Semantic Theory

Lecture 1 – Introduction

Stefan Thater
FR 4.7 Allgemeine Linguistik (Computerlinguistik)
Universität des Saarlandes

Summer 2013

Course Overview

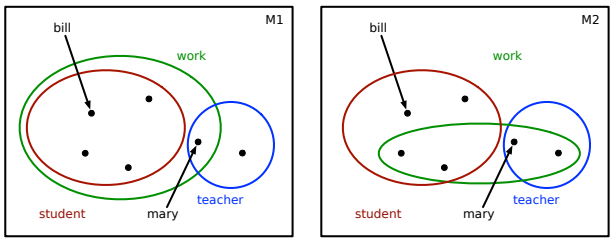
- Lexical semantics
- Sentence semantics (compositional semantics)
- Discourse semantics

Sentence Meaning

- **Truth-conditional semantics:** to know the meaning of a (declarative) sentence is to know what the world would have to be like for the sentence to be true.
- **Sentence meaning = truth-conditions**
  - $[\![\textit{Every student works}]\!]^{M,g} = 1$ iff. student $\subseteq$ work
- **Indirect interpretation** by translating sentences into logical formulas
  - *Every student works* $\mapsto \forall x(\text{student}'(x) \rightarrow \text{work}'(x))$
  - $[\![\forall x(\text{stud}'(x) \rightarrow \text{work}'(x))]\!]^{M,g} = 1$ iff $V_M(\text{stud}') \subseteq V_M(\text{work}')$

Every student works

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



- $[\![\forall x(\text{stud}'(x) \rightarrow \text{work}'(x))]\!]^{M1,g} = 1$
- $[\![\forall x(\text{stud}'(x) \rightarrow \text{work}'(x))]\!]^{M2,g} = 0$

Central Concepts

- Reference and denotation
- Truth and truth conditions
- Entailment and inference

Sentence Semantics

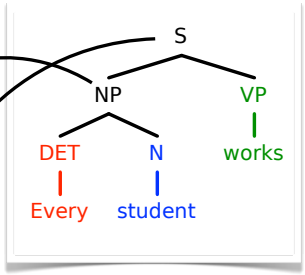
- Basic semantics construction
- Quantifier scope
- Generalized quantifiers

Compositionality

- **The principle of compositionality:** *The meaning of a complex expression is a function of the meanings of its parts and of the syntactic rules by which they are combined* (cited from Partee &al., 1993)
- $[\![\textit{Every student works}]\!]^{M,g} =$
  $f_1([\![\text{Every student}]\!]^{M,g}, [\![\text{works}]\!]^{M,g})$
- $[\![\textit{Every student}]\!]^{M,g} =$
  $f_2([\![\text{Every}]\!]^{M,g}, [\![\text{student}]\!]^{M,g})$

Compositional Semantics Construction

- **Semantic lexicon:**
  - every ↦ λPλQ∀x(P(x) → Q(x))
  - student ↦ student'
  - works ↦ work'
- **Semantics construction:**
  - λPλQ∀x(P(x) → Q(x))(student')
    ⇒β λQ∀x(student'(x) → Q(x))
  - λQ∀x(student'(x) → Q(x))(work')
    ⇒β ∀x(student'(x) → work'(x))



Interpretation of Adjectives

(1) *a. John is a blond piano player*
b. John is blond

(2) *a. John is a poor piano player*
b. John is poor

Quantifier Scope

(1) *An American flag was hanging in front of every building*

(2) *Every student speaks two foreign languages*

(3) *A representative of every company saw most samples*

(4) *Many computational linguists in three Saarbrücken institutes work on a variety of interesting problems in language technology*

