Semantics - The Study of Word and Sentence Meaning

Meaning is at once the most obvious and most mysterious feature of human language. More than 3,000 years of speculation by philosophers and linguists have failed to crack the central conundrum of meaning. We will begin by surveying some theories of meaning and their weaknesses. We will then look at some features of meaning that any theory should explain. We end with some examples of a linguistic approach to the study of meaning.

Theories of Word Meaning

Reference

Ask anyone (over 10 years old!) what cup or sponge means and they are apt to respond by pointing to an instance of the object. Referential theories of meaning define the meaning of words or phrases in terms of the things (or actions, qualities, relations, etc.) that the word or phrase denotes. If we ask someone for a cup and they hand us a sponge, we are apt to think they did not understand the word cup. More precisely, we can equate the meaning of a noun with the set of things that are that object.

\[
\text{CUP} = \text{the set of things that are cups} \\
\text{SPONGE} = \text{the set of things that are sponges}
\]

Just to keep things straight, I will put a word in italics when I mention it and will use capital letters to refer to the meaning of a word. So CUP is the meaning of the word cup. A cup is the thing referred to by the English word cup.

Problem 1: Semantic Intension

A referential theory of meaning accounts for our ability to point to the things that words denote, but it has several critical shortcomings. The philosopher Frege pointed out a critical flaw using the phrases morning star and evening star. These phrases have the same referent, but different meanings. Using them in a sentence makes this difference obvious.

- The morning star is the morning star.
- The morning star is the evening star.

The first of these sentences does not tell us anything new, while the second sentence does. A referential theory of meaning does not predict this difference.

Frege distinguished between a word’s semantic extension and its semantic intension. The semantic extension of a word is the set of things the word denotes, while its semantic intension is the concept or meaning of the word. The meaning of a word determines the things it refers to, but
it cannot be equated with its denotations.

**Problem 2: Opaque Contexts**

Sentence meaning displays a similar distinction between extensional and intensional meanings.

George is the best student in linguistics.
I dreamed that George is the best student in linguistics.

The first sentence asserts that George is one and the same shining paragon of linguistics. In other words, it asserts that George and the best student in linguistics have the same semantic extension. If George is the best student in linguistics then the first sentence is true. Assuming the first sentence is true, however, does not guarantee the truth of the second sentence. The truth of the second sentence depends on what I dreamed and not on the truth of George being the best student in linguistics. We can usually equate the semantic extension of a sentence with its truth value, but we see that the truth of the embedded clause has no effect on the truth value of the second sentence. We need something more than the semantic extension of the embedded clause to understand the second sentence.

**Problem 3: Referential Change**

The things that words refer to seem to be changing constantly. A good example of this change is the name of a town, e.g., Lawrence. Lawrence has been continuously expanding since its beginning. It was even burnt to the ground once and rose from its ashes. Individual buildings in the town are constantly changing shape and color. The entity denoted by the name Lawrence is not the same from one day to the next. A strict interpretation of a referential theory of meaning would predict that the meanings of most names is constantly changing.

The philosopher Hilary Putnam pointed to an interesting case of semantic change in scientific theories. One of the major advances in physics occurred when Newton equated momentum with the product of mass and velocity. We say that Newton defined momentum as mass times velocity. This equation held true until Einstein predicted that it would break down for objects at relativistic speeds. Einstein redefined momentum by adding a relativistic adjustment to Newton’s original equation. Intuitively, we feel that Newton and Einstein were talking about the same concept, but a strict referential theory of meaning would claim that they were talking about different things.

**Problem 4: Semantic Expertise**

Putnam alleges that many people cannot pick out the referents for many words. He claims that he cannot tell the difference between beech trees and elms even though he has used the words beech and elm for most of his life. A referential theory of meaning suggests that anyone would know the difference if they knew the meanings of the words beech and elm.
Mental Images

If Frege is correct then meaning is something more than reference. One idea is that meaning can be equated with pictures in our mind. While this idea has a certain appeal, it also suffers from a number of obvious problems.

Problem 1: Internal Reference

If we use internal pictures to pick out word referents we are equating meaning with mental referents rather than external referents. To the extent that our mental images for *morning star* are similar to *evening star* then we just have a mental image version of a reference theory of meaning. To the extent that our mental images are different for these two concepts, we would need to add a new component to the mental images to explain why these phrases having the same referent.

