HANDOUT 1: TRUTH AND REFERENCE

Semantics – the study of meaning – is a rich topic area that can be pursued from many different perspectives. Rather than “Introduction to Semantics”, a better name for this course might be “Introduction to Formal Semantics”. Formal semantics seeks to understand linguistic meaning by constructing precise mathematical models of the principles that speakers use to define relations between expressions in natural language and the world that supports meaningful discourse.¹ Most current approaches to formal semantics are truth conditional. That is they treat the meaning of a sentence as the conditions under which that sentence is true. Most also rely on a notion of reference, the idea that some linguistic expressions serve to pick out entities in the real world. We’ll begin exploring both of these features of this family of theories below.

What do words stand for?

A naive view: Words stand for concrete things in the world

"We next went to the school of languages, where three professors sat in consultation upon improving that of their own country. The first project was to shorten discourse, by cutting polysyllables into one, and leaving out verbs and participles, because, in reality, all things imaginable are but nouns. The other project was a scheme for entirely abolishing all words whatsoever and this was urged as a great advantage in point of health, as well as brevity. For it is plain, that every word we speak is, in some degree, a diminution of our lungs by corrosion and, consequently, contributes to the shortening of our lives. An expedient was therefore offered, "that, since words are only names for things, it would be more convenient for all men to carry about them such things as were necessary to express a particular business they are to discourse on"...which has only this inconvenience attending it, that, if a man's business be very great, and of various kinds, he must be obliged, in proportion, to carry a greater bundle of things upon his back, unless he can afford one or two strong servants to attend him."


Noun phrases that can refer

When a noun phrase is used to pick out an individual in the actual world, we say that it refers. Not all noun phrases can refer, but here are some that can:

a. **Proper names**

Mary Ann Evans, Wallace Stevens, Tokyo, Morocco, Mount Everest, Connecticut River, Dey Hall, Franklin Street, Lake Michigan

b. **Definite descriptions**

The highest mountain in Massachusetts, the tallest spy, the greatest philosopher of antiquity, the author of "Middlemarch", the left arm of Wallace Stevens, the Queen of the Netherlands, the first man on the moon, the citizens of San Francisco

c. **Demonstratives**

This cup here, that horse over there, these hills, those books

d. **Pronouns**

I, we, you, he, she, it, himself

e. **Common nouns**?

Can common nouns refer, too? Some have said they can. If so, what individuals could they pick out? Take the mass noun slush. Slush might pick out that big and scattered individual that is the sum or fusion of all slush there is in the actual world. Technically, the sum of all slush consists of nothing but slush, and contains all the slush there is. The slush in my back yard is part of that individual, for example, and so is the slush in yours.
Noun phrases that cannot be used to refer

For many kinds of noun phrases it’s controversial whether they can or cannot refer. But there are some where there is nothing to argue about. Look at (1) and (2):

1. Nothing is silly.
2. No cat is blue.

**Nothing** can’t refer to any individual, nor does **no cat**. What (1) tells us is that the set of silly things is empty, that is, there are no silly things. Assuming that the adjective **silly** picks out the set of silly things, the quantifier phrase **nothing** says something about that set: That it is empty. Likewise, the quantifier phrase **no cat** in (2) informs us that the set of blue things does not contain any cats. What about **no** in (2), then? It seems to say something about the relation between the set of cats and the set of blue things, that their intersection is empty. We might consider the possibility, then, that the NP **nothing** stands for a property of sets of individuals, and the determiner **no** for a relation between two sets of individuals.

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**What words can stand for**

Words can stand for individuals in the actual world, and are then said to refer.

But words can also stand for more abstract entities like sets, properties of sets and relations between sets.

Instead of ‘stand for’, we will mostly use the more technical term ‘**denote**’.

We’ve used some other technical terms (set, intersection, etc.). We’ll make due with our intuitive understandings of these concepts for now, but we soon give them precise definitions.
**What do sentences denote?**

Proposal that we are going to investigate

Sentences denote **propositions**. Propositions are bearers of truth value, that is, they are the kind of things that can be true or false. At a certain level of abstraction, propositions can be construed as sets of possible situations. To understand the meaning of a sentence means to know what kind of possible situations would make it true.

