

I. Foundations of semantics

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Abstract

The article provides an introduction to the study of meaning in modern semantics. Major tenets, tools, and goals of semantic theorizing are illustrated by discussing typical approaches to three central characteristics of natural language meaning: truth conditions, compositionality, and context and discourse.

1. Introduction

Meaning is a key concept of cognition, communication and culture, and there is a diversity of ways to understand it, reflecting the many uses to which the concept can be put. In the following we take the perspective on meaning developed within linguistics, in particular modern semantics, and we aim to explain the ways in which semanticists approach, describe, test and analyze meaning. The fact that semantics is a component of linguistic theory is what distinguishes it from approaches to meaning in other fields like philosophy, psychology, semiotics or cultural studies. As part of linguistic theory, semantics is characterized by at least the following features:

1. Empirical coverage: It strives to account for meaning in all of the world's languages.
2. Linguistic interfaces: It operates as a subtheory of the broader linguistic system, interacting with other subtheories such as syntax, pragmatics, phonology and morphology.
3. Formal explicitness: It is laid out in an explicit and precise way, allowing the community of semanticists to jointly test it, improve it, and apply it to new theoretical problems and practical goals.
4. Scientific paradigm: It is judged on the same criteria as other scientific theories, viz. coherence, conceptual simplicity, its ability to unify our understanding of diverse phenomena (within or across languages), to raise new questions and open up new horizons for research.

In the following we exemplify these four features on three central issues in modern semantic theory that define our understanding of meaning: truth conditions, compositionality, and context and discourse.

2. Truth

If one is to develop an explicit and precise scientific theory of meaning, the first thing one needs to do is to identify some of the data which the theory will respond to, and there is one type of data which virtually all work in semantics takes as fundamental: truth conditions. At an intuitive level, truth conditions are merely the most obvious way of understanding the meaning of a declarative sentence. If I say *It is raining outside*, I have described the world in a certain way. I may have described it correctly, in which case what I said is true, or I may have described it incorrectly, in which case it is false. Any competent speaker knows to a high degree of precision what the weather must be like for my sentence to count as true (a correct description) or false (an incorrect description). In other words, such a speaker knows the truth conditions of my sentence. This knowledge of truth conditions is extremely robust – far and wide, English speakers can make agreeing judgments about what would make my sentence true or false – and as a result, we can see the truth conditions themselves as a reliable fact about language which can serve as part of the basis for semantic theory.

While truth conditions constitute some of the most basic data for semantics, different approaches to semantics reckon with them in different ways. Some theories treat truth conditions not merely as the data which semantics is to deal with, but more than this as the very model of sentential meaning. This perspective can be summarized with the slogan “meaning is truth conditions”, and within this tradition, we find statements like the following:

- (1) $[[\textit{It is raining outside}]]^{t,s} = \text{TRUE}$ iff it is raining outside of the building where the speaker s is located at time t , and = FALSE otherwise.

The double brackets $[[X]]$ around an expression X names the semantic value of X in the terms of the theory in question. Thus, (1) indicates a theory which takes the semantic value of a sentence to be its truth value, TRUE or FALSE. The meaning of the sentence, according to the truth conditional theory, is then captured by the entire statement (1).

Although (1) represents a truth conditional theory according to which semantic value and meaning (i.e., the truth conditions) are distinct (the semantic value is a crucial component in giving the meaning), other truth conditional theories use techniques which allow meaning to be reified, and thus identified with semantic value, in a certain sense. The most well-known and important such approach is based on possible worlds:

- (2) a. $[[\textit{It is raining outside}]]^{w,t,s} = \text{TRUE}$ iff it is raining outside of the building where the speaker s is located at time t in world w , and = FALSE otherwise.
 b. $[[\textit{It is raining outside}]]^{t,s} =$ the set of worlds $\{w : \text{it is raining outside of the building where the speaker } s \text{ is located at time } t \text{ in world } w\}$

