Lecture 5. Semantics in generative grammar up to linguistic wars

1. Introduction - Background

1.1 “Semantics” can mean many things

Formal semantics began in the late 1960’s and has been shaped over the last forty-plus years by fruitful interdisciplinary collaboration among linguists, philosophers, and logicians. In this course we’ll spend some time looking at its history, in order to understand more about why things are the way they are now, and how linguists and philosophers can contribute to its future development.

I’m a novice as a historian of linguistics or of philosophy; what I know best comes from my experience as a graduate student of Chomsky’s in syntax at M.I.T. (1961-65), then as a junior colleague of Montague’s at UCLA starting in 1965, and then, after his untimely death in 1971, as one of a number of linguists and philosophers working to bring Montague’s semantics and Chomskyan syntax together, an effort that Chomsky himself was deeply skeptical about.

“Semantics” traditionally meant quite different things to linguists and philosophers, not surprisingly, since different fields have different central concerns.

- Philosophers of language: truth and reference, logic, how compositionality works, how sentence meanings are connected with objects of attitudes like belief, the semantic analysis of philosophically important terms, the nature and ontological status of “meanings”.

References

Readings.


Optional:

(1) (Partee 2005) – semi-autobiographical essay, “Reflections of a formal semanticist”
(2) Video and power-point of one of my first “history” lectures: (Partee 2009)
(3) A very nice short paper written for non-specialists: (Abbott 1999)

1. The roots of formal semantics

1.2 The roots of formal semantics

Theoretical linguists since the Chomskyan revolution: human linguistic competence – what’s “in the head” of the speaker of a language, and how it’s acquired – and the architecture of grammar, including the nature of the interface between syntax and semantics.

Different research methodologies in different fields also lead to different research content:

- Phonology and morphology influenced the use of “semantic features”.
- Field linguists and anthropologists have used componential analysis and structural methods to study kinship systems and other systematic patterns: similar to “semantic features”.
- Psychology: the study of semantics often means the experimental study of concept discrimination and concept acquisition.
- With the growth of generative grammar, syntax has strongly influenced linguists’ notions of “logical form” – ‘structure’ of meaning suggests ‘tree diagrams’.
- Logicians are accustomed to building formal systems with axioms and model theoretic interpretation. ‘Structure’ to a logician suggests ‘inferential patterns’.

These sorts of differences in thinking about semantics help to explain why it took time for linguists and philosophers to appreciate each other’s work, and even longer to be able to work together, and why even now, not all linguists or philosophers prefer the formal semantic approach to semantics.

- Some prefer a different approach because they have a different set of questions or interests or preferred research methodologies.
- Some share the goals of formal semantics but are not convinced that formal semantics can be a successful path to those goals.

The rest of the schedule is tentative and I’m open to suggestions. See the schedule on the course website for my initial ideas for the rest of the schedule.
2. Semantics and generative grammar: from before Syntactic Structures to the linguistic ‘wars’.

2.1 Before Syntactic Structures

Linguistics intersects with the humanities, social sciences, and natural sciences.

The Chomskyan perspective: linguistics as a science, but that didn’t start with Chomsky.

In Europe, linguistics came from philology. And it was there in the nineteenth century that German historical philologists known as the Junggrammatiker made their breakthrough discoveries about the sound changes through which they could establish the evolutionary history of the Indo-European languages.

Darwin in his Origin of Species “said that linguistics, as practiced by the leading exponents of comparative Indo-European philology, offers the paradigm of scientific method.” (Harris and Taylor 1997, p. 187)

In France, De Saussure developed a competing approach to structural linguistics with an emphasis on synchronic description, also aiming to put linguistics on a scientific footing.

In the U.S., linguistics was often a part of anthropology, with fieldwork a main activity, and the writing of grammars of indigenous languages one of the main goals.

In both Europe and the US, there was a drive in the 1930’s to view linguistics as a science in the 1930’s; linguistics was part of the Vienna Circle’s “unified science” movement, with the semiotician Charles Morris as one of its leaders.

In the postwar period, it was advantageous to be considered a science, both for funding and for prestige.