To get a feel for how this works, consider (3) and (4) below:

3. \[[ \text{There is a cat in my bed} ]\] = \{ s ∈ S: a cat is in my bed in s \}

4. \[[ \text{There is a mouse on my plate} ]\] = \{ s ∈ S: a mouse is on my plate in s \}

We’ll unpack the formalism used here after we’ve had a chance to get some set theory under our belts. For now, know that the 3 says the interpretation of the sentence “There is a cat in my bed” – its denotation – is a proposition, which of course is a set of possible situations. Which set of possible situations? The set of all possible situations in which the sentence “There is a cat in my bed” is true. This is the set of all possible situations in which there is a cat in my bed in each of those situations. Similarly, 4 says that the denotation of “There is a mouse on my plate” is the set of all possible situations in which that sentence is true, that is, the set of situations in which there is a mouse on my plate in each of them.
There are many benefits to treating the meanings of sentences as propositions and propositions as sets of possible situations. Chief among them are that this view gives a handle on the meanings of logical words like “and” and “or”, and in doing so, some insight into meaning composition.

[Note: if you are going back over this material on your own, you may want to skip this section and return to it after going over the set theory basics at the end of the handout.]

A simple case of meaning composition

\[
[[ [\text{There is a cat in my bed}] \text{ or } [\text{there is a mouse on my plate}]]] = \\
[[ \text{There is a cat in my bed} ]] \cup [[ \text{there is a mouse on my plate} ]] \\
[[ [\text{There is a cat in my bed}] \text{ and } [\text{there is a mouse on my plate}]]] = \\
[[ \text{There is a cat in my bed} ]] \cap [[ \text{there is a mouse on my plate} ]] \\
\]

A problem?

A former student’s comment:
The rule for or predicts that a sentence like (5) can be true in possible situations in which Sarah visited her uncle in Cleveland and worked on a farm in Montana last summer:

5. Last summer, Sarah visited her uncle in Cleveland or worked on a farm in Montana.

Would (5) be false in such a situation? Or might there be something else that goes wrong when I use (5), knowing perfectly well that Sarah spent three weeks in July with her uncle in Cleveland, and then worked on her cousin’s farm in Montana for the rest of the summer. How we use or is clearly more complicated than we’ve suggested with just the semantics above. There are good reasons to believe that it’s not that (5) is false in the situation I described. It would just be a very misleading thing to say. I shouldn’t have used or, if I was in a position to use the stronger and instead. It is quite possible, then, that our complications here are really a matter of pragmatics rather than semantics.
Matters of notation

Our formulas above make use of the following notation:

For any expression \( \alpha \), \([\alpha]\) is the denotation of \( \alpha \).

\( S \) is the assumed universe of possible situations.

For all sets \( A \) and \( B \) we have:
\[ A \cup B = \{ x : x \in A \text{ or } x \in B \} \text{ (set union)} \]
\[ A \cap B = \{ x : x \in A \text{ and } x \in B \} \text{ (set intersection)} \]

We must distinguish between expressions and what they stand for:

**Boston & Boston**  
**Boston** is a name, that is, an expression. Boston is a city. **Boston** has two vowels and four consonants. Boston has the Big Dig and bad drivers. Rather than bold face, you can also use Italics, underlining, or quotation marks. “Boston” is a name, then, and so is **Boston**, **Boston**, and **Boston**, but, crucially, not Boston. In your homework, you must mark the distinction between expressions and what they stand for consistently, but I don’t care about how you mark it. I will use bold face or quotation marks in my handouts, and underlining on the blackboard.

\([\text{Boston}]\)  
The denotation of **Boston**, that is, the city of Boston. We have, then: \([\text{Boston}] = \text{Boston}\)

\([\text{Boston is polluted }]\)  
The denotation of the sentence **Boston is polluted**. Since we are assuming that sentences denote sets of possible situations, we have:
\([\text{Boston is polluted }\] = \{ s \in S : \text{ Boston is polluted in } s \}\)
What we have gained

Taking sentence denotations to be sets of possible situations, we were able to give a first account of the compositionality of meaning. That is, we were able to make progress towards giving a first answer to the question: How can the meanings of complex sentences be computed from the meanings of their parts? If the denotations of sentences are sets of possible situations, the denotations of and and or can be identified with set theoretic operations:

\[
[[\text{and}]] = \cap \\
[[\text{or}]] = \cup
\]

A bigger problem?

