the grammatical system. Where are these meanings expressed then? We suggest that they are expressed at the level of lexical conceptual structure. The meaning of a lexical morpheme, then, is expressed as a pairing of grammatical semantic structure and lexical conceptual structure. Take, for instance, the meanings of *hit*, *break*, and *shatter*. All of them involve the meaning of acting upon something, which can be shown to interact with morphology, and hence to be part of grammatical semantics. In addition, *break* and *shatter*, unlike *hit*, involve the meaning of change of state, which is also part of grammatical semantics. While *break* and *shatter* are different in meaning, there is no evidence to believe that this meaning difference interacts with the grammatical system, and hence we express it in the lexical conceptual structures of these words. At the level of the grammatical semantic structure, *break* and *shatter* have identical representations.

Pursuing this line of inquiry, we may state the following methodological requirement on the representation of meaning:

- (5) Contrasts in meaning between the morphemes of a language are expressed jointly by Grammatical Semantic Structure and Lexical Conceptual Structure.

The consequence of (5) is that contrasts in meaning between morphemes can be expressed either at the level of Grammatical Semantic Structure, or at the level of Lexical Conceptual Structure, or at both levels.

Now, a search for a universal inventory of atomic units to express the lexical conceptual structure of lexical morphemes may not be a fruitful enterprise. Take, for instance, meaning distinctions between words like *scarlet* and *crimson*, or *prawn* and *shrimp*. Short of having an inventory that includes all atomic concepts of the human knowledge representation, there is no way of expressing such meaning contrasts in terms of a universal inventory. Furthermore, since not all of these concepts bear on linguistic structuring, details of conceptual structure may not be directly relevant to grammar internal structure.

By and large, the meaning of a word or phrase can be inferred from the meanings of its individual morphemes. Therefore, one might entertain the hypothesis that conceptual structure is specified only for lexical morphemes. It is well known, however, that words and phrases have idiosyncratic meanings, not inferable from the meanings of their parts, or from the meaning associated with the construction itself. Some of these meanings are not relevant for grammatical semantics. Thus, the meaning of the compound *blackmail* and the phrase *keep tabs on* is non-transparent, and is not grammatically relevant. Hence we need to assume that conceptual structure representations are specified for larger units as well. We therefore generalize the hypothesis in (5) as (6):

- (6) Contrasts in meaning between linguistic expressions of a language are expressed jointly by Grammatical Semantic Structure and Conceptual Structure.

Thus, the meanings of morphemes, words, and larger units have a dual representation of Conceptual Structure (CONC STR) and Grammatical Semantic Structure (SEM STR). Within this view, what is known as Lexical Conceptual Structure (LCS) is simply word internal (morpheme level and word level) CONC STR representation.

The factoring apart of CONC STR and SEM STR is an important assumption that distinguishes the papers in this volume from some of the other approaches within the broad program of grammatical semantics. This distinction, we believe, corresponds to that between "semantic substance" and "semantic structure" in K.P. Mohanan (1988), "conceptual structure" and "semantic form" in Bierwisch and Lang (1989) and Wunderlich (1997), "conceptual structure" and "semantic structure" in T. Mohanan (1990) and K.P. Mohanan and T. Mohanan (1996), "semantic content" and "semantic structure" in Grimshaw (1994), and "constant" and "template" in Rappaport Hovav and Levin (1996, 1998). In contrast, the research programs of Jackendoff and Dowty do not explicitly separate grammatical semantic structure from conceptual structure, even though both indicate a strong preoccupation with the meanings expressed by the grammatical system. Similarly, GB and its descendants factor out the grammatical semantic structure above the level of morphemes as LF, but they do not factor out the grammatical semantic structure of lexical morphemes from their conceptual structure.

Now, just as a phonologist interested in language internal phonological patterns must pay attention to the phonetic system as a way of understanding the phonological patterns, a semanticist interested in language internal semantic patterns must pay attention to the conceptual system as a way of understanding semantic patterns. However, we are not interested in the conceptual system *per se*, as it includes meanings which have no relevance to the program of grammatical semantics.

Let us now state the questions that guide the exploration of meaning in grammatical semantics:

- What are the meanings that interact with the grammatical systems of human languages? That is, what are the meanings that human languages express in terms of grammatical devices, and what are the meanings that constrain grammatical devices?
- How do we represent these meanings?
- How are these representations related to the representations of other aspects of linguistic structure?

