

Three Theories of Semantics in Generative Grammars¹

Linguistics I

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After discussing the question of what constitutes "semantics", this essay analyses possible ways of representing semantics in a Transformational Generative Grammar. Generative Semantics, Interpretive Semantics, and the Extended Standard Theory are each described and compared.

1. Introduction

"Semantics" is concerned with defining and representing the relationship between the form of a sentence and its expressive function. In short, studying semantics is equivalent to studying meaning.

This essay first summarises some attempts to define this relationship and then describes three theories of how the relationship may be represented in the context of a Transformational Generative Grammar.

This relationship between a sentence and its meaning is clearly quite complex. Whatever rules govern this relationship will need to be very general since both the number of thoughts which can be expressed and the number of possible sentences are infinite.

Transformational Grammars rely heavily on the intuitions of the native speaker/hearer for their verification. This is even more so in the realm of semantics. Semantics is even less available to empirical study than grammaticality : we must rely on intuitions which are more vague and less likely to gain uniform assent.

¹ Citations in this essay are scarce since the only direct source is Janet Fodor's book (except for a few personal thoughts). It must be assumed that parts of this discussion are outdated since Fodor's book is now 11 years old.

2. The Meaning of "Meaning"

2.1 Meaning as reference

The obvious way to account for semantics is to equate the meaning of an expression with the thing to which the expression refers. For example, when we say "the apple is red" we mean there is a thing (an apple) and that it has a certain property (colour) which, in the instance referred to, is red.

This account is inadequate on at least three counts.

First, the referent of a sentence may vary each time the sentence is uttered. "The apple is red" will refer to one apple one time, but a completely different apple another time. Hence one sentence can have multiple meanings (without ever being ambiguous). But if this is so then reference is not the sole criterion of meaning.

Second, making an identity between expression and referent is too strong : it falls to Leibniz' Law. An apple is edible, but the meaning of the expression "apple" is not (in what sense could a *meaning* be said to be edible?).

Third, two expressions may have different meanings but the same referent. "The Morning Star" and "the Evening Star" both refer to Venus (to use a northern hemisphere example). "The Prime Minister" and "Bob Hawke" connote different things, yet denote the same person.

2.2 Meaning as idea

The Ideational account claims that two expressions have the same meaning if and only if they are associated with the same idea.

The motivation of this is to overcome the *third* objection to the Referential account. Although "the Morning Star" has the same referent as "the Evening Star", the two phrases are associated with different **ideas** and so their meanings differ. It may be argued that the "Leibniz' Law objection" is avoided as well.

However, it is still the case that an expression may differ in meaning over time. Since ideas change, the idea associated with an expression cannot be the sole criterion of meaning.

2.3 Meaning as behavior

If we were to take a Behaviourist stance, we would claim that the meaning of an expression is definable in terms of the stimuli which evoked the expression and/or the response it evoked.

Nonsense words, however, have stimuli and response yet no meaning. Furthermore, different sets of stimulus and response may be associated with the same expression.

2.4 Meaning as use

Wittgenstein would claim that the meaning of a word is the way it is used. Words are tools for communicating meaning. Hence, to understand words, study how and why people use them.

I'm unsure of the adequacy of this. While it suggests a method of *studying* semantics, it doesn't seem to capture the essence of semantics. One could study the use of an axe in the same way as one could study the use of a word. But this will tell us nothing about the meaning of the axe (indeed, an axe **has no** meaning), only about its purpose. Equating meaning with use seems too weak a criterion.

2.5 Meaning as truth

Maybe the meaning of an expression follows from the truth or falsity of the expression's claim. Meaning would then be like the meta-analysis of an axiomatic system : sentences inside the system are meaningless; meaning only occurs when they are interpreted from outside the system.

For instance the claim -

- (1) "snow is white" is true if and only if snow is in fact white.

This seems to capture something like what we want, but there is a difficulty : the logical conditions under which (1) is true are exactly the same as for -

- (2) "snow is white" is true if and only if grass is in fact green.

Though (1) and (2) are **logically** equivalent, it is clear that the meaning of "snow is white" bears no relation to grass being green.

An alternative which bypasses this problem would be for meaning to rely on **analytic** truth. But language can express meanings far beyond the range of pure deduction, and so this alternative is too restrictive.

There is a way, however, to outlaw (2) while still retaining (1) : by postulating that meaning relies on **necessary** truth. There are possible worlds where (2) is untrue, but (arguably) no possible world where (1) is untrue. However, this too is overly restrictive. The meaning of "Bob Hawke is Prime Minister" is clear, yet its truth is empirical, not necessary.

