

Semantic Theory

Introduction

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Every student works

$[[\forall x(\text{student}(x) \rightarrow \text{work}(x))]]^{M,g} = 1$ iff $V_M(\text{student}) \subseteq V_M(\text{work})$

Let $M=M1$:

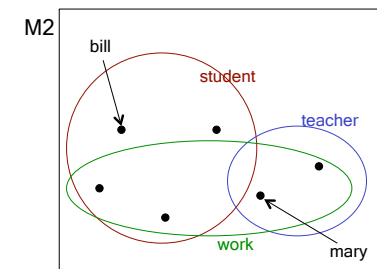
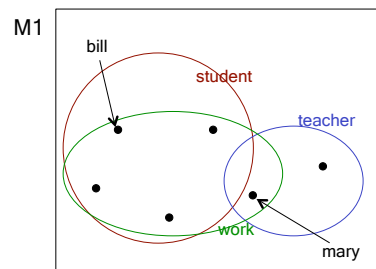
$V_{M1}(\text{student}) \subseteq V_{M1}(\text{work})$,

so $[[\forall x(\text{student}(x) \rightarrow \text{work}(x))]]^{M1,g} = 1$

Let $M=M2$:

$V_{M2}(\text{student}) \not\subseteq V_{M2}(\text{work})$,

so $[[\forall x(\text{student}(x) \rightarrow \text{work}(x))]]^{M2,g} = 0$



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Semantics and Predicate Logic



- Logic as a framework for natural-language processing

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- Logic as a research instrument for meaning analysis and representation

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Semantics and Predicate Logic

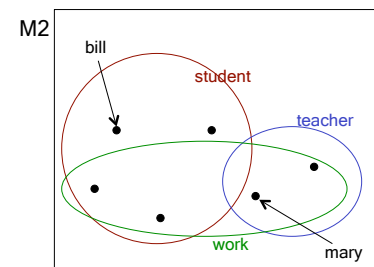


Every student works

The students work

It is not the case that every student works

It is not the case that the students work



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Semantics and Predicate Logic



Central Concepts in Semantic Theory:

- Reference and Denotation
- Truth and Truth Conditions
- Inference and Entailment

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Semantics and Predicate Logic



Every student works

The students work

It is not the case that every student works

It is not the case that the students work

The students don't work

Every student doesn't work

The students met

Every student met

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Semantics and Empirical Evidence



- Text Corpora:
 - Distributional Data
 - Manual Annotation
- Psycholinguistic and neuropsychological evidence
 - Association tests
 - EEG data
 - Brain imaging
- Introspection and intersubjective agreement

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Course Overview



1. Sentence semantics
2. Discourse semantics
3. Lexical semantics

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Sentence Semantics



- (Basic) Semantics construction (“Montague Grammar”)
- Generalized Quantifiers
- Treatment of Quantifier Scope (“Cooper Storage”)
- Underspecification

Higher-Order Expressions



John is a married piano player

John is married

John is a poor piano player

John is poor

Phenomena in Sentence Semantics



Quantifier scope

Every student speaks two foreign languages.

Two foreign languages are spoken by every student.

A representative of every company saw most samples.

Monotonicity and Generalized Quantifiers



Bill got a degree in LST.

Bill got a degree.

Bill didn't get a degree in LST.

Bill didn't get a degree.

Every master student got a degree in LST

Every master student got a degree.

Every student got a degree in LST.

Most master students got a degree in LST.

Exactly three master students got a degree in LST.

Plurals and Collective Predicates



The students worked.
All students worked.
Every student worked.

The students met.
All students met.
Every student met.

Two students presented a paper
Five students carried three pianos upstairs.
500,000 visitors ordered 1,200,000 cups of coffee.

Phenomena in Sentence Semantics



Many computational linguists in three Saarbruecken institutes work on a variety of interesting problems in language technology.

Discourse Semantics



- Anaphora and Ellipsis
- Discourse Representation Theory (DRT)
- Presuppositions
- Tense and temporal structure

Anaphora and Ellipsis



Anaphora

Bill likes his dog. He pampers him.
Bill likes his dog, although he sometimes bites him.
Bill likes his dog, although she sometimes bites him.

Ellipsis

John loves Mary, and so does Bill.
John loves his wife, and so does Bill.

Presupposition



Bill regrets that his cat has died.
Bill doesn't regret that his cat has died.
Bill's cat has died.
Bill's cat hasn't died.
Bill owns a cat.
Bill doesn't own a cat.

Information Structure



Who ate the cake? Bill ate the cake.
What did Bill eat? Bill ate the cake.
Only the CEOs of the startup companies were invited to the meeting.

Lexical Semantics



- Event semantics
- Thematic roles and frames
- Plurals, mass nouns, collective predicates

Phenomena in Lexical Semantics



Synonymy
Twenty-eight states had reductions in the number of automobile accidents.
Twenty-eight states had reductions in the number of car accidents.

Phenomena in Lexical Semantics



Hyponymy

A car accident happened yesterday on the Stadtautobahn.

A motor-vehicle accident happened yesterday on the Stadtautobahn.

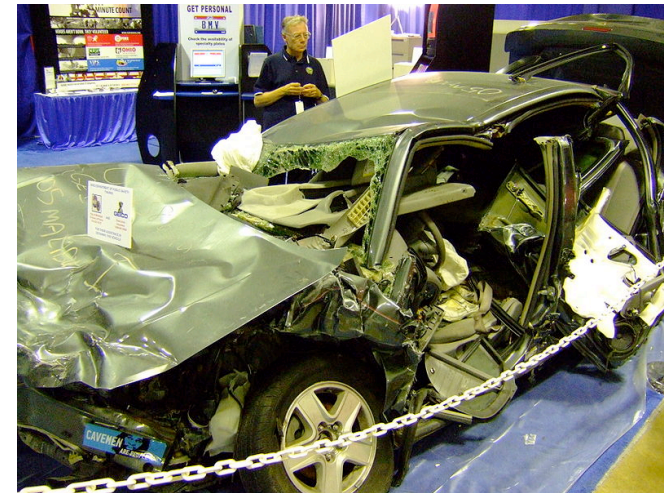
No car accident happened yesterday on the Stadtautobahn.

No motor-vehicle accident happened yesterday on the Stadtautobahn.

Twenty-eight states had reductions in the number of motor-vehicle accidents.

Twenty-eight states had reductions in the number of car accidents.

Meronymy, Antonymy, ...



Phenomena in Lexical Semantics



Verb Alternation/ thematic roles

John sold the book for 19.95€.

The book sells for 19.95€.

Bees are swarming in the garden.

The garden is swarming with bees.

The window broke

A rock broke the window

John broke the window with a rock

Phenomena in Lexical Semantics



Inverse predicates/ thematic roles

John is taller than Bill

Bill is shorter than John

Mary likes John

John pleases Mary

Mary gave Peter the book

Peter received the book from Mary

John sold the car to Bill for 3,000€

Bill bought the car from John for 3,000€



Polysemy

fast car / fast road / fast driver

feed rabbit / eat rabbit / wear rabbit

Bill read every book in the library.

Bill labeled every book in the library.

Non-literal interpretation: metonymy

The ham sandwich wants to pay.

I am parked out back and have a flat tire.

Non-literal interpretation: metaphor