From Logic to Montague Grammar: 
Some Formal and Conceptual Foundations of Semantic Theory

Syllabus

In general, the semantics proseminar is intended to serve as a bridge between the introductory graduate semantics courses (610, 620) and the more advanced semantics seminars. Typically, a specific subject is covered in more depth than is normally done in the intro classes, but the discussion is paced at a level appropriate for second- and third-year students.

The subject of this year’s proseminar is, loosely speaking, the formal semantic framework of Montague Grammar. The overall goal of the course will be to provide students with enough formal background to successfully navigate and critically evaluate the early literature of our discipline. Consequently, this course will be closer in spirit to an introductory semantics course than to a full-fledged seminar. It is my hope that – with input from the students and other participants – this course may ultimately be developed into a regularly taught component our graduate semantics curriculum.
1.1 Goals of the Course

The primary goal of this course is to provide students who have taken 610 and 620 with (some of) the background necessary to read papers written within the Montague Grammar tradition, especially the classic papers in Montague (1974) and Partee (1976).

As the field of formal semantics has grown over the past forty years, it has become more tightly integrated into the other subdisciplines of linguistics – especially syntax. A consequence of this integration is that much semantic research nowadays assumes a GB-style syntactic architecture, where LF tree-structures are separately generated by the syntax and then ‘input’ to a recursively defined semantic interpretation operation. In addition, in much current work, the denotations output by the interpretation operation are characterized purely via representations in a logical metalanguage, one that is implicitly understood by readers.

Although there are many merits to these developments, a negative consequence is that one can be expert in reading and evaluating current semantic research, while nevertheless finding great difficulty in comprehending the earliest and most influential works of our discipline. In addition, although the original ‘Montague Grammar’ framework is no longer widely used, much current work is nevertheless still written in an explicitly ‘model-theoretic’ style akin to those early works. Finally, the research done within frameworks that are ‘directly compositional’ is best understood and contextualized as a development of the key ideas of Montague.

For these reasons, it is quite important for semantics students to have the ability to read and comprehend the classic papers of Montague (1974) and Partee (1976). It is also extremely important to be able to ‘translate’ proposals from one research tradition into another, to allow for effective comparison and evaluation of different analyses. The primary goal of this seminar, then, is to develop these skills, alongside a deeper understanding and appreciation of the seminal works of Montague.

1.2 Structure of the Course

A fundamental concept in the work of Montague and others is that of ‘interpretation with respect to a model’. While this concept is emphasized in some semantics textbooks (Chierchia & McConnell-Ginet 2000), it is not emphasized in all introductory semantics curricula. In addition, in many semantics textbooks, the concept is introduced somewhat by fiat, without much motivating (or clarifying) context. For this reason, our course will begin by providing some crucial historical and conceptual context for the tools of ‘model-theoretic semantics’.

In this first section, “Why Models?”, we begin by reviewing the syntax and proof system of two fundamentally important logical languages: Propositional Logic (PL) and First Order Logic (FOL). We will then see how several key questions about these systems motivate the development of a mathematically precise characterization of what it means to be an ‘interpretation’ of these languages. We will then see how so-called ‘models’ can play this rule for FOL. Finally, we will see how, once armed with the notion of a ‘model’, we can answer those fundamentally important questions about FOL. This general plot structure is outlined below:
Part 1: Why Models?

• Propositional Logic (PL): Syntax and Natural Deduction System
• First Order (Predicate) Logic (FOL): Syntax and Natural Deduction System
• Formal Semantics of PL: Valuations
• Proving Soundness and Completeness of PL Natural Deduction
• Formal Semantics of FOL: Models
• Proof Sketch of Soundness and Completeness of FOL Natural Deduction
• Some Other Neat Results of Model Theory
• A Model Theory for Natural Language? Benefits and Obstacles

Readings and Resources (Posted on Moodle)

As outlined above, once it’s clear what can be achieved with a model theoretic semantics for FOL, the question will naturally arise of whether such a semantics could ever be given for a natural language. We’ll examine the obvious benefits of developing such a semantic theory, as well as some of the obvious obstacles that initially stood in its way.

Next, the class will veer sharply into the domain of abstract algebra. Many of the key ideas in Montague’s work are based on the following core insight: interpreting a language with respect to a model can be conceived of mathematically as a special kind of ‘mapping’ between algebras, namely a ‘homomorphism’. Therefore, we will begin with an introduction to the concepts of an ‘algebra’ and a ‘homomorphism’. We’ll then see right away that a ‘valuation’ of PL is essentially a homomorphism from a kind of ‘syntactic algebra’ (forming the sentences of PL) to a ‘semantic algebra’ (consisting of operations over truth-values). We’ll then further develop this notion of ‘interpretation as homomorphism’ so that it can apply to FOL (without quantification).

