SEMANTICS

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Keywords: cognitive science, componential analysis, compositionality, context, discourse, features, grammar, lexicon, linguistics, logic, meaning, meta-language, model, projection rules, proposition, reference, semantic fields, semantic relations, semiotics, sentence, theta-theory, type-theory, truth

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Summary

Semantics studies meaning following criteria such as: formal vs. cognitive, extensional vs. intensional, and static vs. dynamic. The main linguistic theories of meaning include Lexical Semantics, Generative Semantics, Formal Semantics, and Cognitive Semantics. Lexical Semantics is the oldest linguistic theory of meaning, studying the smallest parts of meaningful linguistic expressions. Formal approaches maintain in the foreground the issue of intentionality: meaning must be conceived as directed towards an extra-linguistic realm. The logics used to model natural language include: Statement Logic, First Order Logic, and Typed Lambda Calculus, each of them having a vocabulary, syntax, and semantics, evaluated with respect to a model. Cognitive approaches assume that semantics ought to be concerned with what goes on in the speaker's mind when

interpreting sentences.

1. Introduction

1.1 Semantics and Related Disciplines

Semantics (A.Gr. σημαντικός = 'that which shows') is the study of meaningful expressions, in natural and artificial symbolic systems (language, painting, literature, mathematics, etc.). Linguistic Semantics studies the meaning of linguistic expressions, such as 'tree' in English, or 'arbre' in French:

What does the word 'tree' mean?
What does the French word 'arbre' mean?

Linguistic expressions may be words, as in the example above, word phrases, sentences, and even entire texts. Linguistic Semantics may be seen as a deductive science, concerned with discovering and studying the abstract structure underlying language. It was established as a new linguistic discipline in the late XIXth century, thanks to contributions by Michel Bréal, Hermann Paul, and Arsène Darmesteter. Related disciplines, having informed and continuing to inform Linguistic Semantics, include: Semiotics, Hermeneutics, Philosophy of Language, Logic, Pragmatics, and Cognitive Science. Throughout the article, 'Semantics' will be used to designate 'Linguistic Semantics'.

Semantics can be studied along several axes: formal vs. cognitive, extensional vs. intensional, and static vs. dynamic. Formal approaches to semantics are primarily aimed at specifying under which conditions linguistic expressions correspond to facts; they are mostly extensional (are concerned with reference to objects) and static (analyze linguistic expressions irrespective of the discourse in which they appear). Cognitive approaches to Semantics try to interpret utterances in terms of their value for speaker and hearer; they are mostly intensional (are concerned with meaning under several aspects, such as time and place), and dynamic (analyze linguistic expressions in discourse). These generalizations, however, do not apply straightforwardly to all semantic theories, as will become evident.

1.2 The Linguistic Sign

Semiotics is a discipline whose object of study, semiotic signs, are meaningful entities of various kinds: stones, clouds, words, books, footsteps. Semantic theories taking into account meaning, and sometimes meaning-givers (the speaker and/or the hearer who assign meaning to linguistic expressions) are concerned with a special category of signs: symbols. Aristotle was among the first to talk about signs and their meaning; he was followed by scholars of the Middle-Ages, and later by Charles Sanders Pierce and Ferdinand de Saussure. The latter analyzed extensively the linguistic sign at the end of the 19th century, as being composed of two inseparable parts: *le signifiant* (= 'the signifier', the form of a linguistic item) and *le signifié* (= 'the significant', the meaning of a linguistic item). Saussure emphasized the idea that linguistic signs (linguistic expressions) are arbitrary symbols, which means that there is no direct relation between

a word, for instance, and its referent. Richard and Ogden (1923) proposed a representation of the linguistic sign, known as 'the semiotic triangle':

An uttered (or written) word (the form) corresponds to a real object (the referent) only indirectly, by linking with its meaning (sense) first. The English word 'water', for instance, translates as 'eau' in French, and 'agua' in Spanish, while 'water', 'eau', and 'agua' all have the same referent – the fluid water. Similarly, an English sentence translates differently in French or Spanish, while having the same meaning; this unique meaning, coming across various sentences, is what logicians call a 'proposition'. Propositions may be further classified as statements, questions, or exclamations. Semantics studies both word senses and propositions (especially statements), but also sequences of propositions and the meaning of texts.

