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Richard Montague
The birth of a new passion: natural language
1966

Draft, 7 March 2021

This is a draft of a chapter of a forthcoming intellectual and personal biography of Richard Montague. The tentative title is *Richard Montague: The simplicity of language, the complexity of life*. I am still working on this chapter and the rest of the book and any feedback is appreciated.

Special thanks to Barbara Partee for her precious and detailed comments. Thanks for their feedback to Gennaro Chierchia, Noam Chomsky, Veneeta Dayal, Hans Kamp, Daniel B. Kane, and the audiences at Johann Wolfgang Goethe-Universität, Harvard University, Macquarie University, University of Hawai'i at Mānoa, University of California Irvine, University of Nantes, and Yale University. I am the only one who is responsible for any remaining mistakes.

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This work is dedicated to Sol Feferman (1928-2016),
for his example, mentorship, support, and friendship

The fall semester of 1965 was probably Montague's most difficult time since he had moved to Los Angeles more than ten years earlier. The contrasts with his colleagues had reached a new peak, becoming known even outside the department, and former close friends like Kalish had turned into potentially dangerous enemies. Months before, Montague had accepted an academic invitation to spend the spring semester of 1966 in Amsterdam. It was a much needed break in a place that he had already enjoyed four years earlier. "Best wishes for a pleasant spring in Amsterdam. It will be a good antidote for what you have been through!"—his former teacher and now friend and colleague Benson Mates wrote from Berkeley right before his departure.[1] Neither Mates, nor Montague himself, could them have imagined what was about to start in Amsterdam: the discovery of a major research interest, the birth of a new field of studies, and the beginning of the intellectual contribution Montague would be mainly remembered for in the decades to come.

Getting ready for Europe

Montague left for Amsterdam on January 24, 1966. The month before was frantic. Between Christmas and New Year's Eve, he was in New York City for the annual joint meeting of the American Philosophical Association and the Association for Symbolic Logic, of which he had recently become the Secretary. This was a very important venue to promote young philosophers and logicians. Montague brought his new student Hans Kamp and his graduating student Nino Cocchiarella. Cocchiarella had three abstracts accepted and was presenting one as a talk. He was already an assistant professor at San Francisco State College, but unhappy and hunting for a better academic position. The student and the professor rushed back to Los Angeles after the conference. Cocchiarella had to defend his dissertation on January 7th, in front of a committee that included Robert Stockwell. Serendipitously, Stockwell was about to

[1] Letter from Benson Mates to M., January 3, 1966. M.b21.f1

found the Linguistic Department at UCLA and had just hired Barbara Partee, a brilliant 25-year-old linguist who was among the first generation of Noam Chomsky's Ph.D. students at MIT. Partee would play a major role in developing the ideas about natural language that Montague was about to father. "Barbara, I think that you are the only linguist who it is not the case that I can't talk to,"[2] This was the public compliment Montague made in May 1970 during a coffee break at a conference—one of the very rare compliments he would ever give to a linguist. In January 1966, the two had not even met.

As soon as Montague returned from New York, despite the many things he had to take care of before leaving for Europe, he continued his battle with his department. They had just voted to offer a position of full professor in philosophy and law to Joel Feinberg (1926-2004) to cover the area of ethics. Montague voted against. On December 28, Montague wrote a letter directly to the UCLA Vice-Chancellor, the second-highest ranked university official, to explain his minority position, to summarize his reasons for being very critical about the Feinberg hire, to suggest better candidates (Arthur Prior, above all), and to ask for the majority decision to be overturned. He did not succeed. Feinberg joined the department in 1966, but left for Rockefeller University in New York City after only one year. Richard Wasserstrom (1936-) was offered the position—not one of Montague's candidates.

In January, Montague took care of the final exams for the two classes he was teaching, made further arrangements for his months in Europe, helped Cocchiarella file his dissertation, and made sure that the final version of the dissertation of his next graduating student, Rudolf Grewe, who had already been hired by the University of Rochester, would be sent to all the committee members. He also found the time to inform the "University Bulletin" editorial team of his new achievements: the position in Amsterdam, the election as the Secretary of the Association for Symbolic Logic, and the appointment to the Conference Board of the Mathematical Sciences as the representative of the Association for Symbolic Logic. A few months earlier, he had been nominated the chairman of the Subcommittee for Logic, Methodology, and Philosophy of Science of the U.S. National Committee for the International Union for the History and Philosophy of Science and a member of the Advisory Committee for the 1967 International Congress of Logic, Methodology, and Philosophy of Science in Amsterdam. Appointments mattered to Montague as independent signs of official recognition of his status within the broader academic community. He took these new duties seriously, though, as shown by the many related letters he received and wrote while on sabbatical leave in Amsterdam. He also stayed in touch with his new student Hans Kamp and kept writing

[2] B. Partee, 'Formal Semantics: Origins, Issues, Early Impact.' In *The Baltic International Yearbook of Cognition, Logic and Communication*, *Volume 6: Formal Semantics and Pragmatics, Discourse, Context, and Models.* 2011: p. 32 and fn. 22. DOI: 10.4148/biyclc.v6i0.1580

recommendation letters for the young scholars who requested them, although they were not his students. Many professors would decline those kinds of duties while on a sabbatical leave.

In November, Montague had received an invitation to be a fellow at the Center for Advanced Study in the Behavioral Sciences next to Stanford University in 1966-67. He thought about it for a while since he was tempted by an entire year without teaching or service and close proximity to his old friends and colleagues Feferman and Scott and, of course, Tarski. In the end, he had to decline since he realized he could not be away from Los Angeles and UCLA so long right after being on sabbatical for a semester. He strongly conveyed his hope that he would be given another opportunity in the near future, especially if they offered a fellowship to Tarski at the same time.[3]

Before leaving, Montague also found time and energy to realize a desire he had had at least since his colleague Hans Meyerhoff had been killed in a car accident in his Beetle at UCLA the previous summer: a new and bigger car. Montague had a Beetle and became convinced it was not safe enough.[4] So he bought a new Mercedes 200 directly from the maker in Germany. It was definitely a safer car and a more dignifying vehicle for a UCLA professor and star in the philosophy firmament whose annual salary had just been raised to $16,900. It was a good investment too. The car cost 10,800 DM in Germany (around $2,700), while it was being sold at $4,000 in the U.S. He picked up his car shortly after his arrival in Holland and drove it in Amsterdam and across Europe. Some of his passengers still remember how fast he drove to a dinner at the Heyting's in Castricum, outside Amsterdam. He seemed to truly enjoy the lack of speed limit outside the city and the fact that his new car could reach 95 mph; his passengers enjoyed it much less.[5] He drove to Paris to see his friend Micheline in April and then to London for a series of lectures in June, despite a major delay due to a ferry strike. He brought his new car back to Los Angeles on the same liner he travelled on in July.