An outrage by Anonymous:

You told us that formal semantics was a part of linguistics and that linguistics was a cognitive science. Linguistic theories, so it seems, are theories about how knowledge of language is represented and acquired. When we did phonology, we talked about the mental representation of sounds. When we did syntax, we talked about the mental representation of syntactic structures and the computation of those structures. Why aren’t we talking about mental representations in semantics? Why are we talking about reference at all? The reference of your name, say, is you, a person, not a mental representation. Things got outright absurd, when you mentioned that according to some, even a word like slush refers to an individual in the world, the sum of all slush. What has all of that to do with cognitive psychology?

Perhaps Putnam’s Puzzle might lead us to an answer.

Putnam’s Puzzle

“Consider some examples from Hilary Putnam (1975, 1988), which I slightly modify for my purposes here. Imagine a normal eight-year-old girl who uses the word water to refer to the stuff that she drinks, washes with, and swims in. She has clearly learned the meaning of the English word and uses it to refer to the stuff that happens to be made up of H2O (though she doesn’t know this). Now imagine that there is another world, Twin Earth, that is exactly the same as ours, except that instead of being composed of H2O the stuff that they call water is made up of different chemicals: XYZ. The eight-year-old will have an identical twin on Twin Earth, who uses water to refer to the
substance that she drinks, washes with, and swims in. But her word does not refer to H2O; it refers to XYZ (though she doesn’t know this). If reference determines meaning, then the two girls use the words with different meanings, and as Putnam (1975, p. 227) famously put it: “cut the pie in any way you like, ‘meanings’ just ain’t in the head!” Chomsky (1995) draws the opposite conclusion. He argues that the above examples show that trying to build up a theory of semantics from notions such as reference is a waste of time. The only scientific theory will be an “internalist” one, the same sort that holds for aspects of language such as phonology and syntax.”


The following further lays out Chomsky’s position.

Noam Chomsky: The Architecture of Language


“QUESTION: What are the latest trends in semantics? Is it likely to develop into a science some day with its own units?

CHOMSKY: That is a really interesting question. That goes into one of those side issues about representations that I put aside in the talk. We have to ask what semantics is. If semantics is what is meant by the tradition (say Peirce or Frege or somebody like that), that is, if semantics is the relation between sound and thing, it may not exist.

If semantics is the study of relations like agency, thematization, tense, event-structures and the place of arguments in them and so on and so forth, that is a rich subject but that is syntax; that is, it is all part of mental representations. It goes on independently of whether there is a world at all just like the study of phonological representations. This is mislabelled ‘semantics’. It would be like taking phonology and deluding yourself into thinking that phonology is the study of the relation between phonetic units and the motion of molecules; it isn’t, that is a separate study.

1 There is a footnote at this point, footnote 32, which in these notes is appended to the main quote. The footnote is on p. 79 of The Delhi Lectures.
Phonology is the study of mental representations that one assumes are close to those parts of the processing system that ultimately moves molecules around. Most of what’s called ‘semantics’ is, in my opinion, syntax. It is the part of syntax that is presumably close to the interface system that involves the use of language. So there is that part of syntax and there certainly is pragmatics in some general sense of what you do with words and so on. But whether there is semantics in the more technical sense is an open question. I don’t think there’s any reason to believe that there is.

I think it goes back to the old and probably false assumption that there is a relation between words and things independently of circumstances of use.”

Footnote 32:
“Elsewhere Chomsky makes a succinct observation in the same vein: “People use words to refer to things in complex ways, reflecting interests and circumstances, but words do not refer; there is no word-thing relation of the Fregean variety, nor a more complex word-thing-person relation of the kind proposed by Charles Sanders Peirce in equally classic work in the foundation of semantics. These approaches may be quite appropriate for the study of invented symbolic systems (for which they were initially designed at least in the case of Frege). But they do not seem to provide appropriate concepts for the study of natural language. (Chomsky 1996, 22-3)

Footnote 33 is inserted here, which explains what pragmatics is.