Linguistics:

What do we know when we know a language?
Chomskian revolution:

Language is not just “verbal behavior” –

- Stimulus-response and associations cannot explain complexity of language use and acquisition

1. Colorless green ideas sleep furiously
2. The teacher holded the baby rabbits, and we patted them
Chomsky’s thesis (1957)

• Natural languages can be described as **formal languages**
• like programming languages or logic, they can be captured by means of **generative grammars**.

• Linguists look for patterns they can describe by systems of rules
  – Competence vs. performance
What are grammatical rules?

- **Descriptive:** What native speakers know that enables them to speak
- **Prescriptive:** Rules of proper usage distinguishing "good" grammar from "bad"
What are grammatical rules?

- **Descriptive:**
  What native speakers know that enables them to speak

  - **Grammatical:**
    He doesn't know. (e.g., SAE)
    He don't know. (e.g., AAVE)

  - **Ungrammatical** (any dialect/style):
    *He not know.
    *He known't.
    *Not know he.

- **Prescriptive:**
  Rules of proper usage telling speakers how they should speak
Richard Montague’s thesis (1960s and early 1970s)

• Natural languages can be described as *interpreted formal languages*

• Like logic, they have a semantics
  – which assigns to expressions in the language *meanings* that have to do with statements being true or false
Richard Montague’s thesis (1960s and early 1970s)

- Natural languages can be described as *interpreted formal languages*

- Like logic, they have a semantics
  - the semantics explains logical inferences between sentences
Implications

- Does Google understand language?
  - Well, consider this
Implications

• Does Google understand language?
  • Well, consider this
• But actually:

  Sophia speaks English, Russian, and she no longer speaks Italian.
  • Does Sophia speak German?
Implications

- Does Google understand language?
  - Well, consider this
- But actually:

  *Sophia speaks English, Russian, and she no longer speaks Italian.*
  - Does Sophia speak German?
  - Does Sophia speak an Indo-European language?
Implications

- Does understand language?
  - Well, consider this
- But actually:
  
  *Sophia speaks English, Russian, and she no longer speaks Italian.*
  
  - Does Sophia speak German?
  - Does Sophia speak an Indo-European language?
  - Did Sophia ever speak Italian?
Implications

• We’ll start with declarative statements:
  • at the end of semester, we will briefly talk about other types of sentences

**Definition.**
A sentence A **implies** sentence B in context \( \mathcal{c} \) iff by expressing A in context \( \mathcal{c} \), the speaker signals that B is true.
Implications

• In ordinary contexts, (1) implies (2), (3), and (4).

(1) Sophia speaks English, Russian, and she no longer speaks Italian.
(2) Sophia does not speak German.
(3) Sophia speaks an Indo-European language.
(4) Sophia spoke Italian at some time in the past.
• For instance, suppose you read on a Brandeis website:

(1) *Sophia speaks English, Russian, and she no longer speaks Italian.*

• The author of the website signals that (2) is true:

(2) *Sophia does not speak German*

So, (1) implies (2) in such a context.
• Now suppose you need trilinguals of English, Russian, and Italian for your linguistic experiment. Alex tells you:

(1) *Sophia speaks English, Russian, and she no longer speaks Italian.*

• Does (1) imply (2) in this context?

(2) *Sophia does not speak German*
Implicature

• Now suppose you need trilinguals of English, Russian, and Italian for your linguistic experiment. Alex tells you:

(1) Sophia speaks English, Russian, and she no longer speaks Italian.

• Does (1) imply (2) in this context?

(2) Sophia does not speak German
    - NO
Implicature

(1) *Sophia speaks English, Russian, and she no longer speaks Italian.*

(2) *Sophia does not speak German*

- The relationship between (1) and (2) is an example of **implicature**: a type of context-dependent pragmatic implication that depends on the goals of the speaker and hearer.
Entailment

(1) *Sophia speaks English, Russian, and Italian.*

(3) *Sophia speaks an Indo-European language*

- The relationship between (1) and (2) is an example of **entailment**: a type of (mostly) context-independent semantic implication.
  - we will later mention “Strawson entailment” which is, in fact, context-dependent
  - Caveat: to figure our meanings, we often will need contextual info
What does this mean?

- I love her.
What does this mean?

• Everyone is here.
(1) Sophia speaks English, Russian, and she no longer speaks Italian.

(3) Sophia speaks an Indo-European language.