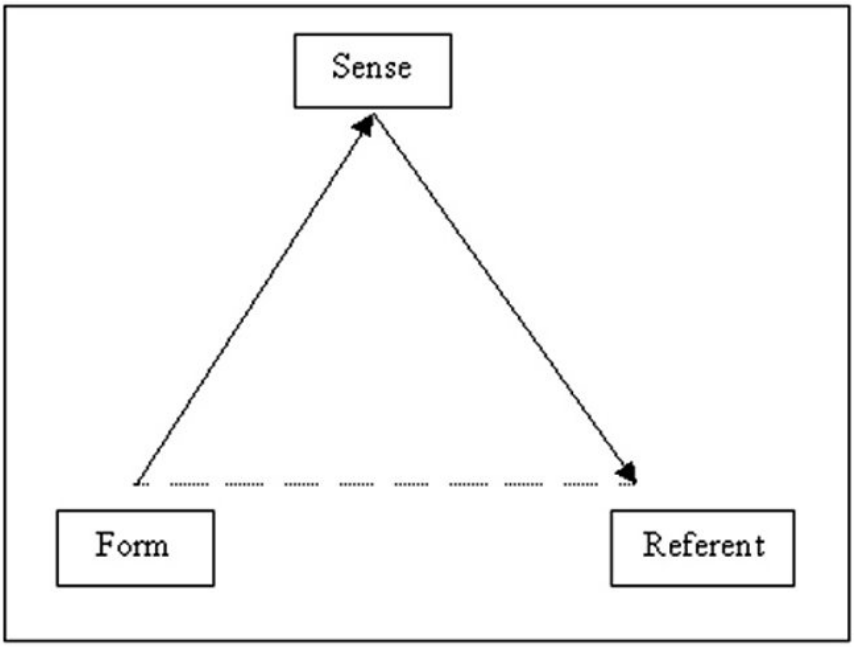

Figure 1: The semiotic triangle

1.3 Semantic Principles

Language displays several characteristics, some of them unique, which must come across in semantic analyses: intentionality, displacement, compositionality, and universality. Intentionality refers to the so-called 'aboutness' of language; when people speak with each other, they speak of something. Formal semantic theories are said to be intentional if they take into account the relationship between linguistic expressions and referents. Other semantic theories (DRT, for instance) are intentional also because they take into account the relationship between linguistic expressions and their discourse antecedents. Displacement is the unique property language has, to refer to objects and phenomena which are not present at the time of utterance (past events, science fiction phenomena, wishes, and possibilities); intensional semantic theories, as originally designed, are able to account for displacement better than lexical semantics or

generative semantics. Compositionality is a requirement on all semantic theories, to assign words well-defined meanings, and to design a set of rules able to build the meaning of larger linguistic expressions from word meaning. Universality is a requirement on semantic theories to offer a description of meaning and meaning relations using a small set of principles, that can be used to handle natural languages.

There are several ways to account for meaning in natural language, and several semantic theories to support them. However, before attempting semantic analysis, one must identify the meaningful units. This becomes sometimes a difficult process, because language is often ambiguous. Ambiguity developed mainly due to biological limitations: human memory may not store an unlimited number of linguistic items, and therefore relies on syntactic rules to obtain new meanings. Natural language employs a finite number of phonemes and words to express a variety of sentences and associated meanings. Consider the following sentence:

Each student read five novels, as assigned by the professor.

The sentence has at least two meanings, which can be paraphrased as follows:

a. Each student read the five novels assigned by the professor.
b. Each student read five novels, the required number required by the professor.

Another way to disambiguate the sentence is to translate it into a metalanguage; this is an approach favored by some theories of lexical Semantics, and especially by formal Semantics.

2. Lexical Semantics

Lexical Semantics is the oldest linguistic theory of meaning, studying the smallest parts of meaningful linguistic expressions. Its roots are found in Lexicography, a related discipline concerned with setting-up dictionaries. The way lexical items are defined in dictionaries is by paraphrasing them in a short text, or by specifying their synonyms, for instance. Some theories of Lexical Semantics de-compose the meaning of lexical items into a small, universal set of elements, called 'features'.