Part of the Chomskyan revolution was to view linguistics as a branch of psychology, and one of his early successes was his attack on Skinner’s behaviorism in psychology, making linguistics an important contributor to the rise of modern cognitive science.

Semantics was rather neglected in early and mid-20th century American linguistics. There were probably several different kinds of reasons for this.

- Little semantics in early American anthropological linguistics and fieldwork
- Behaviorists viewed meaning as unobservable, not fit for scientific study, and that had some influence on the Bloomfieldians.
- Quine had strong skepticism about the concept of meaning, and influenced Chomsky.

At the same time there was great progress in semantics in logic and philosophy of language, as we’ll discuss next week, but that was relatively unknown to most linguists.

Then in 1954, Yehoshua Bar-Hillel wrote an article in Language (Bar-Hillel 1954) inviting cooperation between linguists and logicians, arguing that advances in both fields would seem to make the time ripe for an attempt to combine forces to work on syntax and semantics together.

But Chomsky immediately wrote a reply in Language (Chomsky 1955) arguing that the artificial languages invented by logicians were too unlike natural languages for any methods the logicians had developed to have any chance of being useful for developing linguistic theory.

While Bar-Hillel remained in close contact with Chomsky, and the two discussed issues in the formal theory of grammars, he did not make another public attempt to persuade linguists to work together with logicians. But he did continue to try to bring the two fields together: in 1967, he wrote to Montague, after receipt of one of Montague’s pragmatics papers: “It will doubtless be a considerable contribution to the field, though I remain perfectly convinced that without taking into account the recent achievements in theoretical linguistics, your contribution will remain one-sided.”

2.2 Syntactic Structures

In Syntactic Structures (Chomsky 1957), Chomsky is quite ambivalent about semantics. He spends many pages arguing that semantic notions are of no use in constructing a grammar. “Grammar is best formulated as a self-contained study independent of semantics. In particular, the notion of grammaticality cannot be identified with meaningfulness.” (p.106)

But at the same time he holds that one test of a good syntax is that it should provide a good basis for a good semantics (if we had any idea how to study semantics). “In other words, we should like the syntactic framework of the language that is isolated and exhibited by the grammar to be able to support semantic description, and we shall naturally rate more highly a theory of formal structure that leads to grammars that meet this requirement more fully.” (p.102)

And he argued that transformational grammar is a positive step in that direction, since it uncovers differences at the “transformational level” (what would later be reworked as “deep structure”) that are obscured in the output (later “surface structure”). “The general problem of analyzing the process of ‘understanding’ is thus reduced, in a sense, to the problem of explaining how kernel sentences are understood, these being considered the basic ‘content elements’ from which the usual, more complex sentences of real life are formed by transformational development.” (p.92)

He argues, for instance (pp. 88-89), that the phrase (1a) has an ambiguity that cannot be captured at the level of phrase structure, where it has just a single description, but is transformationally derived from two different kernel sentences, (1b) and (1c).

asking whether or not each case of constructional homonymity is a real case of ambiguity and each case of the proper kind of ambiguity is actually a case of constructional homonymity.” (p.386)

But Chomsky also notes that transformations sometimes change meaning. “… we can describe circumstances in which a ‘quantificational’ sentence such as [I2a] may be true, while the corresponding passive [2b] is false, under the normal interpretation of these sentences – e.g., if one person in the room knows only French and German, and another only Spanish and Italian. This indicates that not even the weakest semantic relation (factual equivalence) holds in general between active and passive.” (pp. 100-101)

(2) a. Everyone in this room knows at least two languages.
   b. At least two languages are known by everyone in this room

Note: In later years, those judgments about (2) came to be questioned; some argued that (2b) is ambiguous, some argued that both are. Chomsky himself noted problems with the judgments and their diagnosis when he discussed the same examples in (Chomsky 1965). Difficulties with such data continued for many years, sometimes with arguments in favor of competing theories built in part on competing judgments about what the data were that should be captured. No perfect methodologies for settling such debates have been found; but over time, linguists have become more aware of the need for care in eliciting judgments and have developed more subtle ways to get data than just asking about their own or their consultants’ intuitions.

