

Personal Notes on the History of Formal Semantics

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Introduction

- This is a wonderful occasion and I'm grateful to everyone who has made it possible. The award itself I cherish as a recognition of the field of formal semantics. Many people were crucial for the development of this field and I hope many people will consider it theirs as well; I accept this award on behalf of a great team of people, past and present, with hopes for the future.
- I'll mention a few of the many people I'm indebted to in my talk; but let me specifically thank the Franklin Institute for making these awards and thereby supporting science and scientists and inspiring the next generations. And I want to thank my sponsors Mitch Marcus and Charles Yang for their role in the awards process and for organizing and hosting this wonderful symposium.

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Introduction, *cont'd*

- I promised to talk about the mysterious combination of serendipity and apparent inevitability that have marked the emergence and development of this still-young field, and as I worked on the talk, I found that serendipity and inevitability often seem to go hand in hand -- like a lightning strike that happens at a random place and time, but in some places and at some times, the conditions are such that it's all but inevitable that a great forest fire will break out.

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1. Personal histories -- how does one find one's field?

- In doing interviews for my book project on the history of formal semantics, I often ask people how they found their way into their field (linguistics, semantics, logic, philosophy of language, syntax), and the stories are always interesting, sometimes surprising. We're not like children of doctors becoming doctors -- though in Russia there are a remarkable number of linguistic family lines!
- I interviewed **Jeroen Groenendijk** in 2011 and **Martin Stokhof** in 2013, two Dutch philosophers and formal semanticists who got into Montague Grammar very young, and who were remarkable for writing virtually all of their work jointly, starting with articles in the 1970s and their joint PhD dissertation in 1984, and continuing that way through about 2000.

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Personal histories -- how does one find one's field?

- I asked Groenendijk and Stokhof how they got into the field and discovered Montague's work so early. It turns out they were friends in secondary school, worked on the school newspaper together, and both wrote poetry and wanted to become writers. When they found there weren't really schools for becoming a writer, they decided that perhaps they should study philosophy, the way Albert Camus had begun.
- So they went to the University of Amsterdam in philosophy, and there they both discovered that they very much liked the formal parts -- logic, philosophy of science, analytic philosophy -- and they decided to study philosophy, for the love of it and to become writers, and also Dutch, to be able to make a living as Dutch teachers.

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Personal histories -- how does one find one's field?

- The Dutch curriculum introduced them to linguistics and to Chomskyan syntax, and they all but completed a master's degree in that, but then they were encouraged to become PhD students in philosophy and pursue that as a career -- which they hadn't known was possible!
- There's more to their story, about how they persuaded their professors to supervise them in studying Montague grammar pursuing their own work, and to do more hiring in philosophy of language. At Keenan's very early Formal Semantics conference in 1973, they heard lots of exciting talks and interviewed Renate Bartsch for the position she then took at the University of Amsterdam.
- Amsterdam quickly became, and remains, a center for new developments in formal semantics.

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Personal histories -- how does one find one's field?

- **David Lewis** had an interesting beginning. The son of a professor of government at Oberlin College, he started Swarthmore with me in the Class of 1961, declared as a chemistry major, but in 1959-60 he went for a year to Oxford, where his father had a sabbatical year, and he thought that would be a good chance to add some philosophy to his program.
- There he had Iris Murdoch as a tutor, and heard the last lecture series of J.L. Austin, as well as lectures by Ryle, Strawson, Geach, and Grice. He loved it all, wrote a lot, and came back to Swarthmore a dedicated philosophy major, graduated in 1962 and went to Harvard to work (very independently) with Quine.

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Personal histories -- how does one find one's field?

- As for my own beginnings, starting in high school I loved math and loved languages and saw no relation between them. I loved grammar more than literature, and in math I especially enjoyed 10th grade Euclidean geometry because of the logic in it -- I can remember arguing with my parents and "using logic" on them!
- In high school I didn't love algebra because it was taught like a recipe book. I only came to appreciate it later when I started teaching math for linguists in graduate school and found in Birkhoff's 1966 *Lattice Theory* an introduction to "what's an algebra", and a general discussion of axioms and models.

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Personal histories -- how does one find one's field?

- At Swarthmore, to be in the Honors program you had to choose a major and two related minors. I asked the head of the math department if I could possibly major in math and minor in Russian and philosophy even though I saw no connection - they were just my three favorite subjects.
- He said he'd heard of something called mathematical linguistics or machine translation, and he imagined I could make up a story about that -- I did (with no idea what it meant) and they let me do such a program - perhaps a lucky byproduct of the sexism of the time, since no one including me was asking what I would do with such a degree.