In the world's gay capital

Montague arrived in Amsterdam on January 25, 1966. Despite its many pluses, Amsterdam could not compete with Los Angeles as far as winter weather was concerned. Montague got a cold right away that dragged on for at least a couple of months. The mathematician and logician Arend Heyting (1898-1980) and the philosopher and linguist Johan Frederik "Frits" Staal (1930-2012), who he had met in his previous sabbatical in Amsterdam in the fall of

[3] Letter from M. to Preston Cutler, February 22, 1966. M.b21.f2
[4] Interview with Hans Kamp on March 13, 2013.
[5] Anne Troelstra, email message, October 9, 2015.

1962, invited him to teach two courses and to be the temporary Director of the Institute for Foundational Research at the University of Amsterdam. It was a great honor. Evert Beth (1908-1964), the leading logician in Amsterdam and the first to hold a chair in logic in Holland, had founded the institute and had directed it until his premature death in 1964. The Polish logician Andrzej Grzegorczyk (1922-2014) had temporarily replaced him in the fall of 1965, while the U.S. logician Haskel Curry (1900-1982) would take over as the permanent director starting in the fall of 1966. Curry had been contacted, together with other leading logicians, by Heyting and Staal in 1964 to ask for suggestions for Beth's replacement. Curry mentioned Montague first among the several candidates from the U.S. he suggested: "I consider him one of the best logicians in the world from the standpoint of philosophy; that is, he is one of the strongest contributors to mathematical logic who is officially rated as a philosopher. I understand he has a very desirable appointment at Los Angeles and he may be difficult to move."[6]

In the many letters Montague exchanged with Heyting and Staal in preparation for his visit, he went over plenty of details, from salary to teaching, vacation time, income taxes, what devices he needed at his place in Amsterdam, and, crucially, what kind of place he needed. He wrote Heyting, who was thirty-two years his senior and the leading logician in Amsterdam after Beth's death: "The most important thing, however, is not the convenience but the privacy; that is, I should not wish to occupy a portion of a private house or someone else's flat. It ought to be a completely independent accommodation with a separate entrance and no restrictions as to hours of entrance and guests."[7]

Why did Montague care so much about housing privacy? He knew from his previous visit that Amsterdam was the gay capital of the world, the best place for an adventurous gay man who did not want legal troubles. Frits Staal himself was taking advantage of that safe freedom. Although still married and living with his wife and two children, he enjoyed adventures with men. Montague must have known about it, given how close they were personally. When Staal became a professor at the University of California Berkeley a few years later, he split from his family and lived with a male partner for the rest of his life.

Since 1962, things had only improved in Amsterdam. The city had become the engine of Dutch cultural, political, social, and sexual revolution with a speed, intensity, and visibility unknown in Los Angeles, San Francisco, or anywhere else in the US in those years. The *Dutch Society for Sexual Reform* had changed its aims from family planning to sexual reform,

[6] Letter from Haskel Curry to Frits Staal, July 9, 1964. Heyting Arch, D1-57-3

[7] Letter from M. to Arend Heyting, July 30 1965, Heyting Archive, D1-31-1.

becoming a major social force in the 1960s with over 200,000 members at its high point, about 1.7% of the Dutch population. In the late 1960s, it welcomed the *Center for Recreation and Culture*, representing the homosexual movement, as a junior partner. They requested the abolition of laws restricting homosexuality, abortion, pornography, prostitution, and divorce, and asked for easy access to contraceptives for all women above 16 years old.

In 1965, Provo ("provocateur") emerged as a new politicized group of young people initiating a radical cultural and political shift and stimulated vital social changes. It has become synonymous with major transformations in Dutch society in the late sixties such as secularization, democratization and individualization, and the rise of a youth culture. Anarchist and hippie Provo youth stood for resistance against the authorities, and were in favor of squatting, communal living arrangements, drug use, ecological solutions, free bicycles, and public transportation instead of cars, which were both dangerous and polluting. They opposed the neo-colonial wars of NATO and support for dictatorships. Provos heartily embraced the sexual revolution. They were in favor of, as one said in the first issue of their journal *Provo* (1965), free love and "complete amoral promiscuity." Together with an internationally active gay movement, a lively and arts-driven gay scene and rich and varied gay entertainment developed as well.

Gay bars had a long tradition in Amsterdam, going back to the thirties and even earlier. They were located in three different areas in the city center, targeting different clientele. For instance, those in the Red Light District were considered to be lower class. This was the traditional district for sailors, hustlers, pimps, and so on, the center of "sex and crime", where the French gay writer Jean Genet liked to come in the fifties and sixties. Initially, gay bars were not places for sex, although male hustlers populated them. At a gay bar, a man would just encounter another man. Then they would go home or somewhere else to have sex. Public restrooms, on the other hand, were places for both cruising and sex. The situation changed in the late fifties when the police stopped harassing gay bars and their clients. They now decided that it was better to keep homosexuals in their clubs than cruising on the streets for straight men, which only led to public nuisances. This policy of toleration in semi-public places, such as bars, led to a rapid development of the gay scene. Although the "street scene" kept flourishing with some fifties urinals, parks, and cinemas, bars really bloomed in number and visibility. They stopped having window curtains or no front windows at all; doormen and alarm systems against unwelcome intruders disappeared. A new bar for men into leather gear and two gay dance halls opened, joined in 1965 by gay saunas. Saunas and bars became places for sex. With these changes, Amsterdam consolidated its fame as a gay paradise for

European tourists and U.S. soldiers.[8]

Less than 13 years after being arrested and brought to trial in Berkeley, as a graduate student, for allegedly attempting to perform oral sex on a 17 year-old man, Montague was now a full professor in a society that was vindicating his unwary but foreseeing words to the District Attorney that could have ruined the rest of his life: "There's nothing wrong with me. There is something wrong with society." Montague must have fully enjoyed it.

Photo 1. Frits Staal at Remmert Kraak's doctoral defense in Amsterdam on February 22, 1966.
By permission of David van Dijk.

Amsterdam and more

While in Europe, Montague hired Barry Kurtzman (1942-1995) under his National Science Foundation grant. To Staal and Heyting, he introduced Kurtzman as his "research assistant", "a very bright young mathematics who does not yet have a B.A., but has obtained interesting

[8] The whole section on Amsterdam is crucially based on email exchanges with Gert Hekma, his paper "Amsterdam Sexual Underground in the Sixties." In: Christoph Lindner & Andrew Hussey (eds) *Paris-Amsterdam Underground: Essays on Cultural Resistance, Subversion, and Diversion,* Amsterdam: Amsterdam University Press, 2013, pp. 49-61, and an English summary of his book *De roze rand van donker Amsterdam. De opkomst van een homoseksuele kroegcultuur*, *1930-1970* ('The pink lining of dark Amsterdam. The emergence of a gay bar culture, 1930-1970'), Amsterdam: Van Gennep. 1992.

original results in set theory and second-order model theory"[9] and asked them to issue him a university ID, so that he could have access to university facilities. Kurtzman was another variation on the theme "smart and unusual young man" that Montague was so intrigued by. Kurtzman was born and grew up in Los Angeles. His gift for mathematics was already evident at North Hollywood High School where he took first place in a math competition.