2.6 Meaning as research agenda

The discussion so far leaves us without a clear idea of what meaning is. One might question whether studying semantics can even get started given this lack of definition. But as Katz points out, meaning is the **goal** of Semantics, not a pre-requisite. Hence we can continue studying possible representations of meaning and hope that they may inspire new definitions of meaning.

3. Interpretive Semantics

This theory of semantics was first proposed by Katz and Jerry Fodor in 1963. Of course, many refinements have been made since. The theory rests on two basic points -

1. The relationship between a sentence and its meaning is effected by recursive rules (ie in the same way that the relationship between a sentence and its syntactic structure is defined).
2. These rules involve both the syntactic structure and the lexical content of the sentence.

With this basis, the process of assigning meaning requires three steps : allow the grammar's Base Component to specify the **phrase structure**; look up a **dictionary** to find the meanings of individual lexical items; then successively merge meanings together by applying **projection rules** appropriate to the arrangement of items.

3.1 The dictionary

The dictionary contains every lexical item (ie word) in the vocabulary, though each word may have multiple **readings** (one for each way the word can be understood). Each reading contains a **distinguisher** (which somehow captures the essence of the word's meaning) and a set of **semantic markers** (which indicate the relationships between the word and other words in the vocabulary).

For example, the word "bachelor" may have a dictionary entry with the following readings -

- (human), (male), [who has never married]
- (human), (male), [young knight serving under the
standard of another knight]
- (human), [who has the first or lowest academic degree]
- (animal), (male), [young fur seal when without a
mate during the breeding time]

(Elements in parentheses are semantic markers and elements in square brackets are distinguishers.)

An item's dictionary entry will also contain its phonological features and syntactic features (for instance that "bachelor" is a noun).

Each reading may also contain **selection restrictions** which define the context in which the reading is appropriate. For instance if "bachelor" appears in a sentence, the first reading of "bachelor" would only be appropriate if some other words in the sentence had semantic markers to do with human relationships.

Additionally, the semantic markers may be more complex than in the above example. They may contain **categorised variables** which indicate the valid ways of ordering syntactic items. For instance a semantic marker for the verb "chase" may indicate not only that "chase" involves physical movement, but also that the thing which is physically moving must precede the verb.

3.2 The projection rules

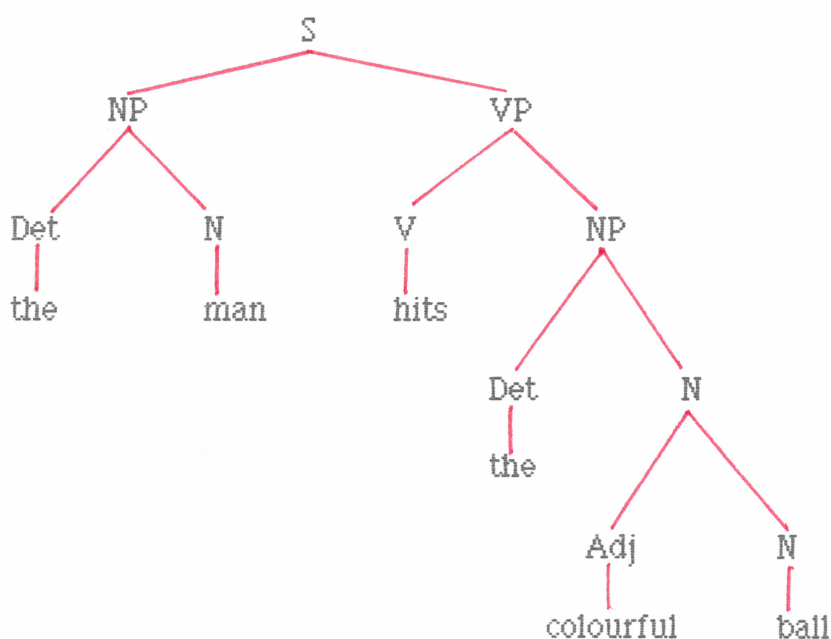
Once the Base Component of the grammar has generated a deep structure, the Semantic Component converts the deep structure to a meaning while the Transformational Component converts the deep structure into a surface structure.

Katz argues that the syntactic transformations never modify the meaning of a structure. Hence any sentences generated from a common deep structure will be synonymous. This claim is not true given the standard account of the Transformational Component. For example, the Question transformation converts a declarative sentence into a question? Katz' rearranges things so that the mood of a sentence (negative, question etc) is represented by a marker in the deep structure. The Question transformation is the only applicable to structures containing the Question marker. Hence a question and its declarative counterpart will be derived from (slightly) different deep structures.

With this understanding, the Semantic Component is reasonably simple. Given that the syntactic transformations do not alter meaning, the only input needed to the Semantic Component is the deep structure. And given the complex structure of dictionary entries, the complexity of the projection rules in the Semantic Component is minimised.