2.3. Katz and Fodor’s Semantic Component

Jerrold Katz and Jerry Fodor were the first to start working on adding a semantic component to generative grammar (Fodor 1961, Katz 1961, Katz and Fodor 1962, Katz and Fodor 1963). They were concerned with compositionality, which they generally called the Projection Problem: how to get the meaning of a sentence from meanings of its parts. Hedges (1998) identifies their 1963 paper as the first use of the term compositionality. “As a rule, the meaning of a word is a compositional function of the meanings of its parts, and we would like to be able to capture this compositionality” (p. 501 in the version reprinted in (Fodor and Katz 1964)).

“Since the set of sentences is infinite and each sentence is a different concatenation of morphemes, the fact that a speaker can understand any sentence must mean that the way he understands sentences he has never previously encountered is compositional: on the basis of his knowledge of the grammatical properties and the meanings of the morphemes of the language, the rules the speaker knows enable him to determine the meaning of a novel sentence in terms of the manner in which the parts of the sentence are composed to form the whole. Correspondingly, then, we can expect that a system of rules which solves the projection problem must reflect the compositional character of the speaker’s linguistic skill.” (p. 482 in the version reprinted in (Fodor and Katz 1964))

At that time, “Negation” and “Question Formation” were transformations of affirmative declaratives. They were prime examples of meaning-changing transformations.

So meaning depended on the entire transformational history. “P-markers” (phrase structure) were extended to “T-markers”, to which semantic Projection rules applied. Katz and Fodor’s idea of computing the meaning on the basis of the whole T-marker can be seen as aiming in the same direction as Montague’s derivation trees: the steps in the semantic interpretation reflect the steps in the syntactic derivation.

Consider the derivation of the sentence *The airplanes will not fly*. The first stage is the derivation of the (positive) kernel sentence in (3a) via phrase-structure rules. The second stage is to apply the optional negation transformation T-NEG to (3a) to derive the final result (3b).

(3) a. [The airplanes [will [fly]]] (“deep structure” or “kernel sentence”)
   \[\rightarrow T-NEG\]
   b. [The airplanes [will not [fly]]] (“surface structure” or “derived sentence”)

Similarly, questions were derived from declarative sentences by an optional transformation T-Q.

(4) a. [Mary [has [visited Moscow]]] \[\rightarrow T-Q\]
   b. [has [Mary [visited Moscow]]]

The T-marker for (3b) or (4b) includes the P-marker for its deep structure (3a) or (4a) plus a graph showing what transformations have been applied. The structure of the underlying “kernel sentence” in (3a) or (4a) is interpreted by “Type 1 projection rules”. Then a “Type 2 projection rule” corresponding to the negation transformation or the question transformation applies to yield the interpretation of the resulting sentence.

Katz and Fodor thus took compositionality seriously at the very outset of their work on semantics.

But their semantic tools were very primitive. Katz and Fodor’s semantic representations were “bundles of features” – suitable at best for decompositions of one-place predicates.

Quine (1970) had a typically felicitous characterization of how compositionality works from a logician’s perspective: “Logic chases truth up the tree of grammar” (p.35); Katz and Fodor’s position might be characterized: “Semantic projection rules chase semantic features up the tree of grammar.”

Later K&F started adding some structure to handle transitive verbs and their arguments, but primitively, and with no attention at all to things like quantifiers. And what they were trying to capture was restricted to things that could be expressed in terms of ‘readings’ – how many, and same or different. The three main things to be captured were

(i) ambiguity – having more than one reading;
(ii) semantic anomaly – having no reading;
(iii) synonymy – sharing a reading or (stronger version) having all the same readings. 
They also tried to capture a notion of analyticity, but only for copular sentences, e.g. “My aunt is a bachelor”. The examples of what they could capture didn’t seem very exciting, and the accounts were sometimes open to easy counterexamples.