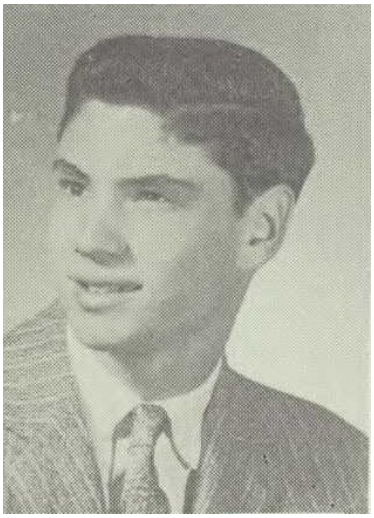

Photo 2. Barry Kurtzman, North Hollywood High School Yearbook, 1959.

He then went to MIT at age 17. This is how his classmate Jeremy Gold remembers him:

> [He] found the early work easy. He was fascinated by number theory, games, poker, pool, and all things probabilistic. Barry plunged into these pursuits, an easy thing to do at MIT. Focusing on games can get you into bad work habits, and after several semesters Barry flunked out. After leaving MIT he hung around Boston, writing microcode for Honeywell, and eventually got drafted. The army realized it had a fine technical mind in its ranks and set Barry to fixing typewriters. After that Jeremy lost touch with Barry, but heard about him later from an Australian folk singer named Carl Cleves, a member of a group called the Hottentots. Carl met Barry in the city of Zomba in Malawi in the late sixties. Barry had come from Cairo, southward bound, hitching rides, with little money but lots of time. He was still passionate about mathematics and whiled away the hot days solving geometry and algebra riddles

[9] Letter from M. to Frits Staal (cc to Arend Heyting), October 25, 1965. Heyting Arch, D1-39-2.

> from a well-worn math book. Carl spent weeks in the market and bars of Zomba, passionately debating African culture, philosophy, politics and travel with Barry. It was the late sixties and there was a revolution happening in the world, but Africa moved at a slower pace. Carl described Barry as an American sadhu, bigbearded [sic!], bighearted, ringwormed on both feet, but continuing on his quest. Barry continued to journey around Africa, visiting the strife torn Sudan, Libya, and Kenya.[10]

Kurtzman must have returned to Los Angeles at some point after dropping out of MIT and met Montague. He took Montague's graduate seminar on metamathematics in Spring 1963[11] and Montague called him his student in the acknowledgments of a paper he was working on around that time.[12] Kurtzman was drafted in 1964 because of the Vietnam war. Montague wrote to Staal that Kurtzman would "be released from the U.S. Army in Europe at about the time the appointment is to commence"[13], i.e., in January 1966. Was it an actual release or desertion? Kurtzman did not return to the U.S. with Montague, but traveled in Europe. He was back in Amsterdam at the beginning of 1967, using the Institute as an illegal sleeping place. When he was kicked out by a guard, he stayed with Kees Doets, a student he had met the year before in Montague's class, collected some money, and then left, probably for Africa. There he met with Carl Cleves, who introduces him in his book as "an American G.I. who had deserted the Vietnam War and found refuge in Africa."[14] While hired by Montague, Kurtzman attended one of his classes in Amsterdam. Montague thanked him in a second paper he was working on then.[15] Kurtzman was introduced by Montague as his "assistant" or "secretary", and was invited to parties with Montague. The two shared Staal's apartment when Montague moved in at the end of April. If Kurtzman had actually deserted and Montague knew about it, the UCLA professor may have felt some special satisfaction in having a U.S. deserter on the U.S. government's payroll through his NSF grant.

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[10] Mike Bertin, *MIT Class of 1963, Class Notes for September 2004 issue of Technology Review*. http://freepages.college-alumni.rootsweb.ancestry.com/~westside1959/MIT1963/memory.shtml#Kurtzman. Accessed on August 1, 2017.

[11] M.b7.f7

[12] R. Montague, 'Reductions of Higher-Order Logic.' In J.W. Addison, L. Henkin, A. Tarski, *The Theory of Models. Proceedings of the 1963 International Symposium at Berkeley*, pp. 251–264, North-Holland, 1965.

[13] Letter from M. to Frits Staal, November 10, 1965. Heyting Arch.D1-42

[14] Carl Cleves, *Tarab: Travels with my guitar*, Revised and expanded e-book edition. Transit Lounge Publishing, Yarraville, Australia. 2014 (no page numbering). Kurtzman will be back in Los Angeles as a UCLA math major in 1968-19, when he took Alonzo Church's undergraduate class on philosophy of language.

[15] R. Montague, 'Recursion Theory as a branch of Model Theory.' In B. van Rootselaar & J.F. Staal, *Logic, Methodology and Philosophy of Science III,* pp. 63-68, North-Holland, 1968.

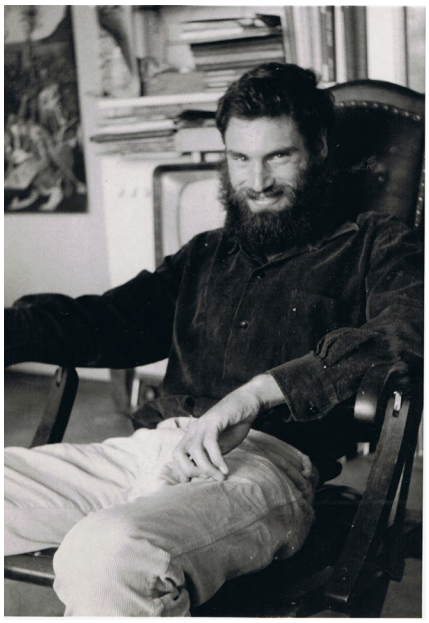

Photo 3. Barry Kurtzman, Amsterdam, about 1967.
By permission of Kees Doets.

Montague received several invitations for lectures, but declined most of them, including one in Manchester from his friend Robin Gandy, the logician and mathematician who had studied under Alan Turing.[16] He did accept an invitation to Stockholm by his younger colleague and friend the logician Dag Prawitz in the second week of March. He gave two lectures. One was on pragmatics, a new framework and a new kind of logic Montague was developing and would soon be using for his work on natural language meaning. We will talk more about it in the next chapter. The other lecture was on a different logical topic: the unprovability of consistency. He had thought to talk about the other main interest of his in those days: recursion theory as a branch of model theory. But, as he wrote to Prawitz, "I haven't been able to work much; and though I've made some progress on general recursion, I can't be sure I'll have enough."[17] He considered going to Stockholm by car, but Prawitz dissuaded him: it would take two full days each way of driving in winter weather. He flew, instead.