Part 2: Algebras and Semantics

• Introduction to Algebras and Morphisms.
• PL as an Algebra, Valuations as Morphisms
• Algebraic Syntax/semantics of FOL (without quantification)

Readings and Resources (Posted on Moodle)
At this point, we will have enough background to begin discussing Montague’s theory of translation. Another key part of Montague’s (1974) framework is the notion that – under certain, very special conditions – translation from one language into another can also be conceived of as a homomorphism between (syntactic) algebras. We’ll see that this ‘homomorphic’ conception of translation has a very crucial consequence: if a language L can be (homomorphically) translated into another language L’, which has a defined (model-theoretic) semantics, then you’ve also thereby provided L with a defined (model-theoretic) semantics. We will discuss the central importance of this consequence for the general program of formal semantics.

Part 3: Algebras, Translations, and Indirect Interpretation

- Montague’s Theory of Indirect Interpretation
- Indirect Interpretation of English (without quantification)
- Algebraic Syntax and Semantics of FOL (with quantification)
- Indirect Interpretation of Quantification in English

Readings and Resources (Posted on Moodle)

Once we’ve reached this point, we’ll actually have developed a significant purely ‘extensional’ fragment of English in Montague’s (1974) framework. However, many of the key advances in Montague’s work stem from his use of a specially designed ‘Intensional Logic’ (IL). Thus, the final stage of our gradual introduction to Montague’s system will be a study of his Intensional Logic, as well as some its basic applications to the analysis of English.

Part 4: Montague’s Intensional Logic (IL) and its Applications

- Key concepts behind the Intensional Logic (IL)
- Formal syntax and model-theoretic semantics of IL
- Algebraic characterization of IL’s model-theoretic semantics
- Indirect Interpretation of English via IL (Basic Examples)

Readings and Resources (Posted on Moodle)
Having come this far, it will now be possible for us to read and discuss much of Montague’s seminal paper “Universal Grammar” (UG). Our guide to this work will be the excellent overviews by Halvorsen & Ladusaw (1979) and Dowty et al. (1981). Having walked through the most important parts of UG, we will also be well-equipped to read and discuss that most seminal of Montague’s works, “The Proper Treatment of Quantification in Ordinary English” (PTQ). If time permits, we will also read one or two other classic works in formal semantics, such as Karttunen’s “Syntax and Semantics of Questions”.

Part 5: Classic Papers in Montague Grammar
- Montague’s “Universal Grammar”
- Montague’s “The Proper Treatment of Quantification in Ordinary English”
- (Perhaps Karttunen’s “Syntax and Semantics of Questions”)
- (Perhaps one more paper, from Partee (1976))

Readings and Resources (Posted on Moodle)

Some Additional Notes About Course Content and Difficulty
- This is not an introduction to semantics. I assume students have taken (the equivalent) of 610 and 620. Thus, many technical concepts from 610 and 620 will be assumed. (e.g., extension, intension, possible world semantics, etc.)

- This is not an introduction to logic. As explained in the course announcement, I assume that students have a basic background in logic, as would be obtained in a typical undergraduate introduction to logic course. (e.g. ‘translation’ into PL and FOL, truth-tables, natural deduction)

- Doing the reading is critical. I’m going to aim to move relatively quickly, particularly through Part 1. This course is cumulative, and so it’s crucial that you keep up.
General Piece of Advice: MEET WITH US!

At any point in the semester, please meet with Barbara and I regarding any issues at all, particularly if you are having any kind of difficulties with the course. We are also very happy to discuss anything at all, especially any interesting puzzles you happen to note along the way.

2. Course Requirements

As mentioned, this class will be closer in spirit to 620 than to a full-fledge seminar. Thus, the course requirements will be similar to those of 620.

2.1 Problem Sets

Due to the technical nature of the course material, it is critical that students complete regular weekly problems sets. These problem sets will be assigned on Thursday and due the following Thursday. Students are permitted to collaborate on problem sets, as long as each student writes up their work individually. The answers to the problem sets will not always be discussed in class. In such cases, I will write up and distribute answer keys.

2.2 Final Presentation and Final Paper

Students will be required to complete a final project, which will be presented in two formats: an in-class presentation at the end of the term, and a final paper.

The nature of this final project is rather open-ended, but any of the following types of project would be acceptable:

- A critical discussion of some aspect of Montague's classic papers UG or PTQ which we did not cover in class.
- A critical discussion of some paper in Partee (1976) (not covered in class)
- A Montague Grammar (MG) or Directly Compositional (DC) adaptation of an existing semantic analysis
- An original analysis of some phenomenon, done within MG or DC

The in-class presentations will take place during a special meeting after the final class; ideally during the week of December 9th – December 13th. The final paper will be due December 20th.

Students should decide upon a final project by November 14th (at the absolute latest).
3. **Various Dates of Interest**

October 15th: No class (Monday schedule)

November 14th: Declare topic of final project

November 28th: No class (Thanksgiving break)

December 5th: Last day of class

December 9th-13th: Final Presentations

December 20th: Final Paper Due

December 23rd: Final Grades Due