4. Meanings and the Grammatical System

The questions raised above trigger further questions:

- What do we mean by 'grammatical system'?
- What are the constraints on the interaction between meanings and the grammatical system?

By grammatical system, we refer to the devices we study in morphology and syntax: affixation, syntactic features, constructions such as clefting, topicalization, passive, and middle, and other devices such as word order. In English, for instance, the prefix *un-* in words like *unbroken* and *unkind* contributes the meaning of negation to the word, and the derivational suffix *-en* in words like *soften* and *redde*n contributes the meaning of change of state. In Hindi, the distinction between old and new information can be expressed in terms of word order. Grammatical semantics therefore includes the meanings of agency, goalhood, definiteness, negation, change of state, and new information.

Now, an affix is a bound grammatical morpheme. Having accepted affixes as part of what we take to be the grammatical system, we may extend its scope to free grammatical morphemes as well. If we take this position, grammatical semantics is committed to the investigation of the meanings of grammatical morphemes (such as inflectional and derivational affixes, prepositions, determiners, and conjunctions), grammatical constructions (such as compounding, reduplication, passive, dative shift, clefts, topicalization, and *wh*-questions), and other means of conveying meaning (such as word order, sentence stress and intonation). We state this methodological commitment explicitly as follows:

- (7) Grammatical semantics is committed to the investigation of meanings tied up with the grammatical system of natural languages.
- (8) By grammatical system, we mean:
 - (i) the grammatical morphemes of the language, and
 - (ii) the morphosyntactic rules and representations.

What is left out by (7)-(8) are the meanings of lexical morphemes and idiosyncratic meanings of larger expressions. Now, when we decompose the meanings of lexical morphemes, we find that they typically contain certain abstract elements such as causation, state, change of state, concreteness, and so on, which also appear in grammatical morphemes, and interact with morphosyntactic rules and representations. In addition, however, lexical morphemes also contain meanings which are not otherwise tied with the grammatical system of any language. The meaning of *thief*, for instance, is 'one who engages in the illegal activity of taking other people's possessions without the knowledge of the owner'. The meaning of 'one who does something' appears in the English suffix *-er* in words like *singer* and *actor*, and

hence is part of grammatical semantics. However, the meaning of illegality, as far as we know, is not expressed by grammatical morphemes or morpho-syntactic rules and representations in any human language, and hence lies outside the scope of grammatical semantics.

The statement in (8) commits us to representing the meanings of grammatical morphemes in SEM STR. For instance, given that the English prepositions *at*, *on*, and *near* are grammatical morphemes, we are committed to the representation of the meaning contrasts between them in their SEM STR. Thus, (8i) leads to the consequence that the SEM STR and CONC STR of these morphemes are identical. As a consequence, we are also committed to the study of grammatical polysemy, that is, the recurrent patterns of polysemy in grammatical morphemes. An instantiation of this commitment is the paper by Wee in this volume.

An alternative to (8) that is more limited in the range of data it is committed to may be stated as (9):

- (9) By grammatical system we mean the morphosyntactic rules and representations.

If we adopt (8), we are committed to the representation of all the meanings expressed by case morphemes, prepositions, and so on as part of grammatical semantics. The adoption of (9) does not enforce this requirement: only those meanings which interact with morphosyntactic rules and representations are represented in SEM STR, and the rest in CONC STR. In this volume, the papers by Mohanan and Mohanan, Wong, and Wee adopt the definition in (8); the one by Alsina adopts the definition in (9).

5. The Place of Semantics in the Organization of Grammar

In sum, the meaning of a linguistic expression is represented along two levels or dimensions of representation, namely, semantic structure (SEM STR) representation and conceptual structure representation (CONC STR). The former can interact with other modules of the grammar (phonology, morphology, syntax), but the latter cannot:

- (10)
$$\left. \begin{array}{l} \text{phonology} \\ \text{morphology} \\ \text{syntax} \end{array} \right\} \longleftrightarrow \text{SEM STR} \longleftrightarrow \text{CONC STR}$$

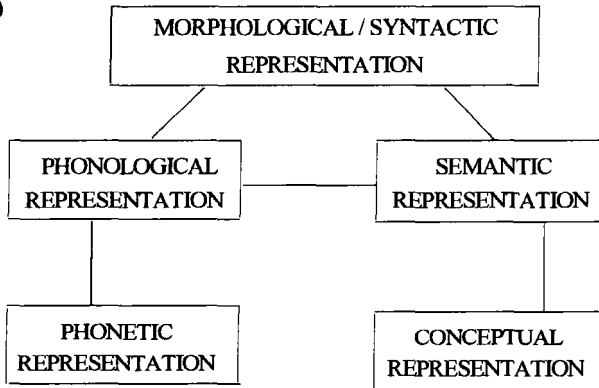
The restriction implicit in (10) can be stated explicitly as (11):

- (11) Lexical conceptual structure is invisible to the principles governing phonological, morphological, and syntactic representations.