Once back in Amsterdam, Staal organized a big party at his place to celebrate Montague's visit. Montague also met with Henry Hiż (1917-2006), a professor of linguistics at the University of Pennsylvania. They wrote each other like friends: "Dear Dick, I will be in

[16] Letter from Robin Gandy to M., May 26, 1966. M.b21.f1; Letter to Robin Gandy, August 23, 1966. M.b21.f1
[17] Letter from M. to Dag Prawitz, Febryary 24, 1966. M.b34.f3

Amsterdam March 27–29 and would enjoy seeing you", "Dear Henry, I'm looking forward to seeing you".[18] They may have met through Tarski, since the young Hiż took classes with Tarski when they were both still in Poland. Or through Quine, who was Hiż's Ph.D. supervisor at Harvard.

The second and final invitation he accepted in Europe was a long trip to London in June, once he completed his teaching in Amsterdam. He repeated the pragmatics lecture in front of the British Association for the Philosophy of Science at University College in London on June 13. Right before and right after, he gave four lectures on "Introduction to model theory" at the London School of Economics, invited by his dear friend the epistemologist Imre Lakatos (1922-1974). Lakatos advertised his friend's lectures broadly ("quite a few people will come from Oxbridge and Bristol"[19]) and, probably knowing his presentation style and standards, begged him to "be as elementary as you can be"[20] for his students' sake. Montague must have found the opportunity to convey interest in moving to England to Richard Wollheim (1923-2002) in the philosophy department at University College, who then wrote him a very encouraging letter about joining his department.[21] After his lectures, Montague spent some more time in England before returning home on June 23rd. He left from London on a Norwegian liner that brought him back to Los Angeles together with his new car in twenty days, with a stop in the Caribbean islands and the crossing on the Panama Canal.[22]

Before leaving Amsterdam, Montague had carefully prepared all his papers, books, and documents and had given instructions to Mrs. Heldring, the secretary at the Institute of Foundations, to send everything by airmail. The university questioned the need for expensive airmail shipping, so Mrs. Heldring, together with the Institute Acting Director Dr. J.J.A. Mooij, opted for the much cheaper surface mail service, knowing that Montague would not be back home anytime soon anyway. When Montague arrived in Los Angeles and found out that his material had not yet arrived because his instructions had been disobeyed, he lost his temper and wrote a frustrated and anxious letter to Mrs. Heldring, dated July 20, that starts with: "This is terrible, terrible! I can hardly believe that you and Mr. Mooij could have deliberately contravened my instructions to send a part of my papers (very carefully separated) by air. I have already been in Los Angeles without my papers for a week and have been in great anxiety as to their whereabouts."[23] He goes on and on conveying his anxiety

[18] Letter from Henry Hiż to M., March 10, 1966; letter to Henry Hiż, March 15, 1966. Both in M.b21.f2
[19] Letter from Imre Lakatos to M., January 18, 1966, M.b22.f16
[20] Letter from Imre Lakatos to M., March 25, 1966, M.b22.f16
[21] Letter from Richard Wollheim to M., June 26, 1966. M.b21.f1.
[22] Letter from M. to Frits Staal, October 10, 1966. M.b20.f12. Travel information material. M.b35.f10
[23] Letter from M. to H. Heldring, July 20, 1966. M.b21.f1

and informing Mrs. Heldring that his papers also included urgent tax documents and extremely important material for his various academic duties. He asks for the precise shipping date and address and urges Mrs. Heldring and Dr. Mooij to mobilize themselves and, if needed, Staal in England and his student Hans Kamp's important father somewhere in Holland in order to stop the surface shipping wherever it was and convince the university that it had to be replaced with airmail. One week after the letter, Montague sent a laconic telegram: "Parcel just arrived. Everything fine. Please forgive my hasty letter. Richard Montague."[24] More than fifty years later Mooij still remembered that episode vividly.[25]

A seminar that triggered a major change

Montague taught two classes in Amsterdam, mainly between February and March. They were both graduate classes that met once a week.[26] One was a course on "Gödel theory and its generalizations" on Monday from 2 to 5 pm starting on January 31. It resembled the graduate course on metamathematics he had taught at UCLA the semester before.[27] The references listed in the syllabus are the last chapter of Quine's *Mathematical Logic* on Gödel's incompleteness theorem and Tarski's indefinability theorem and the 1953 monograph *Undecidable Theories* by Tarski, Mostowski, and Robinson. The latter was about theories "for which no effective step-by-step procedure can be found to tell whether or not a statement is provable from its axioms.[28]" The students who attended it, no more than ten, felt that the seminar was above their heads and Montague's interests were more geared towards the details of the complicated formalism rather than students' understanding and grasping the broader picture. Still Montague was friendly. He often proposed to the students to go for drinks at a nearby terrace after class and spent time talking to them.[29]

The other class was completely new, instead. It is likely that it was also the trigger of a significant broadening of Montague's research interests. Only two years before Amsterdam, in the introduction to his logic textbook, he was of the opinion that "[the] systematic exploration of the English language, indeed of what might be called the 'logic of ordinary English', […] would be either extremely laborious or impossible. In any case, the authors of

[24] Telegram from M. to H. Heldring, July 27, 1966. M.b21.f1
[25] Email message from J.J.A. Mooij on August 7, 2017.
[26] Heyting Archive, D1-49.
[27] M.b4.f3-4
[28] A.Burdman Fefereman and S. Feferman, *Alfred Tarski. Life and Logic,* p. 192. Cambridge University Press, 2004
[29] Email message from Kees Doets, October 10, 2015; email message from Erik Krabbe, October 16, 2015.

the present book would not find it rewarding.[30]" One year after Amsterdam, Montague had completed a 180 degree intellectual turn: "There is philosophic interest in attempting to analyze ordinary English."[31] In particular, "the syntax and semantics of certain not insignificant fragments of English can be treated just as formally and precisely as those of the first-order predicate calculus, and in very much the same manner. No adequate treatment of this sort has yet been published; one has, however, been recently developed by my student J. A. W. Kamp and myself."[32] One more year, and he wrote his first seminal paper on natural language, which opens with the famous bold claim: "I reject the contention that an important theoretical difference exists between formal and natural languages."[33] In the first footnote of that paper, Montague explicitly recognizes that the seminar in Amsterdam was the initial trigger: "Some of the ideas in the present paper were adumbrated in seminar lectures in Amsterdam in January and February of 1966 […]". We will explore the development and the details of this new research project in the next chapter. For now, let's try to reconstruct its birth.