**Definition:** A entails B iff

- Whenever A is true, B is true
- Every situation describable by A is also describable by B
- The information B conveys is contained in the information A contains
- ‘A, but not B’ is a contradiction
Presuppositions

• Suppose Lotus says

(1) *Sophia speaks English, Russian, and she no longer speaks Italian.*

• The speaker signals that (4) is true:

(4) *Sophia spoke Italian at some time in the past*

• But moreover, the speaker signals that she is taking (4) for granted; she is treating (4) as uncontroversial and (likely) known to everyone participating in the conversation.
Presuppositions

(1) Sophia speaks English, Russian, and she no longer speaks Italian.

(4) Sophia spoke Italian at some time in the past

• (4) is a presupposition of (1), both:
  • in the pragmatic sense that the speaker of (1) signals that she is taking (4) for granted, treating (4) as uncontroversial and known.
  • and in the semantic sense that the phrase no longer triggers such presuppositions, which are often also entailments:

(5) Sophia no longer speaks Italian, and in fact she never did.
Presuppositions

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CONTRADICTION!
Entailment and truth-conditions

To determine whether A entails B

• we don’t need to know whether either sentence is in fact true
• we only need to be able discriminate between situations in which a sentence is true and situations in which it is false: its TRUTH CONDITIONS.

**Definition:** A entails B iff

○ Whenever A is true, B is true
○ Every situation describable by A is also describable by B
○ The information B conveys is contained in the information A contains
○ ‘A, but not B’ is a contradiction
Entailment and logic

• Logic: the study of reasoning, entailments, truth
  Aristotle studied syllogisms:
  arguments in which one or more premises, taken together, entail a conclusion
  • We’ll start on those next week!

All men are mortal. (Premise 1)
Socrates is a man. (Premise 2)
Therefore, Socrates is mortal.
Entailment and logic

**Definition:**
- An argument in which premises entail the conclusion is **valid**
- An argument in which premises are true is **sound**

An argument may be:
- sound, but not valid
- valid but not sound
- both (ideally)
- neither (unfortunately)
Entailment and logic

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\[\text{All men are mortal. (Premise 1)}\]
\[\text{Socrates is a man. (Premise 2)}\]
\[\text{Therefore, cats purr.}\]
Entailment and logic

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An argument may be:
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Iron is less dense than water. (Premise)
Therefore, iron floats on water.
Entailment and logic

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All men are mortal. (Premise 1) Socrates is a man. (Premise 2) Therefore, Socrates is mortal.
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Iron is less dense than water (Premise)
Therefore, Socrates is mortal.
Gottlob Frege & Bertrand Russell

- Since language is ambiguous, put together logic as a foundation for math:
  “... to break the domination of words over the human mind”

Richarch Montague, David Lewis (and several others):

- we can get around the problem of ambiguity

““I reject the contention that an important theoretical difference exists between formal and natural language.”” (Montague 1970, EFL)
Sources of multiple meanings

- Prostitutes appeal to Pope
- Kids make nutritious snacks
- Juvenile court to try shooting defendant
- Iraqi head seeks arms
- Man eating piranha mistakenly sold as pet fish
- Stolen painting found by tree
- Enraged cow injures farmer with ax
- Squad helps dog bite victim
Compositionality

The meaning of a complex expression is determined by

- the meaning of its parts &
- the way those parts are combined.

This principle (without the label) appears in Frege’s (1890s-1920s) work.
Compositionality

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This principle (without the label) appears in Frege’s (1890s-1920s) work.

It was the centerpiece of Montague’s approach (1960s) and its exposition and extension by Barbara Partee (1970s). The label was added at some point in the 1970s.
Compositionality

The meaning of a complex expression is determined by

- the meaning of its parts &
- the way those parts are combined.

(1) Sophia saw John. (2) John saw Mary. (3) Mary saw John.
Compositionality

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Compositionality

The meaning of a complex expression is determined by

• the meaning of its parts &
• the way those parts are combined.

(1) Sophia saw John. (2) John saw Mary. (3) Mary saw John.


(6) Sophia only saw JOHN. (7) Sophia only SAW John.
Why Compositionality?

“Why is a raven like a writing desk?”

“It is astonishing what language accomplishes. With a few syllables it expresses a countless number of thoughts, and even for a thought grasped for the first time by a human it provides a clothing in which it can be recognized by another to whom it is entirely new.