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Personal histories -- how does one find one's field?

- But here enters a nice bit of serendipity for me - my uncle, having heard of my curiosity about something called mathematical linguistics, and being an MIT PhD in engineering and on their mailing list, sent me the program for a conference at MIT organized by Roman Jakobson and called "Structure of Language and its Mathematical Aspects".
- Well! A vision of paradise! I wrote to all the American participants to ask if there was anything a young student could do in the summer of 1960 to learn more about this 'mathematical linguistics', in order to find out if I might want to do graduate work in it.

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Personal histories -- how does one find one's field?

- Lots of people actually replied with encouraging letters, including Chomsky, and all roads pointed to the University of Pennsylvania. No one else had any summer possibilities, but several thought that Penn might.
- Lila Gleitman and Carlota Smith, both then faculty wives at Swarthmore who I occasionally babysat for, were also then graduate students at Penn.
- They put me in touch with someone at Penn who told me, Why yes, there's going to be a seminar this summer, funded for all participants by NSF, on "Structural Linguistics" for people with backgrounds in mathematics, philosophy, or psychology, taught by Henry Hiž.

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Personal histories -- how does one find one's field?

- That was perfect for me. And it turned out that quite independently, David Lewis and Gil Harman also found out about that seminar and participated in it. That was the introduction to linguistics for all three of us. Hiž gave us an algebraic foundation, and then we did Harris-style transformations and distributional analysis. I loved it.
- The timing of that summer seminar was amazing good luck, especially since they knew that their Ph.D. Noam Chomsky was about to launch a Ph.D. program at MIT with a similar emphasis, a program that hadn't been officially announced or advertised anywhere.

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Personal histories -- how does one find one's field?

- So it was absolutely a matter of serendipity that I found my way into "mathematical" (i.e. "formal") linguistics and into the new MIT program. But it was not an accident that I rushed through that door as soon as it was opened to me.
- And it was not an accident that I chose math as my minor for my Ph.D. program in linguistics (minors were obligatory back then), with courses in automata theory, logic, set theory, and model theory.
- While David Lewis and I were both in grad school in Cambridge, he sometimes came to Chomsky's lectures, and I took one course from Quine. We were friends and my mathematician apartment mate and I sometimes had him over for dinner.

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Personal histories -- how does one find one's field?

- So when a couple of years after I got to UCLA, David told me that the logician and philosopher Richard Montague was starting to do work on the semantics of natural language that I might find interesting, that was a huge bit of serendipity, but one that in a sense I had been preparing for all along, without knowing it.
- Montague was not easy to understand, but I had gotten enough background that when I asked David to explain things (like "what's a lambda?!"), I could kind of understand his answers, and I could hugely appreciate the enterprise and imagine what it could mean for linguistics.

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2. Questions about the development of the field

2.1. Some factors of apparent inevitability

- Some things might seem to make the rise of formal semantics for natural language inevitable.
- There were important developments going on, at first with hardly any mutual knowledge, in logic and philosophy of language on the one hand and linguistics on the other - -
- the rise of 'formal philosophy', and
- the rise of 'formal (theoretical) linguistics'.

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Some factors of apparent inevitability

- I've discussed these developments, from Frege through Carnap and Tarski and other philosophers and logicians to Montague and Lewis and Parsons, in many talks and papers, and won't repeat them here.
- On the linguistic side, the Chomsky revolution that started with *Syntactic Structures* in 1957 began in the 1960's to lead to a search for a more adequate semantics than the initial Katz/Fodor/Postal efforts, leading to the rise of Generative Semantics and Interpretive Semantics, and increasingly interesting semantic questions, though the linguists' questions tended to be very 'structural', all about scopes and ambiguities.

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Some factors of apparent inevitability

- My 1971 paper 'On the requirement that transformations preserve meaning' was an analysis of some of the problems with each approach - I was dissatisfied but had no idea how to do better.
- That paper was published in 1971, but presented at an April 1969 conference, when I'd only barely begun to get acquainted with Montague's work - it's a snapshot of how linguists were struggling with semantics before Montague's work gave us a very different view of other questions to ask and other tools we could work with.