Problem 2: Different Images

A mental image theory cannot assure that speakers of the same language carry the same mental image for any given concept. To the extent that one speaker’s mental image of a grandmother is different from that of another speaker, the theory cannot explain our ability to communicate via language.

A mental image theory predicts the possibility that every speaker has their own private language. The philosopher Wittgenstein pointed out that it would be impossible to prove that someone had a private language to the extent that it was private.

Prototypes

Wittgenstein offered his own version of a mental image theory built around prototypical images. The idea is that we only require a family resemblance between objects to consider them the same. Wittgenstein pointed out that words like *game* refer to many different types of contests which lack any common features across the whole range. A game may involve multiple players or just one. The players may play strictly for enjoyment or profit. We recognize what counts as a game because it has one or more features of a game. Prototypical games have most of what we think of as game features.

Problem 1: Non-prototypical Examplars

Although many experiments suggest that we recognize prototypical members of a category faster than we recognize non-prototypical members, and recall prototypical members faster as well, we still include non-prototypical members in every semantic category. The set of dogs includes Chihuahuas and Great Danes in addition to Labradors and retrievers. All prime numbers are prime numbers even though 3 and 7 may be prototypical primes. Prototype theory does not explain how we draw the boundaries between different concepts rather than just recognizing the most typical members.
**Problem 2: Prototypical Features**

Prototype theories typically rely on a list of features that speakers use to define the prototype for any concept. Prototypical features for a bird, for example, include a beak, wings, flight and feathers. We recognize a prototypical bird to the extent that it has most of the prototypical features. This process invites the question of how we recognize the prototypical features of birds. They would be features that we observe on prototypical birds. We then have a circular argument that relies on prototypical features to define the prototype, but also relies on the prototype to define its prototypical features.

**Problem 3: Combining Features**

A theory of meaning has to predict how the meanings of individual words combine to produce the meaning of a phrase. Prototype theories of meaning lack the ability to predict how to combine the meanings of words. For example, prototypes for the word *pet* would include dogs and cats. Prototypes for the word *fish* would include salmon and trout. But these prototypes do not predict the prototype for the phrase *pet fish*.

**Mental Features**

If mental images do not supply the critical distinctions necessary for meaning another possibility would be that humans rely on a set of innate semantic features to construct meaning. Another philosopher, Jerry Fodor, maintains this is the only explanation of our ability to communicate ideas. The innate semantic features would be akin to a table of atomic elements. Once we define each semantic element, we will be able to explore how they combine to produce meaning. Needless to say, the theory of innate semantic features also runs into difficulties.

**Problem 1: Feature Arbitrariness**

Semantic feature theories have been criticized for their arbitrary nature (Burling AA 1964 ‘God’s truth or hocus pocus?’). Does the meaning of the word *man* contain a semantic feature [+MALE] or the feature [-FEMALE]. Either feature would allow you to distinguish the meanings of the words *man* and *woman*, but there is no reason to prefer [+MALE] over [-FEMALE].

Mathematicians have devised various definitions for the concept NUMBER. Dedikine proposed a ‘cut’ in the number line, while Russell & White proposed a definition using set theory. Both definitions are equally valid, but we have no reason to prefer one over the other.

**Problem 2: Feature Deficiencies**

Lyons (1973) pointed out that semantic features never seem to provide enough power to explain word meaning. For example, the meaning BLUE might be described by the features [+COLOR], [+ ___?]. The most likely candidate to fill in the blank is the feature [+BLUE].
Feature theories have the same defect when combining features. The meaning KILL has been analyzed as CAUSE [BECOME [ DEAD ]], but the word kill means something more than causing something to become dead.

**Truth Conditions and Possible Worlds**

For many sentences we can tell what the world would be like if the sentences were true. We know that an ordinary situation in which a glass is half full is identical to the situation in which the glass is half empty. The sentences ‘The glass is half full’ and ‘The glass is half empty’ have the same truth conditions, and so have the same meaning. A theory that can account for the conditions under which a sentence is true could capture a great deal about the meaning of the sentence.