A possible world is a complete way the world could be. (Other theories use constructs similar to possible worlds, such as situations.) The statement in (2a) says virtually the same thing as (1), making explicit only that the meaning of *It is raining outside* depends not merely on the actual weather outside, but whatever the weather may turn out to be. Crucially, by allowing the possible world to be treated as an arbitrary point of evaluation, as in (2a), we are able to identify the truth conditions with the set of all such points, as

in (2b). In (2), we have two different kinds of semantic value: the one in (2a), relativized to world, time, and speaker, corresponds to (1), and is often called the *extension* or *reference*. That in (2b), where the world point of evaluation has been transferred into the semantic value itself, is then called the *intension* or *sense*. The sense of a full sentence, for example given as a set of possible worlds as in (2b), is called a *proposition*. Specific theories differ in the precise nature of the extension and intension: The intension may involve more or different parameters than *w*, *t*, *s*, and several of these may be gathered into a set (along with the world) to form the intension. For example, in tense semantics, we often see intensions treated as sets of pairs of a world and a time.

The majority of work in semantics follows the truth conditional approach to the extent of making statements like those in (1)–(2) the fundamental fabric of the theory. Scholars often produce explicit fragments, i.e. mini-theories which cover a subset of a language, which are actually functions from expressions of a language to semantic values, with the semantic values of sentences being truth conditional in the vein of (1)–(2). But not all semantic research is truth conditional in this explicit way. Descriptive linguistics, functional linguistics, typological linguistics and cognitive linguistics frequently make important claims about meaning (in a particular language, or crosslinguistically). For example, Wolfart (1973: 25), a descriptive study of Plains Cree states: “Semantically, direction serves to specify actor and goal. In sentence (3), for instances, the direct theme sign /ā/ indicates the noun *atim* as goal, whereas the inverse theme sign /ekw/ in (4) marks the same noun as actor.”

(3) nisēkihānān atim
scare(1p-3) dog(3)
‘We scare the dog.’

(4) nisēkihikonān atim
scare(3-1p) dog(3)
‘The dog scares us.’

Despite not being framed as such, this passage is implicitly truth conditional. Wolfart is stating a difference in truth conditions which depends on the grammatical category of direction using the descriptions “actor” and “goal”, and using the translations of cited examples. This example serves to illustrate the centrality of truth conditions to any attempt to think about the nature of linguistic meaning.

As a corollary to the focus on truth conditions, semantic theories typically take relations like entailment, synonymy, and contradiction to provide crucial data as well. Thus, the example sentence *It is raining outside* entails (5), and this fact is known to any competent speaker.

(5) It is raining outside or the kids are playing with the water hose.

Obviously, this entailment can be understood in terms of truth conditions (the truth of the one sentence guarantees the truth of the other), a fact which supports the idea that the analysis of truth conditions should be a central goal of semantics. It is less satisfying to describe synonymy in terms of truth conditions, as identity of truth conditions doesn’t in most cases make for absolute sameness of meaning, in an intuitive sense – consider

Mary hit John and John was hit by Mary; nevertheless, a truth conditional definition of synonymy allows for at least a useful concept of synonymy, since people can indeed judge whether two sentences would accurately describe the same circumstances, whereas it's not obvious that complete intuitive synonymy is even a useful concept, insofar as it may never occur in natural language.

The truth conditional perspective on meaning is intuitive and powerful where it applies, but in and of itself, it is only a foundation. It doesn't, at first glance, say anything about the meanings of subsentential constituents, the meanings or functions of non-declarative sentences, or non-literal meaning, for example. Semantic theory is responsible for the proper analysis of each of these features of language as well, and we will see in many of the articles in this handbook how it has been able to rise to these challenges, and many others.