What was the seminar about that affected Montague so deeply? It was initially supposed to be another graduate class on logic. Staal came up with the suggestion to replace it with a seminar on philosophy of language that Montague and he would co-teach until February 20, when Staal left for a two-month trip to India.[34] The seminar met on Wednesday from noon to 2 pm. It started on Wednesday January 26, just one day after Montague had landed. Unlike the other class, it was geared more towards philosophers and linguists than logicians. It was announced as centered around *Word and Object* and some unspecified "other topics". *Word and Object* is the most famous book by the renowned Harvard philosopher and logician W.V.O. Quine (1908–2000), which was published in 1960. Montague had admitted in a letter to Staal that he had not read *Word and Object* yet, "although it concerns things in which I am much interested and I cannot think of a better choice for such a seminar."[35] The "other topics" turned out to be *Aspects of the Theory of Syntax*, the new book by the academic rising star and MIT linguist Noam Chomsky (born in 1928). This was the first time Montague was lecturing on Chomsky's work. Probably it was the first time he even read Chomsky's linguistic work. Staal, instead, had been interested in Chomsky and his theory of grammar early on, under the influence of Evert Beth, Staal's mentor and the leading Dutch logician, who had introduced

[30] R. Montague and D. Kalish, *Logic: Techniques of Formal Reasoning*, p.10, Harcourt, Brace & Wolt, 1964.
[31] R. Montague, 'On the nature of certain philosophical entities', p. 193, *The Monist*, 53(2):159–194, 1969.
[32] J. F. Staal (ed.),'Formal Logic and Natural Language', *Foundations of Language*, 5(2): 274, 1969.
[33] R. Montague, 'English as a formal language,' p. 189. In *Linguaggi nella società e nella tecnica*, pp. 189–223, Edizioni di Comunità, 1970.
[34] Letter from Frits Staal to M., January 3, 1966. Heyting Arch D1-4021
[35] Heyting Archive, D1-39-1.

and defended Chomsky's main ideas in Amsterdam and Holland since Chomsky's first groundbreaking book *Syntactic Structures* in 1957. Here is how Henk Verkuyl, one of the students who attended the seminar, remembered it:

> Staal together with Montague […] sat next to each other, and the lecture was, at that time, *Aspects of the Theory of Syntax*, which was very popular, and it was all the people could see, and Staal was in favor of that […]. They analyzed a sentence [like] *The man walked around the corner* […] And so they discussed the Verb, they discussed the Subject Noun Phrase, and they discussed the Directional Phrase—*around the corner*—Prepositions, etcetera, and the Tense, it was in the past tense, etcetera. What then happened was that Staal explained how this would be treated and analyzed in terms of *Aspects*, and Montague, he explained himself, on the blackboard. He was not good at talking. […] So, he wrote formulas, and it went on and on. I think that the role of Staal was to translate what happened on the blackboard to us.[36]

Chomsky's challenge

Aspects summarizes Chomsky's radically new view of linguistics and proposes detailed solutions to major syntactic issues. It contains several claims that probably captured Montague's attention since they would later directly or indirectly appear—and would be often criticized—in his work on natural language. Chomsky argues that earlier linguistics has not provided a fully detailed rule-based formal system describing Universal Grammar—those aspects of human language that all languages share. Traditional linguistics focused on describing peculiarities and exceptions distinguishing languages rather than commonalities unifying them. One crucial aspect that is common to all languages is their "creativity": each human language can produce a potentially infinite number of sentences and other complex expressions from a finite set of words and rules. Although the creative dimension of human languages had already been noticed and discussed at least a couple of centuries earlier, Chomsky highlights that previous linguistic theories did not focus on creativity and did not have the formal tools to handle it.

> But the fundamental reason for this inadequacy of traditional grammars is a more technical one. Although it was well understood that linguistic processes are in some

[36] Interview with Henk Verkuyl, Amsterdam, September 15, 2013.

> sense "creative," the technical devices for expressing a system of recursive processes were simply not available until much more recently. In fact, a real understanding of how a language can (in Humboldt's words) "make infinite use of finite means" has developed only within the last thirty years, in the course of studies in the foundations of mathematics. Now that these insights are readily available it is possible to return to the problems that were raised, but not solved, in traditional linguistic theory, and to attempt an explicit formulation of the "creative" processes of language. There is, in short, no longer a technical barrier to the full-scale study of generative grammars.[37]

A simple example of what Chomsky is referring to is provided by "clause embedding"—the property that human languages exhibit to allow for a clause to be part of a larger clause. The clause *Richard fainted* can be embedded inside the clause *Bob said Richard fainted*, which in turn can be embedded inside the clause *Don knows Bob said Richard fainted*, which can be embedded inside a clause like *Veronica claims Don knows Bob said Richard fainted* and so on. English grammar allows for this process to go on infinitely and create a potentially infinite number of clauses. This is similar to the set of natural numbers: each natural number is finite, but there is no largest one, and the set of all of the natural numbers is infinite. We need a "recursive" rule to capture this property of human language, that is, a rule that can keep applying to its output creating an unlimited number of loops. Intuitively, this rule must allow for an English clause to contain another clause in order to capture the nested sentences above. Formally, this rule can be written as a "phrase structure rule", a kind of formal rule Chomsky introduced in his 1957 book:

$$S \rightarrow NP\ V\ S$$

This rule is just a compact way to state that a clause or sentence (S) in English can be made of a Noun Phrase (NP) like *Bob* followed by a verb (V) like *said* and another clause (S) like *Richard fainted*. Since the symbol S appears to both the left and the right of the arrow, then the rule is recursive: it can apply to the S in its output and can keep doing that, producing a potentially infinite number of sentences. The reason why speakers don't go on producing extremely long clauses is due to limitations of a different nature: attention (we get bored or tired), memory (we forget), and human nature in general (we need to do other things like eating, sleeping, and finally dying).

Montague must have felt intellectually at home reading all this. His formal training in logic

[37] N. Chomsky, *Aspects of theory of syntax*, Ch. 1: Sec. 1.1, The MIT Press, 1965.

and mathematics had made him familiar with recursion and ways of capturing an infinite number of outputs out of finite sets of devices. Also, Chomsky's claim that intrinsic properties of human language could only be captured by adequate formal tools fully resonated with Montague's overall goal to develop logic as the tool to investigate and understand many — if not all — areas of knowledge, including those areas that, like language, concerned human capacities. While in Amsterdam, Staal had asked Montague to write a brief letter to explain to his department colleagues and the university administrators the need for more logic and more logicians in the philosophy department.

> On historical grounds, on the basis of contemporary applications, and in view of potential applications logic has to be regarded as a branch of philosophy and indeed an important one; and a philosophical education that does not include thorough training in logic must be considered unbalanced. In the light of the current status of philosophy I should suggest that at least one-fourth of the requirements at any stage in a philosophy program be devoted to logic. This is the situation in my home department of philosophy at the University of California at Los Angeles, and I believe at Harvard, the University of California at Berkeley, and several other major American universities. Yale is at present engaged in enlarging its logic program.
>
> I have my own ideas as to the nature of a good logic program, but it would be pointless to express them here. The exact nature of the courses and examinations required of the students should be worked out in consultation with Professor Curry, who will be primarily responsible for the program. (Let me only emphasize my agreement with Professor Grzegorczyk that some way should be found to make regular exercises obligatory.) The important thing at this stage is to reserve sufficient space in the total pattern of requirements.
>
> By logic I mean what is sometimes called symbolic logic (including, among other things, set theory and metamathematics), and I use the term in such a way as not to include the independently interesting discipline of philosophy or methodology of science. I also do not mean to include Aristotelian logic, Stoic logic, and the like, which represent important stages of the development of modern logic, but belong now to the history of philosophy.[38]

Something else in Chomsky's work may have intrigued Montague. Only a couple of years earlier—as we saw—Montague had endorsed logicians' common view about natural

[38] Date is missing, but sometime in the winter or spring of 1966. Heyting Archive, D2

language: "[the] systematic exploration of the English language, indeed of what might be called the 'logic of ordinary English', […] would be either extremely laborious or impossible." One of the main reasons behind this pessimistic conclusion was the lack of a formal and complete rule-based system for describing which sentences are possible in a natural language and which are not, unlike what logicians and mathematicians are used to doing for logic or other formal languages. Chomsky was arguing that such a system could be formulated for natural language too, by means of phrase structure rules and other formal devices, and its precise definition should become the main goal of linguistics.