This would not be possible if we could not distinguish parts in the thought that correspond to parts of the sentence, so that the construction of the sentence can be taken to mirror the construction of the thought. (…)

If we thus view thoughts as composed of simple parts and take these, in turn, to correspond to simple sentence-parts, we can understand how a few sentence-parts can go to make up a great multitude of sentences to which, in turn, there correspond a great multitude of thoughts.”

(Frege, “Logische Untersuchungen. Dritter Teil: Gedankengefuege”.)
To do list

• We need to find out:
  – The meaning (or thought) corresponding to a whole sentence.
  – The meaning (or partial thought) of each sentence-part: word or larger constituent.
  – The semantic contribution of the way the parts are combined.
To do list (cont’d)

• At the same time, some of these may be context-dependent
  – Meanings of words/morphemes may point to aspects of context
  – How we combine meanings may depend on what we’re combining them with

• Some aspects of context may need to be worked out, too
Semantics in theory of grammar:

- **MORPHOLOGY** combines smallest meaningful units of language (*morphemes*) into words

- **SYNTAX** provides the rules for composing words into grammatical sentences

- Words and sentences in language encode information
  - Boris loves Cindy
Division of labour

- **LEXICAL SEMANTICS** studies morpheme meanings
  - Mostly *content*, as opposed to *function* morphemes
- **COMPOSITIONAL SEMANTICS** puts together word meanings
  & combines word meanings into sentence meanings.
  - A priori, semantic composition and syntactic composition need not follow the same path
  - Relationship (and conflicts) between syntax and semantics is an important research question
Sentence vs. Utterance

Sometimes, the whole meaning is more than the sum of its parts!

• Some part of meaning is not “semantic”
  • the extra comes from context
    (1) John has one good leg.
  • the extra comes from convention
    (2) Sybill kicked the bucket.

OR

• Revise word meanings & semantic rules to allow semantics to do more of the work
UTTERANCE MEANING
What the utterer meant by saying the sentence in a given occasion

(LITERAL) MEANING OF THE EXPRESSION
What the utterer literally said

↓
SEMANTICS

MEANING DEPENDENT ON GOALS IN CONTEXT
What the utterer conversationally implicated

↓
PRAGMATICS
UTTERANCE MEANING
What the utterer meant by saying the sentence in a given occasion

(LITERAL) MEANING OF THE EXPRESSION
What the utterer literally said

SEMANTICS

ENTAILMENTS

MEANING DEPENDENT ON GOALS IN CONTEXT
What the utterer conversationally implicated

PRAGMATICS

IMPLICATURES
**UTTERANCE MEANING**
What the utterer meant by saying the sentence in a given occasion

<table>
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**ENTAILMENTS**

**PRESUPPOSITIONS**

**IMPLICATURES**
It was all very well to say 'Drink me,' but the wise little Alice was not going to do THAT in a hurry. 'No, I'll look first,' she said, 'and see whether it's marked "poison" or not' for she had read several nice little histories about children who had got burnt, and eaten up by wild beasts and other unpleasant things, all because they WOULD not remember the simple rules their friends had taught them:

MORE ON IMPLICATURES:

a. A red-hot poker will burn you if you hold it too long.

b. If you cut your finger VERY deeply with a knife, it usually bleeds.

c. If you drink much from a bottle marked ‘poison,’ it is almost certain to disagree with you, sooner or later.
And some more implicatures

a. Irina has four portable chairs.

**Utterance i.** Alice: What camping equipment do you have?
Boris: I have two tents, Rosa has a burner and (a).

**Utterance ii.** Alice: Oh, no! Four more guests are coming, and I’m out of chairs!
Boris: Why don’t you ask Irina? She has lots of camping equipment.
I’m sure (a).

b. Other professors wear a suit when they teach.

i. What do you think of Sophia’s style? – Well, you know, (b).

ii. Does Sophia wear a suit to class? – Not sure about her, but (b).
Entailment vs Implicature

(1) a. This is black, and this is a pen  
   b. This is a black pen

(2) a. This is big, and this is a whale  
   b. This is a big whale
Where implicatures come from

• Speech = goal-directed rational behaviour
• Every act of speech has a purpose

People expect each other to make their contribution to the conversation such as it is required, at the stage at which it occurs, by the accepted purpose or direction of the talk exchange in which they are engaged

The Cooperative Principle

• We expect that speakers will be truthful, relevant, and as informative (but not more informative) as required, ...