3. Compositionality

A crucial aspect of natural language meaning is that speakers are able to determine the truth conditions for infinitely many distinct sentences, including sentences they have never encountered before. This shows that the truth conditions for sentences (or whatever turns out to be their psychological correlate) cannot be memorized. Speakers do not associate truth conditions such as the ones given in (1) or (2) holistically with their respective sentences. Rather, there must be some principled way to compute the meaning of a sentence from smaller units. In other words, natural language meaning is essentially combinatorial. The meaning of a complex expression is construed by combining the meaning of its parts in a certain way. Obviously, syntax plays a significant role in this process. The two sentences in (6), for instance, are made up of the same lexical material. It is only the different word order that is responsible for the different sentence meanings of (6a) and (6b).

- (6) a. Caroline kissed a boy.
b. A boy kissed Caroline.

In a similar vein, the ambiguity of a sentence like (7) is rooted in syntax. The two readings paraphrased in (7a) and (7b) correspond to different syntactic structures, with the PP being adjoined either to the verbal phrase or to the direct object NP.

- (7) Caroline observed the boy with the telescope.
a. Caroline observed the boy with the help of the telescope.
b. Caroline observed the boy who had a telescope.

Examples such as (6) and (7) illustrate that the semantic combinatorial machinery takes the syntactic structure into account in a fairly direct way. This basic insight led to the formulation of the so-called "principle of compositionality", attributed to Gottlob Frege (1892), which is usually formulated along the following lines:

- (8) Principle of compositionality:
The meaning of a complex expression is a function of the meanings of its parts and the way they are syntactically combined.

According to (8), the meaning of, e.g., *Caroline sleeps* is a function of the meanings of *Caroline* and *sleeps* and the fact that the former is the syntactic subject of the latter. There are stronger and weaker versions of the principle of compositionality, depending on what counts as “parts” and how exactly the semantic combinatorics is determined by the syntax. For instance, adherents of a stronger version of the principle of compositionality typically assume that the parts that constitute the meaning of a complex expression are only its immediate constituents. According to this view, only the NP [*Caroline*] and the VP [*kissed a boy*] would count as parts when computing the sentence meaning for (6a), but not (directly) [*kissed*] or [*a boy*].

Modern semantics explores many different ways of implementing the notion of compositionality formally. One particularly useful framework is based on the mathematical concept of a function. It takes the meaning of any complex expression as being the result of applying the meaning of one of its immediate parts (= the functor) to the meaning of its other immediate part (= the argument). With functional application as the basic semantic operation that is applied stepwise, mirroring the binary branching of syntax, the function-argument approach allows for a straightforward syntax-semantics mapping.

Although there is wide agreement among semanticists that, given the combinatorial nature of linguistic meaning, some version of the principle of compositionality must certainly hold, it is also clear that, when taking into account the whole complexity and richness of natural language meaning, compositional semantics is faced with a series of challenges. As a response to these challenges, semanticists have come up with several solutions and amendments. These relate basically to (A) the syntax-semantics interface, (B) the relationship between semantics and ontology, and (C) the semantics-pragmatics interface.

A Syntax-Semantics Interface

One way to cope with challenges to compositionality is to adjust the syntax properly. This could be done, e.g., by introducing possibly mute, i.e. phonetically empty, functional heads into the syntactic tree that nevertheless carry semantic content, or by relating the semantic composition to a more abstract level of syntactic derivation – Logical Form – that may differ from surface structure due to invisible movement. That is, the syntactic structure on which the semantic composition is based may be more or less directly linked to surface syntax, such that it fits the demands of compositional semantics. Of course, any such move should be independently motivated.

B Semantics – Ontology

Another direction that might be explored in order to reconcile syntax and semantics is to reconsider the inventory of primitive semantic objects the semantic fabric is assumed to be composed of. A famous case in point is Davidson’s (1967) plea for an ontological category of events. A crucial motivation for this move was that the standard treatment of adverbial modifiers at that time was insufficient insofar as it failed to account properly for the combinatorial behavior and entailments of adverbial expressions. By positing an additional event argument introduced by the verb, Davidson laid the grounds for a theory of adverbial modification that would overcome these shortcomings. Under this assumption Davidson’s famous sentence (9a) takes a semantic representation along the lines of (9b):