Projection rules are first applied to the deepest constituents of the phrase marker tree and then successively up the tree. The role of a projection rule is to derive a set of readings for a node by forming legal combinations of the readings of that node's children.

For example, suppose we have a phrase marker tree -



The first projection rule will combine the possible readings of "colourful" and "ball". Two possible readings of "colourful ball" may be -

[[abounding in contrast or variety of bright colours],
[having globular shape]] (*along with semantic markers etc*)

[[having distinctive character, vividness or picturesqueness],
[for the purpose of social dancing]]

However, the following combination would be blocked (ie ruled illegal) by the selection restrictions -

[[having distinctive character, vividness or picturesqueness],
[having globular shape]]

The projection rules would then be applied to "the" and "colourful ball" and so on up the tree until a list of readings is attached to each node. We then have a "semantically interpreted underlying phrase marker" (SIUPM) which represents the meaning of the sentence.

Saying two sentences are synonymous is equivalent to saying that the highest S node in their SIUPMs have the same set of readings attached to them. Conversely, an ambiguous sentence is one where the highest S node has more than one reading attached to it.

4. Generative Semantics

The theory of Generative Semantics developed as more and more semantic information was included in deep structures. This approach necessitates more work for the syntactic transformations, but less for the interpretive Semantic Component. Eventually the theory arrived at the point of **equating the meaning of a sentence with its deep structure.**

An early example of how to account for syntactic differences by positing new constituents in deep structures involves the synonymy of the sentences -

(3) Rain may be good for the hair
and (4) It is possible that rain is good for the hair.

Ross claimed that the deep structures for these two sentences should be identical (in contrast to the standard Theory which would assign them different structures). The differences in surface structure are produced by applying different syntactic transformations. The only trick is to incorporate the fact that while "may" and "is possible" are semantically synonymous, they are not syntactically synonymous. That is, we want to be able to generate both (3) and (4) from the same deep structure, without allowing the following to also be generated -

(5)* It may that the rain is good for the hair.

This could be achieved by tagging auxiliary verbs in the deep structure with a new syntactic feature [+Aux] and by making some transformations dependant on this feature. By making the distinction between auxiliary and regular verbs, the deep structure of (3) will contain two clauses (whereas the surface structure has only one).

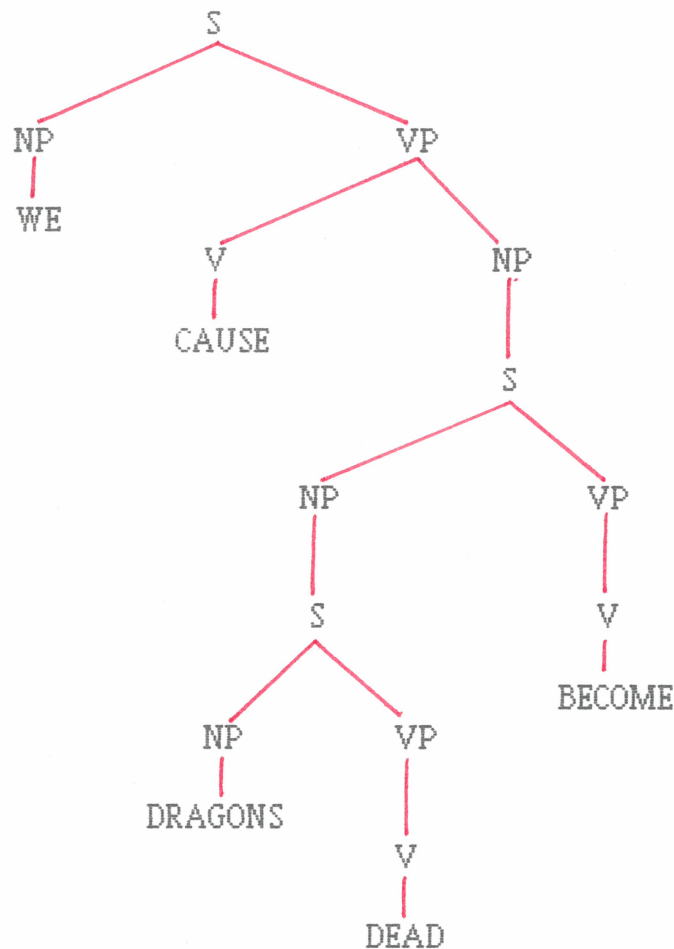
Generative Semanticists have also seen that the standard word categories (verb, adjective etc) are inadequate to express the syntactic role of words. The categories overlap too much. For instance, in the synonymous sentences-

(6) The attempt was a failure
and (7) The attempt failed

the predicate nominal "a failure" plays basically the same role as the verb "failed". To represent such similarities it is better to keep a record of relevant attributes rather than rely on the standard word categories. Like the distinction between regular and auxiliary verbs, this is incorporated into deep structures by tagging words with extra syntactic features. The deep structures for (6) and (7) can then be virtually identical : their syntactic difference is represented by just one feature in the deep structure.