The dual representation of meaning in grammatical semantics is analogous to phonological and phonetic representations in phonological theory. Phonological representations contain relatively abstract elements of the sound system that interact with the rest of the grammar, while phonetic

representations are invisible to the other modules of the grammar. We may therefore expand (10) as (12):

(12)



A crucial difference between the model in (12) and those in the GB tradition is that while (12) permits direct interaction between phonological representations and semantic representations, GB and its descendants, including Minimalism, do not permit the corresponding interaction between LF and PF. The papers by Mohanan and Mohanan provide evidence in favor of (12). Another important difference is that the representation of morpheme internal meaning does not have an LF counterpart in GB, where such meanings are represented in LCS rather than in LF.

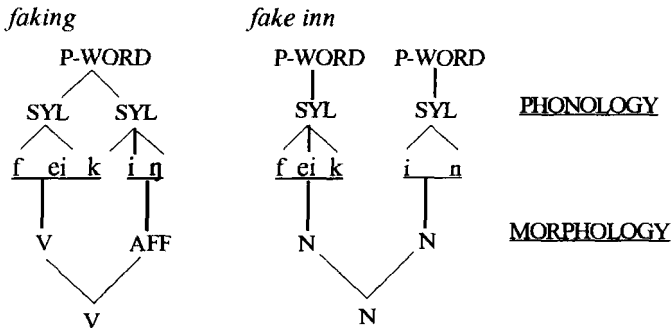
6. Formation Rules and Correspondence Rules

Any mode of inquiry which employs complex representations built out of smaller parts must contain assumptions about atomic units, complex units, and the principles that govern the way atomic units are put together to make complex units. In syntax, for instance, the features $[\pm N]$ and $[\pm V]$ are atomic units which are put together to form complex units like N, V, and P, and still higher units like NP and PP. The way these units are put together to form syntactic representations is governed by the general principles of X-bar theory. In phonology, distinctive features form the atomic units, which are put together to form higher units like place nodes, laryngeal nodes and root nodes, and finally, segments. These combine further to form higher order units like syllables and phonological words. Pursuing the same strategy in semantics, we may raise the following research questions:

- What are the *units* in the representation in SEM STR?
- Of these, which are the *atomic units* in the universal inventory?
- What are the *formation rules* that govern the combination of atomic units into complex units of semantic structure?

A crucial aspect of an adequate theory of grammatical semantics is a theory of the correspondences between structures along different levels of representation: between semantics on the one hand, and word internal syntax and sentential syntax on the other, and between phonological structure and semantic structure, particularly in the study of prosodic phenomena such as stress and intonation. In stating these correspondences, we follow the model in Jackendoff (1987, 1990).

Take, for instance, the pairing of phonological and morphological representation. In the suffixed word *faking*, the medial /k/ belongs to the second syllable: [fei - kiŋ]. In contrast, the medial /k/ belongs to the first syllable in *fake inn* [feik - in] used as a compound. The phonological and morphological structures of these words are given below:



The pairing between phonological and morphological representations is accomplished by general principles like that in (13a) or its equivalent:

- (13) a. Each stem of a compound in English forms a separate p-word.
b. No syllable can stride two p-words.

The correspondence rule in (13a) defines the wellformed connections between information in the phonological representation (p-word) and morphological representation (compound).

To take another example, consider the meaning of productive compounds in English, as illustrated in coinages like *flower paint*, *clock book*, and *glass powder*. *Flower paint* can refer to paint for flowers or paint made out of flowers, but not to a painted flower. A *clock book* can be a book that has a clock in it, or a book about clocks, but not a clock with a book in it. *Glass powder* can be powder for glasses or powder made out of glass, but not glass made out of powder. The general principle that constrains the meaning of such nominal compounds can be stated as (14):

- (14) Given N_1 with the meaning "X", and N_2 with the meaning "Y",
the compound $N_1 N_2$ has the meaning "a type of Y, restricted by its relation to X".