- (9) a. Jones buttered the toast in the bathroom with the knife at midnight.
 b. $\exists e$ [butter (jones, the toast, e) & in (e, the bathroom) & instr (e, the knife) & at (e, midnight)]

According to (9b), there was an event e of Jones buttering the toast, and this event was located in the bathroom. In addition, it was performed by using a knife as an instrument, and it took place at midnight. That is, Davidson's move enabled standard adverbial modifiers to be treated as simple first-order predicates that add information about the verb's hidden event argument. The major merits of such a Davidsonian analysis are, first, that it accounts for the typical entailment patterns of adverbial modifiers directly on the basis of their semantic representation. That is, the entailments in (10) follow from (9b) simply by virtue of the logical rule of simplification.

- (10) a. Jones buttered the toast in the bathroom at midnight.
 b. Jones buttered the toast in the bathroom.
 c. Jones buttered the toast at midnight.
 d. Jones buttered the toast.

And, secondly, Davidson paved the way for treating adverbial modifiers on a par with adnominal modifiers. In the meantime, researchers working within the Davidsonian paradigm have discovered more and more fundamental analogies between the verbal and the nominal domain, attesting to the fruitfulness of Davidson's move.

In short, by enriching the semantic universe with a new ontological category of events, Davidson solved the compositionality puzzle of adverbials and arrived at a semantic theory superior to its competitors in both conceptual simplicity and empirical coverage. Of course once again, such a solution does not come without costs. With Quine's (1958) dictum "No entity without identity!" in mind, any ontological category a semantic theory makes use of requires a proper ontological characterization and legitimization. In the case of events, this is still the subject of ongoing debates among semanticists.

C Semantics-Pragmatics Interface

Finally, challenges to compositionality might also be taken as an invitation to reconsider the relationship between semantics and pragmatics by asking how far the composition of sentential meaning goes, and what the principles of pragmatic enrichment and pragmatic licensing are. One notorious case in point is the adequate delineation of linguistic knowledge and world knowledge. To give an example, when considering the sentences in (11), we know that each of them refers to a very different kind of opening event. Obviously, the actions underlying, for instance, the opening of a can differ substantially from those of opening one's eyes or opening a file on a computer.

- (11) a. She opened the can.
 b. She opened her eyes.
 c. She opened the electronic file.

To a certain extent, this knowledge is of linguistic significance, as can be seen when taking into account the combinatorial behavior of certain modifiers:

- (11) a. She opened the can {with a knife, *abruptly, *with a double click}.
 b. She opened her eyes {*with a knife, abruptly, *with a double click}.
 c. She opened the electronic file {*with a knife, *abruptly, with a double click}.

A comprehensive theory of natural language meaning should therefore strive to account for these observations. Nevertheless, incorporating this kind of world knowledge into compositional semantics would be neither feasible nor desirable. A possible solution for this dilemma lies in the notion of *semantic underspecification*. Several proposals have been developed which take the lexical meaning that is fed into semantic composition to be of an abstract, context neutral nature. In the case of *to open* in (11), for instance, this common meaning skeleton would roughly say that some action of an agent *x* on an object *y* causes a change of state such that *y* is accessible afterwards. This would be the verb's constant meaning contribution that can be found in all sentences in (11a–c) and which is also present, e.g., in (11d), where we don't have such clear intuitions about how *x* acted upon *y*, and which is therefore more liberal as to adverbial modification.

- (11) d. She opened the gift {with a knife, abruptly, with a double click}.

That is, underspecification accounts would typically take neither the type of action performed by *x* nor the exact sense of accessibility of *y* as part of the verb's lexical meaning. To account for this part of the meaning, compositional semantics is complemented by a procedure of pragmatic enrichment, by which the compositionally derived meaning skeleton is pragmatically specified according to the contextually available world knowledge.