2.4 Philosophers’ reactions to linguists’ “semantic representations”

The most famous reaction and influential critique of Katz and Fodor’s approach (and the approach of Katz and Postal to be discussed in section 2.5) was David Lewis’s:

“But we can know the Markerese translation of an English sentence without knowing the first thing about the meaning of the English sentence: namely, the conditions under which it would be true. Semantics with no treatment of truth conditions is not semantics.” … “Translation into Markerese is at best a substitute for real semantics, relying either on our tacit competence (at some future date) as speakers of Markerese or on our ability to do real semantics at least for the one language Markerese.” (Lewis 1970, p.1)

But linguists did presuppose tacit competence in Markerese; they took it to be universal and innate, and many (e.g. Jackendoff, Jerry Fodor) still do take some kind of semantic representation language to be universal and innate. To philosophers and logicians doing formal semantics, the language of Markerese looked empty, since it was uninterpreted.

To linguists, concern with truth looked puzzling. Linguists were trying to figure out mental representations that would underlie linguistic competence. “Actual truth” was (correctly) considered irrelevant, and truth conditions were not really understood or appreciated.

When the linguistic relevance of truth conditions finally penetrated (later), the very nature of linguistic semantics changed – not just in terms of the tools used, but also in the questions asked and the criteria of adequacy for semantic analyses.

2.5 Katz and Postal: Deep Structure as Input to Semantics

In a theoretically important move, separable from the “Markerese” issue, and related to the problem of compositionality, Katz and Postal (1964) made the innovation of putting such morphemes as Neg and a Question morpheme Q into the Deep Structure, as in (5), arguing that there was independent syntactic motivation for doing so, and then the meaning could be determined on the basis of Deep Structure alone.

\[
\text{a. } \left[ \text{Neg} \left[ \text{Mary has visited Moscow} \right] \right] \Rightarrow_{\text{FL, NEG}} \left[ \text{Mary has not visited Moscow} \right]
\]

This led to a beautiful architecture: Deep Structure is the input to semantics. Transformations map Deep Structure to Surface Structure. Surface Structure is the input to phonology.

(6)

![Diagram](Image)

Semantics $\rightarrow$ Deep Structure

1. Syntactic Transformations

Surface Structure $\rightarrow$ Phonology

This big change in architecture rested on the claim that transformations should be meaning-preserving. It was an interesting and provocative claim, and even without any ‘real semantics’ at the foundation, it led to interesting debates about apparent counterexamples. And the architecture of the theory (syntax in the middle, mediating between semantics on one end and phonology on the other) was elegant and attractive.

2.6 The Garden of Eden period

Chomsky’s thinking about semantics evolved from Syntactic Structures (1957) to Aspects of the Theory of Syntax (Chomsky 1965). There he tentatively accepted Katz and Postal’s hypothesis of a systematic connection between syntax and semantics at the level of Deep Structure.

“Thus the syntactic component consists of a base that generates deep structures and a transformational part that maps them into surface structures. The deep structure of a sentence is submitted to the semantic component for semantic interpretation, and its surface structure enters the phonological component and undergoes phonetic interpretation. The final effect of a grammar, then, is to relate a semantic interpretation to a phonetic interpretation – that is, to state how a sentence is interpreted. This relation is mediated by the syntactic component of the grammar, which constitutes its sole “creative” part.” (Chomsky 1965, pp. 135-136)

During the brief period when Aspects held sway, there was a rosy optimism that the form of syntactic theory was more or less understood and we could start trying to figure out the “substantive universals”.

Quite a few dissertations were written about the grammar of one language or another, all with Deep Structures similar to what Chomsky proposed for English in Aspects, and differing only in what transformations applied to make those languages look different from English on the surface.
This was also the period when the “Universal Base Hypothesis”, the conjecture that the grammars of all natural languages have the same base rules, was developed independently by McCawley, Lakoff, and Bach.

In that period, roughly the mid-60’s, before the linguistic wars broke out in full force, I think generative grammarians generally believed the Katz and Postal hypothesis. The idea that meaning was determined at this “deep” level was undoubtedly part of the appeal of the notion of Deep Structure beyond linguistics (cf. Leonard Bernstein’s Norton Lectures (Bernstein 1976)) and probably contributed to the aura surrounding the notion of “language as a window on the mind.”

So around 1965, there was very widespread optimism about the Katz-Postal hypothesis that semantic interpretation is determined by deep structure, and the syntax-semantics interface was believed to be relatively straightforward (even without having any really good ideas about the nature of semantics.)