Monotonicity and Generalized Quantifiers

(1) a. *Bill got a degree in LST*
b. *Bill got a degree*

(2) a. *Bill didn't get a degree in LST*
b. *Bill didn't get a degree*

Monotonicity and Generalized Quantifiers

(1) *Every master student got a degree in LST*

(2) *Every master student got a degree*

(3) *Every student got a degree in LST*

(4) *Most master students got a degree in LST*

(5) *Exactly three master students got a degree in LST*

Discourse Semantics

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

Anaphora and Ellipsis

- **Anaphora**
  (1) *Bill likes his dog. He pampers him.*
  (2) *Bill likes his dog, although he sometimes bites him.*
  (3) *Bill likes his dog, although she sometimes bites him.*
- **Ellipsis**
  (4) *John loves Mary, and so does Bill.*
  (5) *John loves his wife, and so does Bill.*

Donkey Sentences

(1) *If Pedro owns a donkey, then Maria is happy.*

(2) *If Pedro owns a donkey, he beats it.*

Presuppositions

(1) *a. Bill regrets that his cat has died*
b. Bill doesn't regret that his cat has died

(2) *a. Bill's cat has died*
b. Bill's cat hasn't died

(3) *a. Bill owns a cat*
b. Bill doesn't own a cat

Information structure

(1) *a. Who ate the cake?*
b. Bill ate the cake.

(2) *a. What did Bill eat?*
b. Bill ate the cake.

(3) *Only the CEOs of the startup companies were invited to the meeting.*

Lexical Semantics

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

Synonymy

(1) *Twenty-eight states had reductions in the number of* ***automobile*** *accidents*

(2) *Twenty-eight states had reductions in the number of* ***car*** *accidents*

Hyponymy

(1) *a. A* ***car*** *accident happened yesterday on the highway*
b. A ***motor-vehicle*** *accident happened yesterday [...]*

(2) *a. No* ***car*** *accident happened yesterday on the highway*
b. No ***motor-vehicle*** *accident happened yesterday [...]*

Meronymy, Antonymy, ...

Verb Alternations

(1) *a. John sold the book for 19.95€*
b. The book sells for 19.95€

(2) *a. Bees are swarming in the garden*
b. The garden is swarming with bees

(3) *a. The window broke*
b. A rock broke the window
c. John broke the window with a rock

Inverse Predicates

(1) *a. John is taller than Bill*
b. Bill is smaller than John

(2) *a. Mary likes John*
b. John pleases Mary

(3) *a. Mary gave Peter the book*
b. Peter received the book from Mary

(4) *a. John sold the car to Bill for 3.000€*
b. Bill bought the car from John for 3.000€

Plurals and Collective Predicates

(1) *a. The students worked*
b. All students worked
c. Every student worked

(2) *a. The students met*
b. All students met
c. Every student met

Plurals and Collective Predicates

(1) *Two students presented a paper*

(2) *Five students carried three pianos upstairs*

(3) *500.000 visitors ordered 1.200.000 cups of coffee*

States vs. Events

(1) *a. John is running*
b. John is building a house
*c. * John is knowing the answer*

(2) *a. John ran carefully*
b. John carefully built a house
*c. * John carefully knew the answer*

(3) *a. John runs (has the habit of running)*
b. John recites poems (has the habit of reciting poems)
c. John knows the answer

Further Phenomena

- Polysemy
  - *fast car / fast road / fast driver*
  - *feed rabbit / eat rabbit / wear rabbit*
- Non-literal interpretation: metonymy
  - *The ham-sandwich wants to pay*
  - *I am parked out back and have a flat tire*
- Non-literal interpretation: metaphor

Exercises & Exam

- **Final exam** takes place on Thursday, July 18th
  - (date to be confirmed)
- **You have to register**
  - until Monday, July 8th (TBC)
- **Exercise sheets:**
  - You have to get at least 50% of the points to be admitted to the final exam
  - Exercise sheets can be done in groups (up to 2 students)
- For more details, see
  - www.coli.uni-saarland.de/courses/semantics-13

Literature

- Gamut, Logic, Language, and Meaning, Vol. 2, University of Chicago Press, 1991
- Kamp and Reyle, From Discourse to Logic, Kluwer, 1993