Aspects also discusses the role of semantics in linguistic theory, recognizing the lack of a fully developed semantic theory and highlighting some open issues.

> It is quite apparent that current theories of syntax and semantics are highly fragmentary and tentative, and that they involve open questions of a fundamental nature. Furthermore, only very rudimentary grammatical descriptions are available, for any language, so that no satisfactory answers can be given for many factual questions. Consequently, the problem suggested by the title of this section [*Degrees of grammaticalness*] can, for the present, be at best a source for speculation.[39]

> In general, one should not expect to be able to delimit a large and complex domain before it has been thoroughly explored. A decision as to the boundary separating syntax and semantics (if there is one) is not a prerequisite for theoretical and descriptive study of syntactic and semantic rules. On the contrary, the problem of delimitation will clearly remain open until these fields are much better understood than they are today. Exactly the same can be said about the boundary separating semantic systems from systems of knowledge and belief. That these seem to interpenetrate in obscure ways has long been noted. One can hardly achieve significant understanding of this matter in advance of a deep analysis of systems of semantic rules, on the one hand, and systems of belief, on the other. Short of this, one can discuss only isolated examples within a theoretical vacuum. It is not surprising that nothing conclusive results from this.[40]

When Chomsky talks about semantics and semantic rules, he has in mind the issues related to sentences like his famous *Colorless green ideas sleep furiously* from his 1957 book *Syntactic Structures*. This string of words sounds like a fully "grammatical" sentence of English,

[39] N. Chomsky, *Aspects of theory of syntax*, Ch. 4: Sec. 1.1, first paragraph, The MIT Press, 1965.
[40] N. Chomsky, *Aspects of theory of syntax*, Ch. 4: Sec. 1.2, last paragraph, The MIT Press, 1965.

although it is meaningless. In other words, it does not violate any rules of English syntax. Compare it with the string of the same words but in the reverse order: *Furiously sleep ideas green colorless*. The latter is both meaningless and ungrammatical. Clearly, the anomaly of *Colorless green ideas sleep furiously* is not a syntactic/grammatical one, but a semantic one. How could this be explained? Each word is stored in our lexicon—the areas of our mind/brain where information about lexical items is preserved—as a set of various "features" or pieces of information: from the way the word is pronounced to its morphological and syntactic properties all the way to its meaning. Chomsky proposes that each word comes with its own "semantic features"—specifications of basic semantic properties that word has. For instance, a word like *idea* will be stored in our mind/brain with features like [+abstract] and [–animate], among many others, meaning that we speakers know that *idea* refers to some entity that is abstract and is not animate. A word like *green*, instead, will be [±animate], a short way for saying that *green* is unspecified as far as animacy is concerned, since we speakers know that both animate and inanimate entities can be green, like frogs and emeralds. *Green* will also be [–abstract], since we speakers know that abstract entities don't have colors. Chomsky thinks that semantic features on a word have to match those of other words it is combined with by the syntactic structure it is part of. If these semantic "matching rules" are violated, the sentence sounds awkward. G*reen* and *idea* occur in the same Noun Phrase c*olorless green ideas* as in the sentence above: *ideas* acts as the core element of the Noun Phrase—the noun, while *green* is its closest adjectival modifier. The "semantic rules" impose full feature-sharing, but those two elements don't share the same features. As we just saw, *green* is [–abstract], while *idea* is [+abstract]. Therefore, semantic matching rules are violated and the whole sentence sounds awkward. *Colorless green ideas sleep furiously* contains many such violations.

Chomsky's view of semantics in *Aspects* was essentially the same as the one he had conveyed in *Syntactic Structures*: syntax and semantics are two independent dimensions of language that are governed by different principles.

> A serious discussion of [...] the question of dependency of syntax on semantics, awaits a development of the theory of universal semantics, that is, an account of the nature of semantic representation. Although various positions about these questions have been stated with great confidence and authority, the only serious work that I know of on the relation of these domains is that of Katz, Fodor, and Postal […]. For the moment, I see no reason to modify the view, expressed in Chomsky (1957) and elsewhere, that although, obviously, semantic considerations are relevant to the construction of general linguistic theory (that is, obviously the theory of syntax should be designed so that the syntactic structures exhibited for particular languages will support semantic interpretation), there is, at present, no way to show that

> semantic considerations play a role in the choice of the syntactic or phonological component of a grammar or that semantic features (in any significant sense of this term) play a role in the functioning of the syntactic or phonological rules. Thus no serious proposal has been advanced to show how semantic considerations can contribute to an evaluation procedure for such systems or provide some of the primary linguistic data on the basis of which they are selected.[41]

Chomsky's MIT colleagues Jerrold Katz, Jerry Fodor, and Paul Postal had just started developing the theory of semantics Chomsky was referring to. It was based on semantic features that were assigned to individual lexical items and rules to combine these features parallel to the way syntax combined the same lexical items into larger units or phrases. In this way, they could systematically derive the ambiguity of a sentence like *Richard went to the bank* from the lexical ambiguity of the word *bank*: a financial institution or the land alongside a river or a lake.[42] The only other form of ambiguity they mention is the syntactic one. *Bob saw a friend with binoculars* has two meanings because it has two different syntactic structures. When the Preposition Phrase *with binoculars* directly combines with the Noun *friend* as part of the Noun Phrase *a man with binoculars*, then the sentence means that Bob saw a friend who was carrying binoculars. On the other hand, when the Preposition Phrase *with binoculars* combines with the Verb Phrase *saw a friend*, then the sentence means that Bob saw a friend by means of binoculars. They were also concerned with accounting for semantic intuitions like synonymy: the fact two sentences that are different in their wording and syntactic structures may convey the same meaning. *Frits hosted Richard* and *Richard was hosted by Frits* is a typical example of a pair of synonymous sentences with the former being in the so-called "active form," while the latter in the so-called "passive form".