Semantic underspecification/pragmatic enrichment accounts provide a means for further specifying a compositionally well-formed, underspecified meaning representation. A different stance towards the semantics-pragmatics interface is taken by so-called "coercion" approaches. These deal typically with the interpretation of sentences that are strictly speaking ungrammatical but might be "rescued" in a certain way. An example is given in (12).

- (12) The alarm clock stood intentionally on the table.

The sentence in (12) does not offer a regular integration for the subject-oriented adverbial *intentionally*, i.e., the subject NP *the alarm clock* does not fulfill the adverbial's request for an intentional subject. Hence, a compositional clash results and the sentence is ungrammatical. Nevertheless, although deviant, there seems to be a way to rescue the sentence so that it becomes acceptable and interpretable anyway. In the case of (12), a possible repair strategy would be to introduce an actor, who is responsible for the fact that the alarm clock stands on the table. This move would provide a suitable anchor for the adverbial's semantic contribution. Thus, we understand (12) as saying that someone put the alarm clock on purpose on the table. That is, in case of a combinatorial clash, there seems to be a certain leeway for non-compositional adjustments of the compositionally derived meaning. The defective part is "coerced" into the right format. The exact mechanism of coercion and its grammatical and pragmatic licensing conditions are still poorly understood.

In current semantic research many quite different directions are being explored with respect to the issues A–C. What version of the principle of compositionality

ultimately turns out to be the right one and how compositional semantics interacts with syntax, ontology, and pragmatics is, in the end, an empirical question. Yet, the results and insights obtained so far in this endeavor are already demonstrating the fruitfulness of reckoning with compositionality as a driving force in the constitution of natural language meaning.

4. Context and discourse

Speakers do not use sentences in isolation, but in the context of an utterance situation and as part of a longer discourse. The meaning of a sentence depends on the particular circumstances of its utterances, but also on the discourse context in which it is uttered. At the same time the meaning of linguistic expression changes the context, e.g., the information available to speaker and hearer. The analysis of the interaction of context, discourse and meaning provides new and challenging issues to the research agenda in the semantics-pragmatics interface as described in the last section. In the following we focus on two aspects of these issues to illustrate how the concept of meaning described above can further be developed by theorizing on the interaction between sentence meaning, contextual parameters and discourse structure.

So far we have characterized the meaning of a sentence by its truth conditions and, as a result, we have “considered semantics to be the study of propositions” (Stalnaker 1970: 273). It is justified by the very clear concept that meaning describes “how the world is”. However, linguistic expressions often need additional information to form propositions as sentences contain indexical elements, such as *I, you, she, here, there, now* and the tenses of verbs. Indexical expressions cannot be interpreted according to possible worlds, i.e. how the conditions might be, but they are interpreted according to the actual utterance situation. Intensive research into this kind of context dependency led to the conclusion that the proposition itself depends on contextual parameters like *speaker, addressee, location, time* etc. This dependency is most prominently expressed in Kaplan’s (1977) notion *character* for the meaning of linguistic expressions. The character of an expression is a function from the context of utterance *c*, which includes the values for the speaker, the hearer, the time, the location etc. to the proposition. Other expressions such as *local, different, a certain, enemy, neighbor* may contain “hidden” indexical parameters. They express their content dependent on one or more reference points given by the context. Thus meaning is understood as an abstract concept or function from contexts to propositions, and propositions themselves are described as functions from possible worlds into truth conditions.

The meaning of a linguistic expression is influenced not only by such relatively concrete aspects of the situation of use as speaker and addressee, but also by intentional factors like the assumptions of the speaker and hearer about the world, their beliefs and their goals. This type of context is continuously updated by the information provided by each sentence in a discourse. We see that linguistic expressions are not only “context-consumers”, but also “context-shifters”. This can be illustrated by examples from anaphora, presuppositions and various discourse relations.

- (13) a. A man walks in the park. He smokes.
 b. #He smokes. A man walks in the park.