In this theory the lexical items are much simpler than in Interpretive Semantics : much of the detail of a word's distinguishing characteristics can be represented by tagging the word with various syntactic features.

This has been taken a step further by removing language-specific information (such as phonological properties) from the deep structure. Instead of the terminal nodes in a deep structure being lexical items, they are now "universal semantic elements" (indicated by using upper case). For instance -



From this deep structure we could quickly derive -

(8) We caused dragons to become dead

After suitable transformations, BECOME and DEAD can be replaced by "die", giving -

(9) We caused dragons to die

After further transformations, CAUSE BECOME DEAD can be replaced by "kill", giving -

(10) We killed dragons.

The synonymy of sentences (8), (9) and (10) is a natural consequence of applying different transformations to one deep structure.

Since the terminal nodes in the deep structures hold universal semantic elements, there is no longer a need to convert the deep structure into a semantic structure : the two are the same.

5. Extended Standard Theory

Chomsky has rejected Interpretive and Generative Semantics. In summary, he has claimed that synonymous sentences need not have the same deep structure and that some aspects of surface structure need to be included in semantic analysis. If these claims are true then syntactic issues must play an important role in semantic analysis.

To highlight a shortcoming of Generative Semantics, consider the deep structures representing -

(11) John is eager to please
and (12) To please John is easy.

We could postulate that both the following could be transformationally derived from (11) -

(13) John's eagerness to please
and (14) John's being eager to please

But then we would have to allow similar transformations to derive the following from (12) -

(15) John is easy to please
and (16)*John's easiness to please.

In order to outlaw (16), Chomsky proposes that "derived nominals" (like "eagerness" and "easiness") are represented as separate noun phrases in the deep structure. Thus (14) may be derived from (11), but (13) comes from a *different* deep structure; (15) may be derived from (12), and there is no deep structure which gives rise to (16).

If it is necessary to propose different deep structures to explain the *differences* between (13) and (14), how is the *similarity* between them explained? According to Chomsky, both deep structures refer to a common lexical entry, and it is this lexical item which captures the similarity of "eager" and "eagerness".

While this argument raises a difficulty with the Generative approach, it does not affect the Interpretive theory. However, Chomsky also questions the Interpretive claim that deep structures are the only input to the semantic component.

In some sentences, phonological aspects such as stresses and intonation play an important role in conveying the sentence's meaning. For instance, the following sentence could be understood in several ways -

(17) Was he warned to look out for an ex-convict with a red shirt?

If the *last* part of (17) is emphasised, then "red shirt" becomes the **focus** of the question and it is taken for granted (**pre-supposed**) that the person *was* warned to look out for an ex-convict.

These features may be included in a surface structure, but aren't normally represented in the deep structure. But if foci and pre-suppositions affect the meaning, then semantic analysis must take this into account in addition to the deep structure. Chomsky claims that the Semantic Component must take as input both the deep and surface structures.

Two responses to this argument have been -

1. Foci and pre-suppositions are rhetorical properties, not semantic properties. Sentences like (17) are ambiguous however they are presented : the rhetorical properties of the surface structure only help to indicate the preferred interpretation.
2. Foci and pre-suppositions can be associated with the deep structure phrase markers. Hence the various interpretations of (17) would each have (slightly) different deep structures.

6. Conclusion

The three theories of semantics reviewed here have quite divergent conceptions of the role, content and organisation of deep structures, while still remaining in the Generative tradition.

Interpretive Semantics places the burden of meaning in the dictionary. The Semantic Component contains a few simple rules which derive the meaning(s) of a sentence by combining the meanings of individual lexical items.

Generative Semantics adds extra features to the deep structure and replaces lexical items by universal semantic elements. The deep structure of a sentence is then equivalent to the meaning of the sentence.

In the Extended Standard Theory semantic analysis involves complex rules acting on surface structures at least as much as deep structures.

These three options - that meaning is in the lexicon, that meaning IS the deep structure and that meaning is transformationally derived - each capture something about how to recognise synonymous sentences and how to differentiate between non-synonymous sentences. However, none of them provide answers for the issues raised in Section 2. It is still unclear how any of the proposed structures (including the hypothetical "universal semantic elements") count as representations of meaning.

Bibliography

Fodor, J.D.; "Semantics : Theories of meaning in generative grammars"; Pub. Harvester Press, 1977