What semantics is really about

Montague must have nearly fallen off his chair when he read all this. Neither Chomsky nor his MIT colleagues seemed to care about other kinds of well-known ambiguities like "ambiguity of scope" and "opacity." Logicians cared about them a lot, instead, and Chapter 4 of Quine's *Word and Object* dedicates several pages to them. Interestingly, Chomsky was lecturing on *Word and Object* as well in those years, but was asking Barbara Partee and the other students in his new linguistics graduate program at MIT to read only the first two

[41] N. Chomsky, *Aspects of theory of syntax*, Ch. 3: note 15, The MIT Press, 1965.
[42] J. Katz and P. Postal, *An integrated theory of linguistic descriptions*, The MIT Press, 1964.

chapters in order to criticize Quine's endorsement of behaviorism that is presented there.[43] We will return to ambiguity of scope and opacity in the next chapter and discuss them in detail since they occupy a central place in the theory for natural language that Montague developed. Three examples suffice for now. First, the sentence *Every doctor visited a patient* can be interpreted as true in a situation in which every doctor visited at least one possibly different patient or in a situation in which there's a single special patient who every doctor took care to visit. Notice that if we change one of the two Noun Phrases, the ambiguity may disappear. *Every doctor visited the patient* is not ambiguous. Second, the sentence *Each thing that glisters is not gold*[44] is true in a situation in which no things that glister are gold or in a situation in which not everything that glisters is gold. If negation is removed, the resulting sentence is not ambiguous: *Each thing that glisters is gold*. These are examples of ambiguities of scope. Unlike the ambiguities the MIT scholars focused on, they do not contain words that are ambiguous nor have more than one syntactic structure each. Their ambiguity is triggered by the way the meaning of a certain kind of Noun Phrase interacts with the meaning of a different kind of Noun Phrase or the meaning of negation. Last, let's look at an example of opacity ambiguity. The sentence *Richard is looking for a friend* can be true in two very different situations: if Richard has a specific friend in mind and is looking for her or if Richard doesn't have a specific friend in mind and is just looking for any friend. The sentence is, therefore, ambiguous. Its ambiguity depends on its verb: *look for*. If the verb is changed to *write to*, the resulting sentence is no longer ambiguous. *Richard is writing to a friend* can only be true if Richard has a specific friend in mind and is writing to her.

Chomsky and his MIT colleagues were guilty of an even worse sin in Montague's eyes: they did not mention—let alone deal with—the empirical pillars, the core facts any respectable semantic theory had to be able to account for, according to Montague: truth and entailment. We are all familiar with truth and falsity. Most declarative sentences (aka "statements") are associated with the intuition that they are true or false under given circumstances. For instance, if Bob utters *Richard fainted*, this sentence will be true if and only if the person named Richard is among those who fainted before Bob uttered the sentence. If these conditions are not satisfied, my intuitions and yours are that the sentence is false in those circumstances.

What about the less familiar notion of entailment? If we know that the sentence *Richard fainted* is true, then we know for sure that the sentence *Somebody fainted* is true as well, while

[43] Email message from Barbara Partee, July 14, 2017.

[44] W.V.O. Quine, *Word and Object*, Ch. 4: §29, The MIT Press, 1960. Adapted from Shakespeare: "All that glisters is not gold." *The Merchant of Venice*, Act II, Scene vii (N.B.: Quine is adopting the original text with the spelling "glister", rather than "glitter").

we do not feel the same certainty about the truth of a sentence like *Everybody fainted*. In other words, in any situation in which we can think of *Richard fainted* as true, then we also have to think of *Somebody fainted* as true as well. Logicians say that *Richard fainted* entails *Somebody fainted* or, put another way, *Richard fainted* has *Somebody fainted* as one of its logical consequences.

We deal with issues about true or false sentences all the time from early on in our lives. How many times have we heard or said *It's true* or *It's a lie* or similar statements? They are specifically about the truth or falsity of sentences that were previously uttered. It is the same with entailments.

We calculate them all the time, even if we are not aware of it. If you visit your good friend Richard, who you trust fully, and he tells you that no food at his place contains meat or fish since he's fully vegetarian, then you know for sure that the sausage-looking food in his fridge is not made of meat (or fish), although Richard never told you that specifically. The reason why you are sure is because your mind just calculated an entailment. You know that everything at Richard's is vegetarian—your trustworthy friend just told you that. You also know that there's some sausage-looking food in Richard's fridge since you saw it with your own eyes. Therefore, your mind forces you to necessarily conclude that the sausage-looking food in Richard's fridge contains no meat or fish, even if nobody explicitly pointed that out.

Kids compute entailments too, constantly and early on. If I tell little Richie and his friends *Every kid is getting ice cream*, little Richie will be very happy and expect to receive an ice cream, although I didn't say *Richie is getting an ice cream*. But little Richie has computed the correct entailment. Ivano stated *Every kid is getting ice cream* as true, little Richie knows that he is a kid, that is, the sentence *Richie is a kid* is true. Therefore, *Richie is getting ice cream* must be true as well.

Truth and entailment had been core notions for natural and artificial languages for Montague since the very beginning of his training as a logician in Berkeley. He had written an entire logic textbook with Kalish to show which arguments are valid, that is, under which "rules" the truth of some sentences ("premises") entails the truth of other sentences ("conclusions"). Chomsky and his acolytes were on the wrong track in handling meaning in natural language. He could definitely do better than them, Montague must have thought.

Beyond Quine, and Russell too

Word and Object felt more like home for Montague. Quine's book exhibited the usual investigative strategy of logicians working on natural language in those years. Let's get

familiar with it to better appreciate the change Montague would introduce with his own work later. Logicians (including philosophers of language within the so-called analytical tradition) focused on specific constructions in natural language and translated them into expressions of some logical language whose interpretation was precisely defined. A classic example is the way they analyzed the meaning of a sentence like *Every logician is fallible* and the meaning of a sentence like *Quine is fallible*. The two sentences share the same simple syntactic structure. It can be described by the phrase structure rule:

$$S \rightarrow NP\ VP$$

This rule says that a sentence/clause (S) in English can be made of a Noun Phrase (NP) followed by a Verb Phrase (VP). The proper name *Quine* is the NP in one sentence, while the quantifier *every* followed and the common noun *logician* together form the NP in the other sentence. The same expression *is fallible* is the VP in both sentences. Despite their syntactic identity, logicians assigned very different interpretations to them. *Quine is fallible* asserts that the person the name *Quine* refers to has the property of making mistakes. They would translate this intuition in the language of logic as in (1):

(1) *Quine is fallible* $\rightsquigarrow$ F(q)

(1) is just a shortcut for the following: the sentence *Quine is fallible* in English translates ($\rightsquigarrow$) as the expression—"formula" in logical jargon—*F(q)* in first-order logic which says that the property of being fallible (*F*) applies to Quine (*q*).

On the other hand, *Every logician is fallible* asserts something very different: it states that for every logician x that you may consider, that logician x has the property of being fallible. In other words, if that sentence tells the truth, then you cannot find a logician that doesn't have the property of being fallible. If you find one, then the sentence is false. This intuition can be made explicit and precise with the logic translation in (2):

(2) *Every logician is fallible* $\rightsquigarrow \forall x\ [L(x) \rightarrow F(x)]$

(2) is just a shortcut for the following: the sentence *Every logician is fallible* translates into ($\rightsquigarrow$) the following logical expression: for every thing x ($\forall x$), if x has the property of being a logician (*L(x)*), then ($\rightarrow$) x has the property of being fallible (*L(x)*) as well.