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2.2. Obstacles to inevitability

- There were certainly common interests and some shared goals between linguists, logicians, and philosophers, but in the 1960s, there were serious obstacles to synthesis.
- **Linguists** in the 60s didn't know:
 - type theory
 - the semantic motivation of categorial grammar -- function-argument structure
 - higher-order logic
 - lambdas!
 - We didn't have any idea that truth conditions could be relevant to meaning, let alone basic to it.
- **Partial exceptions:** Jim McCawley, Ed Keenan

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Obstacles to inevitability

- **Logicians and philosophers** didn't know much syntax except traditional grammars. There was a common idea that language was too unruly, and too full of vagueness and ambiguity, to ever analyze formally.
- **Exceptions:** Evert Beth and then Frits Staal in Amsterdam, Yehoshua Bar-Hillel, Henry Hiz, Julius Moravcsik, Jerry Fodor & Jerry Katz.
- And from Chomsky's years as a Junior Fellow at Harvard in the 1950s, at least Goodman, Quine, Putnam, Scheffler, and Bar-Hillel.

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2.3. Active efforts of various people to bring linguists and philosophers together

- **Frits Staal** - founded the new journal *Foundations of Language* in 1965, with the explicit goal to bring together work in linguistics, philosophy, logic, psychology, and even more fields to try to understand language and its foundations. Original group of editors included Staal, Morris Halle, Benson Mates, others.
- And he invited Montague to teach a seminar with him in Amsterdam in 1966 – more on that later.

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Active efforts of various people to bring linguists and philosophers together

- **Yehoshua Bar-Hillel** - I've often commented on the paper that Bar-Hillel published in *Language* in 1964, arguing that the time was ripe for linguists and philosophers of language to work together, to exploit the great progress that had been made in both fields.
- Chomsky's reply in *Language* in 1965 was that the artificial languages of logic were too different from natural languages for the logicians' methods to be of any use for the linguists' goals of understanding the properties of the human faculty of language.

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Active efforts of various people to bring linguists and philosophers together

- Bar-Hillel kept trying. In the summer of 1967, Staal, Bar-Hillel, and Haskell Curry organized a symposium during the 3rd International Congress for Logic, Methodology, and Philosophy of Science in Amsterdam, on "The Role of Formal Logic in the Evaluation of Argumentation in Ordinary Language". Bar-Hillel prepared an opening position paper, and participants included Montague, Jerry Katz, Dummett, Hintikka, and others.
- As Staal noted (Staal, 1969), quite a few people then knew of Montague's work, and quite a few knew about MIT linguistics (represented by Katz), but few knew both.
- Bar-Hillel also corresponded with Montague and had conversations with Chomsky, but never managed to persuade them to meet or interact or to study each other's work seriously.

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Efforts to bring linguists and philosophers together

- **Donald Davidson and Gil Harman**, who were both in or near Princeton 1967-76, played a major role in efforts to encourage linguists and philosophers to interact.
- In August 1969 they organized a conference on the Semantics of Natural Language at CASBS in Stanford. The participants were linguists Bach, Fillmore, Lakoff, McCawley, and Partee, and philosophers Davidson, Geach, Harman, Kaplan, Quine, Staal, and Vermazen.
- Montague was not invited, which I thought was a pity.
- I found the conference stimulating and interesting, but no one changed anyone's mind on any important issues. Quine states in his autobiography that the conference was "a fiasco at bridge-building".
- Nevertheless, a wonderful huge edited volume came out of that conference, with papers by many who were not at the conference, including Montague and Kripke.

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Efforts to bring linguists and philosophers together

- Davidson and Harman then organized a 6-week Summer Institute in Philosophy of Language and Linguistics at UC Irvine in Summer 1971, divided into two three-week sessions. Each week had lectures by three philosophers and one linguist, and the "students" were themselves all young philosophy professors, including Rich Thomason, Bob Stalnaker, Gareth Evans, Bill Lycan.
- I was the linguist for the first session, and attended the lectures by Davidson, Harman, and Grice; I commuted to the second session to hear Strawson, David Kaplan, Quine, and Haj Ross, as well as the extra series by Saul Kripke on his new work, "Naming and Necessity". The long discussion periods following each lecture, as well as many discussions outside of lecture time, yielded mutual education and lasting friendships.

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Efforts to bring linguists and philosophers together

- That institute was held in August 1971; Montague had been murdered in March 1971, a tragedy and a terrible shock to everyone.
- I was still just trying to learn to understand his work. But that summer was also my first experience teaching a little bit of it, with help from “students” like Thomason and Stalnaker.
- And I made, and talked about, a few first steps towards integrating Montague Grammar and Chomsky’s transformational grammar.
- Davidson and Harman tended to favor first-order extensional logic over higher-order intensional logic; they were sympathetic to the work of the Generative Semanticists, and Davidson was not fond of Montague. But their efforts did a great deal to bring linguists and philosophers together.