Once we investigate the truth conditions for sentences, we soon discover that the truth conditions for some sentences are anything but straightforward. Counterfactual sentences (e.g., ‘If time travel was possible, I’d visit my great, great grandmother.’) construct truth conditions that can only be evaluated in some imaginary scenario—not the real world! These possible worlds of counterfactual semantics are different from the parallel universes of science fiction in that the possible world created by a counterfactual sentence is as close to reality as possible given a single change. Making this similarity precise enough to evaluate the truth of a counterfactual sentence creates a challenge.

Another challenge for a theory of meaning based on truth conditions is to provide for sentences which fail to meet the necessary conditions for having a truth value. These conditions are known as presuppositions in the semantics literature. Russell’s famous example of such a sentence was ‘The present king of France is bald.’ Since there is no king of France at present, we can not assign a truth value to the sentence.

There are also a great many sentences whose meaning is largely determined by their conditions of use rather than their truth conditions. Any question, e.g., ‘Why did the chicken cross the road?’ lacks a direct connection to a set of truth conditions. One possibility is to evaluate the truth conditions of questions in terms of the truth conditions of the answers to the question. Another possibility is to evaluate the meaning of questions and commands in terms of their situations of use. We ask ‘Can you pass the salt?’ not out of concern about their recent medical history, but to obtain the salt. Even though the sentences ‘The glass is half full’ and ‘The glass is half empty’ have the same truth conditions, they have very different situations of use.

**Semantic Relations**

A theory of meaning should be able to account for the traditional types of semantic relations.
Synonymy

A theory of meaning should account for the degree of similarity in meaning between words, phrases and sentences, e.g., *saunter* and *amble*; *bachelor* and *unmarried male*; ‘The glass is half empty’ and ‘The glass is half full.’

Hyponymy

A theory of meaning should also predict when the meaning of one word, phrase or sentence is included in the meaning of another word, phrase or sentence. A horse is a type of mammal. Therefore everything that is true about mammals should be true about horses. We can only make this inference from the larger set to the smaller. We can not conclude that everything true about horses should be true about mammals. The word *horse* is a hyponym of the word *mammal.*

Antonymy

A theory of meaning should finally account for the contradictory or ‘opposite’ relations in meaning between words, phrases and sentences. There are several different forms of antonymy. Words with *complementary* or *contradictory* meanings have no overlap between their referents. The pairs *male* and *female,* and *true* and *false* have complementary meanings. Words that are *relational opposites* or *contraries* allow for a neutral case in which things are neither one or another. Examples of contrary pairs include *come* and *go,* and *up* and *down.* Coming is never an instance of going, but it is possible to do neither. *Scalar antonyms* or *gradable pairs* refer to opposite ends of a continuum. *Hot* and *cold* form a gradable pair because hot gradually shades into cold, passing through various intermediate stages such as lukewarm. Words that are members of a gradable pair can usually be modified by *quite.*

Entailment

A theory of meaning should account for an entailment relation between sentences. A sentence entails a second sentence when the truth of the first sentence guarantees the truth of the sentence sentence, and the falsity of the second sentence guarantees the falsity of the first. For example, the sentence ‘Ian drives a Corvette’ entails the sentence ‘Ian drives a car’ because the second sentence will be true if the first sentence is true. However, the sentence ‘Ian drives a car’ does not entail the sentence ‘Ian drives a Corvette.’

Semantic Composition

Finally, a theory of meaning should be able to predict the meaning of a phrase or sentence from the meanings of the words used to compose the phrase or sentence. This requirement is often referred to as the *Principle of Compositionality.* Sentences with structural ambiguity reflect this principle directly. In the sentence ‘Jason saw the woman with the binoculars’, the person holding the binoculars could be either the woman or Jason. Our syntactic theory is able to account for such effects.
In the case of a sentence such as ‘The cat is on the mat’ a semantic theory should be able to derive the spatial relation between the cat and the mat. The prepositional phrase provides the location, and the predict asserts that this is the location of the cat.

The combinations of adjectives and nouns demonstrate that semantic composition is not always straightforward. The simplest form of adjective noun combination is pure intersection. If we assume nouns and adjectives refer to sets of things then the result of pure intersection combination is the intersection of the two sets. If red names the set of red things and car names the set of things that are cars then a red car names the intersection of the two sets–things that are both red and cars.