Technicalities aside, the core aspect of this analysis is that in (1) the Noun Phrase *Quine* refers to a specific person, while in (2) the Noun Phrase *every logician* does not refer to anything, but introduces some form of counting or "quantification" affecting the interpretation of the entire sentence (for every thing x …). Logicians took this mismatch about syntax and

semantics as another instantiation of the "illogicality" of natural language with the consequent need to bring clarity by translating natural language into logic. One thing to notice is that logicians never provided a fully-explicit formal procedure—an algorithm—to link the English expression to the left of the curly arrow with the logic expression to the right. They used their own intuitions as native speakers of English and their own knowledge as logicians to go from English to logic. The complex process takes place privately in their minds and we are only provided with the final output. Montague's theory of semantics will challenge both the assumption and the practice by providing a full match between syntax and semantics and a fully detailed translation procedure from English (or, in principal, any natural language) to logic.

Back to Quine, his *Word and Object* contains many instantiations of the attitude towards natural language we just saw. The interpretation via logical translation for restrictive relative clauses is an important example. His core insight was adopted by Montague himself and has remained essentially the same until today. An example of a restrictive relative clause is the underlined string in *The students in my class who are Italian talk a lot*. What's the meaning of *who are Italian*? Quine argues that it is the same as the adjective *Italian* in *The Italian students in my class talk a lot*. They both refer to the same object: the set of human and non-human entities that are Italian in the given situation. When the adjective or the restrictive relative clause combines with the expression *student in my class* syntactically, it restricts the meaning of that expression from the set of all the students that are in my class to the subset of those that are in my class and are also Italian. This "restrictive" meaning can be assumed to be the basic meaning of the single word *Italian*, but needs to be derived step-by-step ("compositionally") for relative clauses. They are not made of a single word, but many words that are assembled together according to a complex syntactic structure. Quine is of course aware of the syntactic complexity of relative clauses and even describes an informal way to interpret a relative clause: it "is true of just those things which, if named in the place of the relative pronoun, would yield a true sentence."[45] So, in the case of *who are Italian*, Quine would say that it is an expression that is true of just those humans x such that x are Italian. Montague will develop this suggestion in prose into a fully explicit treatment of restrictive relative clauses that could in principle be turned into a computer program.

Quine's discussion of opacity and opaque verbs in *Word and Object* is another issue that intrigued Montague but also left him unsatisfied. Quine handles the opacity ambiguity of a sentence like our earlier example *Richard looked for a flying pig* by postulating that *look for* has two very different meanings. One of them assigns the sentence a meaning that Quine

[45] W.O.V. Quine, *World and Object*, Ch. 4: §23, The MIT Press, 1960.

would paraphrase as 'Richard endeavored (-to-cause) himself to find a flying pig', while the other assigns it the meaning 'Richard endeavored (-to-cause) himself and a (certain) flying pig to be related as finder and found.'[46]

Montague objects that this solution would postulate massive ambiguity in natural languages since there are plenty of predicates that behave like *look for* (*seek, want, wish, hunt*, etc.) and each of them trigger ambiguity only when combine with certain kinds of objects: *look for a flying pig* triggers ambiguity, while *look for the flying pig* does not. In other words, *look for a flying pig* is just one word with its fixed meaning for Quine, while *look for the flying pig* would be a completely unrelated different word. Montague is concerned that this strategy "would raise the psychological problem of explaining how a natural language containing infinitely many primitive predicate constants can be learned?"[47] with "primitive predicate constants" being the logician's way to label words like verbs.[48]

More broadly, Quine exemplified the typical attitude of logicians towards natural language: unlike logic, natural language is vague, ambiguous, messy, and in need to be brought to clarity and regimented by means of logic (*Regimentation* is indeed the title of Chapter 5 of *Word and Object*). Quine discusses various kinds of opacity and argues that they should all be "regimented" via the logic he is adopting, essentially first-order predicate calculus with quantification, a well-established and relatively simple form of logic. Montague must have found this decision highly unsatisfactory, as shown in his subsequent work. He was already developing a more complex logic as a better framework to conduct rigorous philosophical analysis in all areas. His closer encounter with natural language in his seminar in Amsterdam must have triggered the idea that his new logic was the perfect tool to analyze natural language as well and that he could definitely do better than Quine.

A more personal challenge?

Quine and Chomsky may have been responsible for Montague's interests in natural language for one more reason. Professor Quine was a 57-year-old towering figure among the logicians and the philosophers of his generation. From Harvard he dominated the East Coast logic landscape in the U.S., similar to what Tarski did on the West Coast. Montague knew Quine

[46] W.V.O. Quine, *World and Object*, Ch. 4: §32, The MIT Press, 1960.
[47] R. Montague, 'On the nature of certain philosophical entities', p. 174–175, *The Monist*, 53(2):159–194, 1969 [written in 1967].
[48] Montague's objection to Quine's approach also shows sensitivity to the learnability issues that Chomsky discusses in *Aspects*: a theory of natural language as to be such that it can be learned by a child who is exposed to a limited amount of data.

personally. They had participated at events together and sat on the same committees many times. Professor Chomsky was a 38-year-old MIT star and revolutionary thinker in linguistics and in other fields. It does not look like Chomsky and Montague ever met in person[49], though Montague may have seen Chomsky at the lectures Chomsky gave and the appearances he made at Berkeley or at UCLA in the 1960s.

Montague was slightly younger than Chomsky. He was a star in his department and at UCLA, which was an excellent public university, but not of the caliber of two institutions like Harvard and MIT. Within the field of logically-inclined philosophers of his generation, Montague ranked at the top. But he was ambitious and in need of further recognition. He was always eager to show that he could do better than other academics. Now he had the knowledge and the tool to do better than Quine and Chomsky, he must have thought. While Montague would always be respectful towards Quine despite his strongly divergent views on logic, he did not miss one opportunity to criticize Chomsky and his followers in any of his publications on natural language.

David Berlinski tells an anecdote that supports this picture. He had a brief encounter with Montague, probably a couple of years after Montague's sabbatical in Amsterdam. Dan Gallin, who was Berlinski's dear friend and Montague's student and friend, had arranged a drink for the three of them at a hotel bar in New York City. They started talking about taxes, politics, and New York City.

> Then the discussion turned to mathematics and Montague cheered up. He had just commenced his research program into formal grammars […]. He liked to imagine that he and Chomsky were rivals. "There are," he said, "two great frauds in the history of twentieth-century science. One of them is Chomsky." I reached for the peanuts. "And the other?" "Albert Einstein," Montague said decisively, glad that I had asked.[50]

[49] Interview with Noam Chomsky, Cambridge, MA, September 6, 2013.
[50] D. Berlinski, *Black Mischief*, 2nd ed., p. 77, Harcourt Brace Jovanovich, 1988.