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Efforts to bring linguists and philosophers together

- **Ed Keenan** merits a special mention -- he was the first *linguist* to host a conference aimed at bringing linguists and philosophers together.
- It was in 1973 while he was at Cambridge University, and its title, *Formal Semantics of Natural Language*, used the then unfamiliar term ‘formal semantics’. The book from the conference was published in 1975.
- Participants included David Lewis, Partee, John Lyons, Östen Dahl, Pieter Seuren, Hans Kamp, Renate Bartsch, Arnim von Stechow, George Lakoff, Petr Sgall, Steve Isard, Joe Emonds, Yorick Wilks, Ed Keenan, and Haj Ross, and more.
- Quite a few of us met each other for the first time at that conference. Ed had and has very broad tastes and an inclusive and welcoming nature.

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3. People and contexts

3.1. Montague

- In high school in Stockton, Montague studied 3 foreign languages - Latin, French, and Spanish. He was also serious about music there and at UC Berkeley, giving organ recitals and served as the Minister of Music at a church in Oakland.
- As an undergraduate at Berkeley, he studied mathematics, philosophy, and Semitic languages. He continued graduate work in all three areas, especially with Walter Joseph Fischel in classical Arabic, with Paul Marhenke and Benson Mates in philosophy, and with Tarski in mathematics and philosophy, receiving an M.A. in mathematics in 1953 and a Ph.D. in philosophy in 1957.
- So he did have some interest in language. But much more in logic, mathematics, and philosophy.

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Montague

- So why did he change gears in the second half of the 60s and start working on formal semantics of natural language, after working on logic, set theory, and recursive function theory - properly Tarskian topics?
- I’ve written elsewhere about two sources. One was the logic textbook that he and Donald Kalish wrote in the early 1960’s, which paid unusually careful attention to algorithms for translating back and forth between first-order logic and a regimented subset of natural English. Another was a page I found in the Montague archives with the preamble to one of his early talks on English as a Formal Language, which includes “This work is the result of two annoyances ...”, which turn out to be (i) the Ordinary Language vs. Formal Language wars in philosophy of language, and (ii) “The great sound and fury that nowadays issues from MIT under the name of “mathematical linguistics” or “the new grammar” – a clamor not, to the best of my knowledge, accompanied by any accomplishments.”

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Montague

- Ivano Caponigro, in his biography of Montague in progress, identifies as a crucial turning point Montague's sabbatical in Amsterdam in 1966, where Frits Staal invited him to co-teach a seminar on Chomsky's 1965 *Aspects of the Theory of Syntax* and Quine's 1960 *Word and Object*.
- Henk Verkuyl explained to me and to Ivano how Staal would put some syntactic trees on the blackboard and Montague would then fill the board with formulas, which Staal would have to interpret for the students.
- I think Ivano is probably right that that was a major turning point. It was clear that by the time of Montague's "English as a Formal Language", taught in a seminar I attended in 1968, Montague thought that he could "do better" and that it would be worthwhile to devote some effort to it - effort that continued through the rest of his short life, and which left a great legacy for the rest of us to work with.

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3.2. Some counterfactual questions related to inevitability

- At a workshop organized by Rich Thomason in Michigan in 2015 on the UCLA years in the beginnings of formal semantics, two counterfactual questions were raised -
 - (1) What if Montague had never lived?
 - (2) What if Montague had not died so young (at 40)?
- There was no clear resolution, of course. But those of us there didn't think that formal semantics would have gotten off to such a flying start as it did in the 70s if Montague had never turned his energies to it.
- About the other - what if he hadn't died when he did -- we had much less idea, only that it might have been a little harder and taken a little longer for the linguists to 'take possession' of formal semantics as they did by the mid 80s.

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Some counterfactual questions ...

- David Lewis could well have become the founder of formal semantics -- he had the tools, he knew more linguistics than Montague did, and he had a very 'compatibilist' temperament about the many topics on which he believed there was more than one way to do things.
- But that wasn't his main interest. He declined, for instance, to write an article for my 1976 anthology *Montague Grammar*, instead giving me permission to reprint his seminal 'General semantics' paper there.
- He made many wonderful lasting contributions, and I know that my colleague Angelika Kratzer very much considers him, and not Montague, to be her principal 'ancestor' in formal semantics.

