Hot and Odd Topics in Semantics

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Organisatorisches

- How to get credit points?
  - Read background papers and *ask questions*
  - Attend regularly and participate in discussions
  - Optional: discuss presentation with me
  - Present a topic (4CP) OR present + write up (7CP)
  - Sign up for the class electronically

- *Two* class times
  - Fixed slot: Monday 4pm c.t.
  - Alternative: TBD
What is Semantics?

Traditionally: *the study of meaning*

- ... but what does “meaning” mean?

  *Mary means trouble.*  
  *Smoke means fire.*

- \( \text{mean}'(x, y): x \text{ is a sign of } y \)

  *Mary means well*

Examples from Lyons (1995, chapter 1.1)
What is Semantics?

- Traditionally: the study of meaning
  - ... but what does “meaning” mean?

      Mary means trouble. Smoke means fire.

- mean′(x, y): x is a sign of y

- Utterances have wide ranges of meanings
  - Interpretation based on contextual assumption
  - Meaning and intention not necessarily the same

      Mary did not mean what she said.

Examples from Lyons (1995, chapter 1.1)
Different meanings are not independent, but “interconnected“, shading into one another

Similarly, not necessarily is there *one* study of meaning, but many intersecting branches:

- Philosophical semantics
- Logical semantics
- Linguistic semantics
- ...
What is Linguistic Semantics?

- Natural languages are communication systems
  - Grammatical and semantic structures “by design”
  - i.e. grammar/vocab *systematically* encode meaning

  \[ \text{Smoke means fire} \rightarrow \text{Fire is the source of smoke} \]

- Linguistic vs. extra-linguistic meaning?
  - 1930s–50s: subjective, non-scientific study!
  - Many aspects now well studied, e.g. countability

  study of *language* vs. study of *a language*
What is this course about?

First: Topics from linguistic semantics
- How do we know the meaning of an utterance?
- Review “hot and odd topics” from the linguistic semantic literature

Second: Computational models thereof
- How can we teach models to understand?
- Discuss annotated corpora, technical challenges, and state-of-the-art (usually statistical) models
Who am I?

- Researcher in computational linguistics
  - BSc/MSc from USaarland in 2006 and 2008
  - Back in Saarland since 2017: mroth@coli.uni-sb.de

- Computational models of semantics for ~10 yrs
  - MSc on distributional and frame semantics
  - PhD work on implicit arguments
  - PostDoc research on lexical relations, semantic roles, machine comprehension, and scripts
<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
<th>References</th>
</tr>
</thead>
</table>
| 23.4  | **Distributional semantics**               | Sahlgren (Italian Journal of Linguistics, 2008). The Distributional Hypothesis.  
+ e.g. Mikolov et al. (ICLR 2013). Efficient Estimation of Word Representations in Vector Space. |
| 4.5   | **Multimodality**                          | Johns & Jones (TopiCS 2012). Perceptual Inference Through Global Lexical Similarity.  
+ e.g. Silberer & Lapata (EMNLP 2012). Grounded Models of Semantic Representation. |
| 4.6   | **Frames and scripts**                     | Minsky (Report 1974). A Framework for Representing Knowledge. Chapter 2: Language, ...  
+ e.g. Das et al. (CL 2014). Frame-semantic Parsing. |
| 11.6  | **Implicit references**                    | Löbner (Report 1998). Definitive Associative Anaphora                     
+ e.g. Roth & Frank (CL 2015). Inducing Implicit Arguments via Cross-document Alignment. |
| 18.6  | **Constructions**                          | Kay & Michaelis (2012). Constructional Meaning and Compositionality (Ch. 86 of "Semantics").  
+ e.g. Ziem & Boas (AAAI 2017 Spring Symposium). Towards a Constructicon for German. |
+ e.g. Shwartz & Dagan (*SEM 2017). Adding Context to Semantic Data-Driven Paraphrasing. |
| 9.7   | **(Mis-)understanding**                   | McRoy (1993). Abductive Interpretation and Reinterpretation of Natural Language Utterances. Ch. 2.3.  
| 16.7  | **Abschlusssitzung**                       | [Final topic or brief discussion of uncovered topics: e.g. intent, belief, sarcasm, sentiment, vagueness, coercion, semantics of verb phrases, adjectives, information structure, semantic-pragmatic interface] |
Visualization from Aurelie Herbelot (aurelieherbelot.net)
Visualization from Hamilton, Leskovec and Jurafsky (ACL 2016)
Components of meaning of a linguistic unit, e.g.

- GENDER, ANIMACY (→ he, she, it)
- SPECIFICITY, COUNTABILITY (→ a lion/lions, salt)

Which components are encoded linguistically depend on language:

- SIZE
- EDIBILITY
- TRANSPORTATION
- ...
Multimodality

Example from Paul Trap/Thatababy
“Dynamic” Semantic Properties

<table>
<thead>
<tr>
<th>Sentences</th>
<th>Property</th>
<th>(A)</th>
<th>(B)</th>
<th>(C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) She was untrained and, in one botched job killed a client.</td>
<td>instigated</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>(B) The antibody then kills the cell.</td>
<td>volitional</td>
<td>2</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>(C) An assassin in Colombia killed a federal judge on a Medellin street.</td>
<td>awareness</td>
<td>3</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>PropBank KILL.01, ARG0-PAG: killer</td>
<td>sentient</td>
<td>5</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>VerbalNet MURDER-42.1-1, AGENT: ACTOR in an event who</td>
<td>moved</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>initiates and carries out the event intentionally or consciously,</td>
<td>phys_existed</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>and who exists independently of the event</td>
<td>created</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>FrameNet KILLING, KILLER/CAUSE: (The person or sentient</td>
<td>destroyed</td>
<td>1</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>entity) / (An inanimate entity or process) that causes the death of the</td>
<td>changed_poss</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>VICTIM.</td>
<td>changed_state</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>stationary</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

Table from Reisinger et al. (TACL 2015)
Example from Ferraro and Van Durme (AAAI 2016)
Yesterday, John washed the dishes.
Implicit Arguments

Yesterday, John washed the dishes.
Google search for "kill a process"
Jesus, what a mess!

Example from Michaelis (LU&LT book 2001, sect. 79)
A car hit a jogger in Palo Alto last night.
A car hit a professor in Palo Alto last night.

Example from Hobbs (Technical Report, 1985)
Example from Marty Bucella (martybucella.com)
Additional Topics

- Intent/belief
- Sarcasm/humor
- Sentiment
- Vagueness
- Semantic coercion
- Adjective semantics
- Verb-phrase semantics
- Ties to discourse and pragmatics