Pure intersection makes the right predictions in the case of red cars, American women, and amusing stories, but not for small elephants, good beer, and beautiful minds. We cannot compose the meaning for small elephant by looking at the intersection between the set of small things and elephants. Adjectives like small pick out their reference relative to the noun they modify. They provide an example of relative intersection. A small elephant is small relative to other elephants, but not relative to mice, sticks or quarks.

Pure and relative intersection adjectives both pick out a subset of the things named by the noun they modify. Non-intersecting adjectives such as possible and alleged do not even do this much. A possible solution may turn out to be a mis-direction or dead end, not a solution at all. Anti-intersection adjectives are extreme cases of non-intersecting adjectives. A fake Picasso and false teeth do not even entertain the possibility of being actual instances of things named by their nouns. Finally, consider the phrase a hot cup of coffee. The usual interpretation of this phrase implies that the contents of the cup are hot rather than the cup itself. The relative intersection adjective is used to modify the container which we interpret as standing for its contents.

Linguistic Semantics

It is possible to use linguistic methods to investigate semantics rather than philosophical arguments. The primary method linguists can deploy is to describe the semantic distinctions speakers use their words to make akin to the phonemic distinctions that speakers observe. One early paper that illustrates the linguistic approach is Labov’s study of cups (‘The Boundaries of Words and Their Meanings’, in R. Fasold, ed. 1973). Labov explored the semantic boundaries of the words cup, mug, bowl and vase. He provided subjects with line drawings of containers that varied in width and height. He also presented the drawings to his subjects in two contexts. In the first, or ‘neutral’ context, he merely presented the drawings. In the second, or ‘food’ context he presented the drawings and said they contained rice or mashed potatoes.
Color

Color terms provide another example of a semantic domain that has received empirical investigation. The visible spectrum contains an infinite number of different wavelengths that languages typically divide into a more manageable finite number of basic color terms. Linguists distinguish between basic color terms such as *green* and *red* from nonbasic color words such as *burnt umber* and *olive drab*. Basic color words are known by every speaker and can be easily identified. They are not restricted to certain domains (as is the English word *sorel*), they are not included in the range of another term (as is the English word *scarlet*), and their meaning is not predictable (*bluish*). Compare the basic color terms in English, Shona and Bassa:

**English**

<table>
<thead>
<tr>
<th>purple</th>
<th>blue</th>
<th>green</th>
<th>yellow</th>
<th>orange</th>
<th>red</th>
</tr>
</thead>
</table>

**Shona**

<table>
<thead>
<tr>
<th>cipswuka</th>
<th>citema</th>
<th>cicena</th>
<th>cipswuka</th>
</tr>
</thead>
</table>

**Bassa**

<table>
<thead>
<tr>
<th>hui</th>
<th>ziza</th>
</tr>
</thead>
</table>

Berlin & Kay (1969 Basic Color Terms) discovered that although languages have different numbers of basic color terms, they add terms in a definite progression:

- light < red < yellow < blue < brown

They also found that the focal color for each term was very similar across languages.
Space

The meaning of spatial relations has begun to receive linguistic attention as well. Languages such as English employ a **relative system** of spatial reckoning (e.g., front/back, left/right). Penelope Brown (2001 ‘Learning to talk about motion UP and DOWN in Tzeltal’ in Bowerman and Levinson, Language Acquisition and Conceptual Development) describes the **absolutive system** that Tzeltal Mayan uses based on the predominant uphill/downhill lay of the land (along a South (uphill)-North (downhill) axis).

<table>
<thead>
<tr>
<th></th>
<th>Verb</th>
<th>Position</th>
<th>Relation</th>
</tr>
</thead>
<tbody>
<tr>
<td>UP</td>
<td>mo ‘ascend’</td>
<td>kaj ‘be above’</td>
<td>ajk’ol ‘uphill’</td>
</tr>
<tr>
<td>DOWN</td>
<td>ko ‘descend’</td>
<td>pek ‘be low down’</td>
<td>alan ‘downhill’</td>
</tr>
</tbody>
</table>

e.g., ‘The rain is descending’ (i.e., coming from the south)
‘It (a puzzle piece) goes in downhillwards’