



DEPARTMENT OF PHILOSOPHY, LINGUISTICS AND THEORY OF SCIENCE

Constructive Type Theories and Natural Language Semantics, 7,5 higher education credits

Konstruktiv typteori för naturliga språk semantik, 7,5 högskolepoäng

Third Cycle/Forskarnivå

Confirmation

The course syllabus was confirmed by the Department of Philosophy, Linguistics and Theory of Science on ÅÅÅÅ-MM-DD to be valid from ÅÅÅÅ-MM-DD.

[In case of revision, please use the following text:

The course syllabus was confirmed by the Department of Philosophy, Linguistics and Theory of Science ÅÅÅÅ-MM-DD and was last revised ÅÅÅÅ-MM-DD. The revised course syllabus will be valid from ÅÅÅÅ-MM-DD.]

Entry requirements

General and specific entry requirements for third-cycle education according to Admissions Regulations and the general syllabus for the subject area at hand.

Learning outcomes

After completion of the course the doctoral student is expected to be able to :

Knowledge and understanding

- demonstrate enhanced knowledge and understanding of the subject areas of the course,
- discuss in detail key theories and issues in one or more of the subject areas of the course,

Skills and abilities

- offer a detailed analysis of issues, lines of arguments or methods from the literature,
- select and define issues, lines of arguments or methods from the literature that are suitable for a short critical essay or a conference paper,

Judgement and approach

- critically discuss, orally or in writing, questions, lines of arguments or methods that are used in the literature,
- critically assess the validity of the studied lines of argument.

Course content

The course concentrates on the use of constructive type theories to the study of natural language semantics. It presents an alternative language to be used in representing the semantics of NL based on the notion of proof, rather than the notion of truth with respect to a model as standard in classic Montague Semantics. The course concentrates on Martin L of's type theory and its variations as these are applied to NL semantics. An introduction to MLTT from the perspective of linguistic semantics is given in the first lectures and meaningful comparisons with mainstream formal semantics theories follow. Recent advances of a field that is flourishing in the last decades are going to be discussed in the form of seminars, where seminal papers are going to be presented. The course will also touch on the connection between the proof-theoretic specification of such theories and effective reasoning. The end result will be a discussion on the use of systems implementing such theories, called proof-assistants, for computational semantics. Two applications to be introduced is reasoning with NL semantics and formally verifying them. Students will have a first taste of the proof-assistant Coq and will be encouraged to do their own proofs of NL theorems. The course will conclude with discussions related to recent extensions of MLTT and type theories in general.

Teaching format

The course will include both lectures related to the readings, as well workshop-style discussion and presentations of issues related to the literature or novel underexplored issues from the perspective of constructive type theories. Participation is mandatory.

Primary language of instruction:

English

Assessment

The course is assessed individually by writing a course-paper

Grades

The grading scale comprises Pass (G) or Fail (U).

Course evaluation

The course is evaluated by way of a written questionnaire or oral feedback.

Additional information

Bibliography is appended.

Bibliography (partial)

Daisuke Bekki (2013): Representing anaphora with dependent types. In: Asher, N., Soloviev, S. (eds.) Logical Aspects of Computational Linguistics, Lecture Notes in Computer Science, vol.8535, pp. 14–29.

Jean-Philippe Bernardy and Stergios Chatzikyriakidis (2017): A Type-Theoretical system for the FraCaS test suite: Grammatical Framework meets Coq. In the proceedings of IWCS 2017, Montpellier, France

Yves Bertot and Pierre Castéran. Interactive theorem proving and program development: Coq'Art: the calculus of inductive constructions. Springer Science & Business Media, 2013.

Stergios Chatzikyriakidis, Zhaohui Luo (2017): Modern Perspectives in Type-Theoretical Semantics. Springer.

Stergios Chatzikyriakidis and Zhaohui Luo: Adjectival and Adverbial Modification: The View from Modern Type Theories *J of Log Lang and Inf* (2017) 26: 45.

Robin Cooper and Simon Dobnik and Staffan Larsson and Shalom Lappin: Probabilistic type theory and natural language semantics. *LiLT (Linguistic Issues in Language Technology)*. 2015 Oct 26;10.

Zhaohui Luo (2014): Formal semantics in modern type theories: Is it model-theoretic, proof-theoretic, or both? Invited talk at logical aspects of computational linguistics 2014 (LACL 2014), Toulouse. In *LNCS (Vol. 8535, pp. 177–188)*.

Per Martin-Löf (1975): An intuitionistic theory of types: Predicative part. In H. Rose & J. C. Shepherdson (Eds.), *Logic Colloquium'73*.

Christine Paulin-Mohring (2015): Introduction to the calculus of inductive constructions.

Per Martin-Löf (1984): Intuitionistic type theory. Napoli: Bibliopolis.

Aarne Ranta (1994): Type-Theoretical Grammar. OUP.

Christian Retoré (2013): Type-theoretical natural language semantics: on the system F for meaning assembly, *Types* 2013.