2.1 Semantic Relations and Semantic Fields

Several kinds of semantic relationships can be established between the words of a specific language; basic semantic relationships include: synonymy, antonymy, hyponymy, hyperonymy, and polysemy, as defined below.

Synonymy

Two language expressions are said to be synonyms if they have the same meaning (the same truth conditions), and if they can replace each other *salva veritate* in the larger linguistic expressions that includes them (words in italics are *synonyms*):

Susan bought a pair of *handsome* chairs. $\Leftrightarrow$ Susan bought a pair of *beautiful* chairs.

In the example above, *handsome* is a close synonym of *beautiful*. However, complete synonymy is almost impossible, since languages apply an internal economy principle, according to which not more than a single word should be used to refer to a single entity. The only cases where synonymy is complete are words used in different regions or dialects of the same language, but also known by the speakers throughout the entire linguistic area. It may be the case of words such as *underground* (in the U.K.) and *subway* (in the U.S.). Synonyms may differ stylistically: *baby* vs. *neonate*; *youth* vs. *adolescent*; *fiddle* vs. *violin*; *marriage* vs. *wedlock*. One can also speak of near-synonyms, such as *kill* and *murder*, which differ from each other in terms of selectional restrictions (the former, but not the latter may take animals as direct objects, etc.).

Antonymy

Antonymy is a type of incompatibility which applies to a word pair, usually adjectives (*hot* vs. *cold*, *open* vs. *close*, *long* vs. *short*), but also adverbs (*near* vs. *far*, *fast* vs. *slow*, *up* vs. *down*), and verbs (*ascend* vs. *descend, fall asleep* vs. *awake*). Antonyms denote thus qualities, ordered along directions such as temperature, distance, speed, etc.

Hyponymy and Hyperonymy

A word is said to be the hyponym of another word (its hyperonym), if everything that holds for the hyperonym also holds for the hyponym. A good example is the word *furniture*, which is a hyperonym for an entire host of objects, such as *chair, table*, *sofa*, *bookcase*, etc. Hyponymy is a complex phenomenon, since sometimes it does not hold under negation or other operators (like 'every'):

John likes *strawberries*. |≠ John likes *fruit.*

Homophony and Polysemy

Homophony and Polysemy are two types of lexical ambiguity which must be carefully distinguished from each other, since only the latter is a semantic relation. Homophony applies to words which have the same form, but different meanings, whereas polysemy applies to words which have the same form and different, though well-related meanings. Both homophony and polysemy can be resolved by considering the context in which the words appear. The following are examples of homophony:

We need a *taxi* in half an hour.

Passengers are required to keep their seat while the plane will *taxi* on the runway.

The following examples illustrate polysemy:

The builders are working on a new *bank*.

The central *bank* will take measures to lower the inflation rate.

Word meanings are related to each other when they belong to the same domain (e.g.

kinship terms, color terms, cookware, domestic animals, etc.) - this was the starting assumption of Jost Trier who introduced, in 1931, the notion of 'semantic fields' to refer to these domains. He was arguing that the meaning of words should not be considered in isolation, but in relationship with the meanings of other words in the field, since historical changes in the lexicon do not affect single individuals. A word like *daughter*, for instance, relates to words such as *father*, *mother*, or *granddaughter*, for instance, and not to words such as *brick*, *refrigerator*, or *horse*, belonging to other semantic fields. Here are the main tenets of Trier's theory:

1. Words in a semantic field cover all the phenomena expressed by these words, without gaps or overlap (however, this idea has been challenged the most by subsequent findings).
2. The meaning of a word depends on the meaning of other words in the same semantic field; it was found, for instance, that languages including the word *yellow* in their lexicon, also include the word *red*, but not otherwise.
3. Meaning changes in one word lead to meaning changes in other words of the same semantic field.

2.2 Componential Analysis

In the 1950s, the anthropologists Kroeber, Goodenough, and Lounsbury introduced componential analysis, in order to describe kinship relations in various cultures, using a small set of components (features):

Father = {**GENERATION**: -1; **SEX**: male; **CLOSENESS-OF-RELATIONSHIP**: direct}

It became obvious that, by using a small set of features (such as **GENERATION**, **SEX**, and **CLOSENESS-OF-RELATIONSHIP**, etc.), one could describe the entire lexicon of a language. Componential (structural) analysis was thus adopted by linguists as well, among whom Bernard Pottier (1978) and Eugenio Coseriu (1986).