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3.3. After Montague's death in 1971

- At UCLA, I mostly supervised syntax PhDs, but also Frank Heny and Larry Horn.
- In the year after Montague's death, David Kaplan and I jointly supervised Montague's two Ph.D. students, Michael Bennett and Enrique Delacruz, and I taught two quarters of "Montague Grammar."
- Terry Parsons and I both moved to UMass in 1972 and Emmon Bach came in 1973 (when we got married.) Terry and Emmon and I found UMass an ideal breeding ground for fruitful linguistics-philosophy joint development of formal semantics ... a brand-new linguistics department and an established good philosophy department, the fruitfulness of joint seminars, joint NSF grants, and joint advising of students in linguistics and in philosophy.

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3.4. At UMass Amherst in the 70s and beyond

- We had a series of great students in the 70s and 80s who made those seminars and research projects wonderful -- Robin Cooper, Muffy Siegel, Greg Carlson, Paul Hirschbühler, Elisabet Engdahl, Mike Flynn, Ken Ross, Irene Heim, Gennaro Chierchia, Dorit Abusch (Philosophy), Mats Rooth, Jonathan Mitchell, Craige Roberts, Nirit Kadmon, Jae-Wong Choe, Sandro Zucchi, Arnold Chien (Philosophy), Karina Wilkinson, Paul Portner, Hotze Rullmann, just to mention the ones whose dissertations I chaired.

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At UMass Amherst in the 70s and beyond

- After Terry left in 1979, there was less involvement of philosophy students or faculty, but then Angelika Kratzer joined our department in 1985, and we had and still have many joint seminars within linguistics and lots of great students, increasingly supervised by Angelika. About the more recent years I'll only mention that we had several wonderful years with Lisa Matthewson on our faculty, and then several wonderful years with Chris Potts on our faculty, and now many wonderful years with Seth Cable on our faculty, joined still more recently by Vincent Homer and Ana Arregui.

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At UMass Amherst in the 70s and beyond

- So what if anything was either inevitable or serendipitous about the developments at UMass?
- Serendipities -
- (1) meeting Terry not long before we each for different reasons aimed to move, and discovering that we were both interested in UMass Amherst and influencing each other to say yes - we even applied for our first NSF grant the year before we got there (it was turned down, but we got it the next year.)

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At UMass Amherst in the 70s and beyond

- Serendipities, continued:
- (2) Don Freeman founded our Linguistics Department just 50 years ago - it was approved in December 1970 [we'll celebrate when it's safe to!] - and remembered that when he had met me at UCLA in 1966 I'd told him how much I loved Vermont; so he called me up and told me to come to UMass, that it's less than 50 miles from Vermont. That wasn't the only reason, but I did. I had never heard of the place before.

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At UMass Amherst in the 70s and beyond

- Serendipities, continued:
- (3) Don Freeman had the foresight to get the 1974 LSA Linguistic Institute at UMass. As soon as I arrived in 1972 he gave me free rein to organize a major set of offerings in semantics and philosophy of language, and with a pile of courses and a grant-funded workshop we managed to bring in a stellar array of linguists and philosophers, which attracted lots of graduate students and visitors interested in those areas.
- The 1974 Institute was both a hotbed of intense interactions and, as someone put it, something of a coming-out party for our department, which went from birth to a top-3 national ranking in about 5 or 6 years.

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At UMass Amherst in the 70s and beyond

- Once Terry and Emmon and I were all there, and had such wonderful graduate students, the enterprise picked up momentum, attracting more wonderful grad students in a virtuous cycle - a non-serendipitous result of those auspicious beginnings.
- I could say much more (and have in other places) about other people and other places that were important for the development of formal semantics, including in Europe and on other continents as well.
- But time and space constraints mean I have to stop here. Happily the rest of the program today will bring us closer to the present and with glimpses of the future.

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Acknowledgements

- My thanks to many people who have helped me learn more about the history of my field, too many to name, but especially Nino Cocchiarella, Hans Kamp, Richmond Thomason, Dana Scott, F.J. Pelletier, David Kaplan, †Emmon Bach, Max Cresswell, Dagfinn Føllesdal, Ede Zimmermann, †Solomon and †Anita Feferman, Edward Keenan, †Steffi Lewis, Jeroen Groenendijk, Martin Stokhof, †Theo Janssen, Tyler Burge, †Patrick Suppes, John Perry, Dag Westerståhl, Stanley Peters, †Ivan Sag, Arnim von Stechow, Fred Landman, †Jerry Fodor, Robert Stalnaker, Hilary Putnam, Noam Chomsky, Irene Heim, Gennaro Chierchia, Angelika Kratzer, Ivano Caponigro and others whose interviews and correspondence I am still digesting. And to the Special Collections archivists at UCLA for valued help in accessing the archived collection of Montague's papers.

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