Formal Semantics of Natural Language

ESSLLI 2019 introductory course proposal – Language and Logic area

Yoad Winter
Utrecht University
y.winter@uu.nl

Motivation and description

Background

Modern formal semantics emerged in the late 1960s as a result of research efforts in linguistics, philosophy and mathematical logic. A major exponent of these efforts is the classical work by Montague [23], which is grounded in abstract mathematical logic and pays little attention to language as a cognitive faculty [18]. Over the last decade, this situation has changed dramatically. Experimental work in semantics and pragmatics has become more central than ever before [2, 21, 9, 12], and new empirical findings have led to new research hypotheses about presuppositions [1], implicatures [5], adjectival meanings [17, 15] and other areas that go beyond classical semantic analyses. These developments reflect more than a change of trend. Indeed, they highlight major limitations of classical Montagovian semantics: shortcomings that are inherent to the theory's original setup and motivations (psychological reality, cross-linguistic coverage and relations to pragmatics) as well as specific descriptive limitations in treating central phenomena like plurals, events, presupposition, generics, questions, and adjectives.

Despite the wide recognition of these problems with classical modeltheoretic semantics, they have not led to its abandonment. Rather than replacing it by a new paradigm, major theoretical efforts that culminated in the 1990s [11, 10, 4] introduced modifications in Montague's framework, with interfaces to generative syntax and discourse semantics. While methodological difficulties still abound in formal semantics, these interfaces have allowed semanticists to address many of its new challenges [19].

This situation makes it important for graduate students who are interested in formal semantics to be familiar with its mathematical foundations. While savvy in the specifics of quantifying-in, translation rules in fragments, or the $\hat{}$'s and $\check{}$'s of Montague's PTQ is no longer required from the professional semanticist, a sound understanding of higher-order functional denotations and the way they conspire to account for intricate facts about entailment continues to serve as an irreplaceable part of the semantic toolbox. Recent developments in areas like presuppositions, plurality and event semantics are profitably analyzed using this toolbox.

With this consideration, the proposed course will give a quick introduction to the foundations of modeltheoretic formal semantics, illustrating the importance of these foundations for recent developments in theoretical and empirical work.

Course structure and material

The course will consist of two parts:

Part I Classes 1 and 2 will cover basic foundational topics: entailment, ambiguity, direct compositionality, types and model structure, with a quick introduction to the lambda calculus. Selected exercises on these topics will be recommended for students who do not have formal background in semantics.

Part II Classes 3-5 will address current work on presupposition, plurals and events, with emphasis on empirical challenges to compositionality: presupposition projection, distributive and reciprocal quantification, and modification across categories.

Each of the two parts will concentrate on direct compositionality as one of the main vehicles for analyzing linguistic meanings. Part I will use basic examples as in (1) to highlight the challenges that they introduce and their compositional treatment in classical modeltheoretic semantics:

(1) a. Cross-categorial boolean operators: *Sue and/or Dan danced*; *Sue is tall and thin.*
b. Simple quantifiers: *Every/some/no man ran*; *Few/most/three men ran.*
c. Intersective modification: *No hungry man ran*; *Max is a hungry man.*
d. Variable-free reflexive anaphors: *Max admires himself*; *Every man admires himself.*

Part II will address the challenges for compositionality that are raised by covert distributivity and reciprocity (2a), event modification (e.g. the narrow scope existential in (2b)), and presupposition projection (2c).

(2) a. Covert distributivity: *Sue & Dan (each) won $100*; *Sue & Dan met/hugged (each other).*
b. Event modification: *No man ran quickly* = $\neg\exists x.\exists \mathsf{e}.\mathbf{man}(x)\wedge\mathbf{ran}(\mathsf{e},x)\wedge\mathbf{quick}(\mathsf{e})$
c. Presupposition projection: *If Max stops smoking he'll be healthier* $\Rightarrow$ *Max smokes*

The course reader will include parts of my textbook [24], presentation slides and survey articles at an introductory level, which will be made available online. The class presentations will be intense but self-contained. I will partly rely on materials that I have developed over the last 20 years for graduate and undergraduate courses taught to students in computer science, linguistics, and AI at various institutions in the Netherlands, Israel and China, as well as in ESSLLI (2013,2016) and NASSLLI (2014, 2016).

For a detailed outline of the course see the next page.

Expected level and prerequisites

The course is intended for graduate students with basic mathematical and scientific background, and does not presuppose specific knowledge in logic and theoretical linguistics. It is especially suitable for graduate students in theoretical linguistics, logic, philosophy of language, AI and computational linguistics. Advanced undergraduate students in theoretical linguistics, computer science and mathematics will also be able to follow this course.
Prerequisites:

(i) basic naive set theory, e.g. at the level of [20]
(ii) acquaintance with the general aims of theoretical linguistics, e.g. as in [7]

Familiarity with elementary logic and philosophy of language (e.g. as in [8]) will be an advantage, but will not be presupposed.

Recommended reading

See references in the detailed course outline below.

Potential external funding

May be available, depending on some factors that are unknown at the moment (other expected expenses from a running grant)

Outline – on next page.

Outline

Class 1 – Basic notions and tools
- Entailment as a core semantic intuition
- The truth-conditionality criterion
- Equivalence, tautology, contradiction, contingency
- Comparison to philosophical and mathematical logic
- Compositionality
- Structural ambiguity; ambiguity vs. vagueness
- Types and domains
- Characteristic functions
- Currying
- Arbitrary, combinatorial and logical denotations

Reading: chapters 1 and 2 of [24], including exercises

Class 2 – Simple meaning composition
- Using Lambda notation
- Reflexive pronouns in variable-free semantics
- Simple intersective modifiers
- Cross-categorial coordination and negation
- Simple quantifiers
- Word meaning and intended models
- Function application
- Syntax-semantics interface
- Category-to-type matching

Reading: chapter 3 of [24], including exercises

Class 3 – Plurals and distributivity
- Collective reference
- Effects of plural morphology
- Ontology: mereology, sets, groups, impure atoms
- Distributivity/reciprocity (D/R)
- Lexical sources of D/R
- Grammatical D/R operators: *each other*, floating *each*, adverbials, derivational reciprocity, pluractional markers
- Arguments for covert D/R
- Covers and pragmatic effects
- Logical D/R quantifiers
- Vague D/R quantifiers
- On-going experimental efforts

Reading: review articles [14, 25, 3]

Class 4 – Modification and events
- Adverbial modification
- Event nominals
- Intensional vs. non-intensional modification
- Davidson's proposal
- Existential closure: events and DRT
- Compositional event modification
- Time adverbials and argument orientation
- Languages with free word order
- Neo-Davidsonian approaches
- Remaining Challenges

Reading: review articles [16], [13,ch.1]

Class 5 – Presupposition
- Strawsonian vs. Russellian approaches
- Truth-value gaps
- Presupposition projection
- Holes, plugs and fillers
- Semantic vs. pragmatic approaches
- Formal semantic account (Schlenker)
- Formal pragmatic account (Stalnaker/Heim)
- Accommodation
- On-going experimental efforts

Reading: review articles [1, 6, 22]

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