2.7 Expulsion from Garden of Eden and the roots of the linguistic wars

What happened to upset that lovely view? Although of course there were multiple factors, I think it’s fair to focus on one salient issue: linguists discovered quantifiers! I think it’s fair to focus on one salient issue: linguists discovered quantifiers! (Bach 1968, Karttunen 1968; Karttunen 1969, Lakoff 1968, McCawley 1971) Transformations that preserved meaning (more or less) when applied to names clearly did not when applied to some quantifiers. Clear examples come from “Equi-NP Deletion”, the transformation that applied to (7a) to give (7b).

(7) a. John wants John to win.
    b. John wants to win.

When the identical NPs are names, the transformation seems to preserve meaning all right. But if applied to sentences with quantifiers, it would have the unwanted result of deriving (8b) from (8a).

(8) a. Everyone wants everyone to win.
    b. Everyone wants to win.

Similar problems arise for the then-assumed Reflexivization transformation: should (9b) be derived from (9a)? And likewise for the “Conjunction-Reduction” transformation, which would transform (10a) into the non-synonymous (10b).

(9) a. Every candidate voted for every candidate.
    b. Every candidate voted for himself.

(10) a. Every number is even or every number is odd.
    b. Every number is even or odd.

(We’ll return to these problems when we discuss early efforts to combine Montague Grammar with Transformational Grammar.)

2.8 The linguistic wars

There were two classes of responses by linguists to the problematic relation between classic transformational derivations and semantics, the Generative Semantics response and the Interpretive Semantics response. Much has been written about the ensuing linguistic wars, so I will be very brief and schematic; see (Harris 1993, Huck and Goldsmith 1995, Newmeyer 1980, Seuren 1998).

The Generative semantics response (Lakoff, Ross, McCawley, Postal, early Dowty, Larry Horn, sometimes Bach): For deep structure to capture semantics, it must be deeper, more abstract, more like “logical form” (first-order-logic). The resulting syntax seemed implausible to some, though it should be noted that some rules like the Generativists’ “Quantifier Raising” were later reproduced “upside down” by the “interpretivists” (cf. “Quantifier Raising” of May (1977)). But semantics was taken seriously by the generative semanticists, much more so than by Chomsky; they were trying to preserve the kind of elegant relation between the deepest level of structure and semantic interpretation that Chomsky had espoused, following Katz and Postal, in Aspects.

The Interpretive semantics response (Chomsky 1971, Jackendoff 1972): Keep syntax beautiful and ‘independently motivated’. Give up the principle that an ambiguous sentence should always have two different deep structures. There is no independent evidence for syntactic ambiguity for a semantically ambiguous sentence like (11).

(11) Every student answered one question correctly.

Different semantic modules may work at different levels; quantifier scope and anaphoric relations may be determined at surface structure. The resulting semantics often seemed architecturally ad hoc, although this approach brought many insights as well, and attention to the ways in which surface structure, lexical semantics, and topic-focus articulation contribute to semantic interpretation.

In 1971 I published a paper (Partee 1971) in which I analyzed some of central issues I saw behind the debate, focusing on the Katz-Postal hypothesis that transformations preserve meaning and identifying the main problems I saw on each side. I didn’t reach any definite conclusions, and at the time I saw that as a shortcoming of the paper, but at least for me the paper helped clarify the issues, and helped me be ready to appreciate the potential usefulness of Montague’s work once I began to understand it. (The paper was written after I had had my initial exposure to Montague’s work in a seminar in Fall 1968 but before I had understood it well enough to say anything about it.)

2.9 Looking ahead

So at this point we will leave linguistics in the midst of the battles of the late 60’s and early 70’s. In the next lecture we will turn to philosophy and logic, where there were important developments from Frege in the 19th century up through the whole first half of the 20th century, and where there were battles concerning the relation between ordinary language and formal languages. And that will set the scene for the appearance of Montague’s papers of the late 1960’s and early 1970’s, followed by work that several of us did to try to bring Montague’s and Chomsky’s work together.
References