- (14) a. Rebecca married Thomas. She regrets that she married him.
 b. Rebecca regrets that she married Thomas. ?She married him.
- (15) a. John left. Ann started to cry.
 b. Ann started to cry. John left.

In (13) the anaphoric pronoun needs an antecedent, in other words it is a context-consumer as it takes the information provided in the context for fixing its meaning. The indefinite noun *a man* however is a context-shifter. It changes the context by introducing a discourse referent into the discourse or discourse structure such that the pronoun can be linked to it. In (13a) the indefinite introduces the referent and the anaphoric pronoun can be linked to it, in (13b) the pronoun in the first sentence has no antecedent and if the indefinite noun phrase in the second clause should refer to the same discourse referent it must not be indefinite. In (14) we see the contribution of presupposition to the context. (14b) is odd, since one can regret only something that is known to have happened. To assert this again makes the contribution of the second sentence superfluous and the small discourse incoherent. (15) provides evidence that we always assume some relation between sentences above a simple conjunction of two propositions. The relation could be a sequence of events or a causal relation between the two event, and this induces different meanings on the two small discourses as a whole. These and many more examples have led to the development of dynamic semantics, i.e. the view that meaning is shifting a given information status to a new one.

There are different ways to model the context dependency of linguistic expressions and the choice among them is still an unresolved issue and a topic of considerable contemporary interest. We illustrate this by presenting one example from the literature. Stalnaker proposes to represent the context as a set of possible worlds that are shared by speaker and hearer, his “common ground”. A new sentence is interpreted with respect to the common ground, i.e. to a set of possible worlds. The interpretation of the sentence changes the common ground (given that the hearer does not reject the content of the sentence) and the updated common ground is the new context for the next sentence. Kamp (1988) challenges this view as problematic, as possible worlds do not provide enough linguistically relevant information, as the following example illustrates (due to Barbara Partee, first discussed in Heim 1982: 21).

- (16) Exactly one of the ten balls is not in the bag. It is under the sofa.
- (17) Exactly nine of the ten balls are in the bag. #It is under the sofa.

Both sentences in (16) and (17) have the same truth conditions, i.e. in exactly all possible circumstances in which (16) is true (17) is true, too; still the continuation with the second sentence is only felicitous in (16), but not in (17). (16) explicitly introduces an antecedent in the first sentence, and the pronoun in the second sentence can be anaphorically linked to it. In (17), however, no explicit antecedent is introduced and therefore we cannot resolve the anaphoric reference of the pronoun. Extensive research on these issues has proven very fruitful for the continuous developing of our methodological tools and for our understanding of natural language meaning in context and its function for discourse structure.

5. Meaning in contemporary semantics

Meaning is a notion investigated by a number of disciplines, including linguistics, philosophy, psychology, artificial intelligence, semiotics as well as many others. The definitions of meaning are as manifold and plentiful as the different theories and perspectives that arise from these disciplines. We have argued here that in order to use meaning as a well-defined object of investigation, we must perceive facts to be explained and have tests to expose the underlying phenomena, and we must have a well-defined scientific apparatus which allows us to describe, analyze and model these phenomena. This scientific apparatus is contemporary semantics: It possesses a clearly defined terminology, it provides abstract representations and it allows for formal modeling that adheres to scientific standards and renders predictions that can be verified or falsified. We have illustrated the tenets, tools and goals of contemporary semantics by discussing typical approaches to three central characteristics of meaning: truth conditionality, compositionality, and context and discourse.

Recent times have witnessed an increased interest of semanticists in developing their theories on a broader basis of empirical evidence, taking into account crosslinguistic data, diachronic data, psycho- and neurolinguistic studies as well as corpus linguistic and computational linguistic resources. As a result of these efforts, contemporary semantics is characterized by a continuous explanatory progress, an increased awareness of and proficiency in methodological issues, and the emergence of new opportunities for interdisciplinary cooperation. Along these lines, the articles of this handbook develop an integral, many-faceted and yet well-rounded picture of this joint endeavour in the linguistic study of natural language meaning.

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