Semantic features were forming the first semantic metalanguage ever; until then, the only way to specify the meaning of words was via other using words of the same language (paraphrases, synonyms, hyperonyms, words of the same semantic field, etc). Bierwisch (1970, 181) defined features as "the basic dispositions of the cognitive and perceptual structures of the human organism" Here are examples of componentially analyzed terms, involving kinship relations:

man: [+HUMAN], [+MALE], [+ADULT]
woman: [+HUMAN], [-MALE], [+ADULT]
boy: [+HUMAN], [MALE] ,[-ADULT]
girl: [+HUMAN], [-MALE], [-ADULT]
child: [+HUMAN], [-ADULT]

Both componential analysis and semantic fields have proven useful in uncovering relationships and regularities in the lexicon; however, it is not sure whether they are equally suitable for representing the full variety of meaning in a given language, as they

are for representing color terms, kinship relations, and cooking terms.

3. Sentence Semantics

Many semantic theories take into account syntactic structure and syntactic principles, as defined in the Chomskian generative transformational theory. Such semantic theories studying the meaning of sentences and of syntactic phrases are, mainly: Interpretive Semantics, Generative Semantics, and Pustejovsky's Generative Lexicon.

3.1 Semantic Roles

Semantic roles and their mapping unto syntactic constituents are a focus of research since the mid 1960s, when Jeffrey Gruber introduced the notion of 'semantic relations', and Charles Fillmore the notion of 'case roles'. The study of semantic roles is now part of the Theta Theory, and therefore one may also refer to them as 'thematic roles'. According to Theta Theory, a verb or head takes a number of arguments and associated theta-grid (list of theta-roles), as follows:

Leo gave Mary *a ring*.	**Agent**, Recipient, *Theme*
Fred saw an elephant yesterday.	**Experiencer**

Here is a rich, though not exhaustive list of semantic roles and their definitions:

- Agent – human or just animate participant causing an event consciously and intentionally
- Patient – animate or inanimate participant affected by an event
- Experiencer – animate participant experiencing a state or event
- Possessor – usually animate participant that possesses or controls a second participant in a state
- Theme – usually inanimate participant that neither causes an event, nor is it affected by it
- Causer – usually human participant that determines an agent to cause an event
- Recipient – the animate goal of a transferring event
- Source, Goal, Path – roles defining the spatial aspects of a moving of transferring event.
- Instrument – participant used by an agent to achieve an event:
- Beneficiary/Sufferer – animate participants affected by an action in a positive/negative way
- Location, Time – inanimate participants situating an event in space or time

Each argument must be assigned a unique theta-role; the principle is known as the 'theta-criterion', and has been adopted to account, semantically, for syntactic transformations (movement).

Also, it is true that the subject noun phrase is very often the agent, or that a prepositional phrase is an instrument, etc. However, it is not the case that certain semantic roles correlate with certain syntactic categories:

Examples	Semantic (thematic) roles
Mary won *the competition*.	**Agent**, *Theme*
The competition was won **by Mary**.	*Theme*, **Agent**
Leslie took off *the tire* with a wrench.	**Agent**, *Theme*, Instrument
Fred sprayed the wall *with paint*.	Location, *Patient*
Fred sprayed *paint* on the wall.	*Patient*, Location

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Biographical Sketch

Magda Dumitru holds a Masters in Linguistics from The University at Buffalo, SUNY, and is preparing her PhD in Semantics. Her research interests focus on Representations and Reference, Definiteness, Genericity, Presuppositions, Resultatives, Ontology, Tense and Aspect. Published work includes articles (*The role of fundamental frequency in perceiving prominence* - 2004 and *Modeling cognitive complexity in Semantics* - 2005), reviews for LinguistList (*Time, tense, and reference*, Aleksandar Jokic and Quentin Smith (eds.); *Truth and Justification*, Jürgen Habermas; *The proper treatment of events*, Michiel van Lambalgen and Fritz Hamm), and translations of books on linguistics and philosophy (*Plato*, by Léon Robin and *Problèmes de Linguistique Générale* by Émile Benveniste).