



UNIVERSITATEA DIN BUCUREȘTI  
MELVIN FITTING

*Doctor Honoris Causa*

MELVIN FITTING  
DOCTOR HONORIS CAUSA





**THE  
GRADUATE  
CENTER**

CITY UNIVERSITY  
OF NEW YORK

*In the nineteenth and early twentieth centuries philosophy often came in big, comprehensive systems: Fichte, Hegel, Schopenhauer, even Marx and Freud, and others. Perhaps the post-modernists can be counted as late outliers in this tradition. Big scale philosophers aspired to a complete world view. In the popular mind this approach was simply identified with philosophy. In 1940, Richard Rodgers and Lorenz Hart wrote a Broadway Musical called "Pal Joey," perhaps their best. In it one character, based on the exotic dancer Gypsy Rose Lee, sings a song that contains the lines, "I was reading Schopenhauer last night, And I think that Schopenhauer was right." The assumption was that a Broadway audience would at least know a little of what Schopenhauer was about—or at least had heard the name.*

**Melvin Fitting**



Laudatio | Melvin Fitting

**Most distinguished guest, Professor Melvin Fitting,  
President of the Academic Senate, Professor Marian Preda,  
Distinguished Members of the Academic Senate,  
Distinguished guests, ladies and gentlemen,**

The University of Bucharest is extremely honored to accept today Professor Melvin Fitting, Emeritus, CUNY, and Lehman College, New York City, as one of our most distinguished members. The man whom we are conferring upon today the honorary degree of Doctor Honoris Causa is an outstanding personality of contemporary mathematical logic, a world-renowned philosopher of logics and academic who works in the forefront of contemporary logic and philosophy of logics. Professor Fitting proved himself exemplary in the areas of research, scholarship and teaching, in a career spanning more than fifty years. His primary field is mathematical logic, but his ground-breaking and pioneering work has had profound implications for domains of exact philosophy as well. In a profession which has the reputation of feeding itself with the substance of harsh criticism, and what I mean by this here, primarily, is philosophy, Professor Fitting is unanimously considered as one of the most profound and seminal contemporary logicians whose remarkable contributions starting from 1960s onwards have reshaped the agenda of many domains which are in the forefront of mathematical logic.

**Professor Melvin Fitting** is an American. He was educated at the well-known Rensselaer Polytechnic Institute, where he graduated from with a BS in mathematics, in 1963. Then, he pursued graduate studies at Yeshiva University, where he received an MA, and then a Ph.D. in mathematics, in 1968. He was a student of the legendary Raymond M. Smullyan, with whom he co-authored scientific work, amongst which a marvelous monograph which combines foundational results in mathematical logic (forcing, the continuum problem), with modal logic.

**Professor Fitting's teaching** career has been of the highest rank and it mirrors his outstanding scientific achievements and the highest standards of academic excellence. Thus, he held successively or concomitantly the following positions: Assistant and Associate Professor, 1968–1980, in the Department of Mathematics and Computer Science at both

Lehman College, and CUNY; then, a full Professor in the Department of Mathematics and Computer Science, at Lehman College, and CUNY, between, 1980–2013, then Emeritus; Professor, in the Department of Computer Science, Graduate School and University Center, CUNY, between 1986–2013, then Emeritus; Professor in the Department of Philosophy, Graduate School and University Center, CUNY, between 1987–2013, then Emeritus; Professor in the Department of Mathematics, Graduate School and University Center, CUNY, between 1988–2013, then Emeritus.

The success of a professor can also be measured by the number of his doctoral students that he supervised over the years, and that is 35.

On a rather personal note, I would like to add a subjective testimony. I have had the chance to attend several of Professor Fitting's classes at CUNY, the Graduate Center, way back, in 1998, thus some twenty years ago. More specifically, I attended a couple of classes on Incompleteness of Arithmetic, and I vividly recall how I was struck by his sheer virtuosity of the highest distinction. With very little technical fuss or hair, as they say in the field, Professor Fitting could convey the essence of some abstruse and intricate results which are of paramount importance for mathematical logic, with as much technicalities as needed, which in reality meant that he could tell the story of those very complicated issues with very few technical apparatus. With my musical background he made me think of those musical geniuses who can perform extremely difficult musical pieces exquisitely without leaving the impression of the real enormous technical difficulties of scales and arpeggios but emphasizing the beauty and simplicity of music itself, which is a mark of greatness.

One can easily see in Professor Fitting's career a golden combination of mathematics (logic), computer science, and philosophy, which is currently a true measure of genuine interdisciplinarity, which grows from the needs to address very complex issues in science. In his paper that Professor Fitting contributes to the booklet of *Laudatio* for this *Honorary Doctorate*, which is a true philosophical gem, Fitting is considering the issue of complexity and how to manage the vast panoply of logics with their fragmentation of theories, methods, and techniques. This development of logics parallels a similar process which occurred

over the last one hundred and fifty years in philosophy, and Fitting makes a very compelling connections between the two sciences showing that the *Zeitgeist* is not only *Small is Beautiful*, but that there is no other option to deal nowadays with complexity but using the strategy *Divide and Conquer*, both in logic and in philosophy.

**The wide interest in, the appreciation of, and the global recognition of Professor Fitting's work** have been proven by the awards that he received and by his being elected in numerous and very prestigious associations and learned societies. From amongst the many awards and distinctions that he has got I shall mention here only one, which is indeed of the highest magnitude, *the Herbrand Award*, 2012, for his pioneering work in computer science and logic, "in recognition of his outstanding contributions to tableau-based theorem proving in classical and non-classical logics, as well as to many other areas of Automated Reasoning, Logic Programming, and Philosophical Logic."

Melvin Fitting served in the Association for Computing Machinery, Association for Symbolic Logic, in the Executive Committee of Philosophy Department, Graduate Center, from 2008 to 2012; in the Executive Committee of Computer Science Department, Graduate Center, from 1988 to 1991, 1996 to 2002; in the Executive Committee of the Association for Symbolic Logic, from 1992 to 1995; in the Steering Committee of Tableaux Conferences, from 2000 to 2003. He has been an editor and a member of the Editorial Board, *Journal of Logics and their Applications* (ifCoLog); in the Editorial Board, *Journal of the IGPL*; an Editor for *Studia Logica*; in the Editorial Board, *Notre Dame Journal of Formal Logic*; in the Executive Editorial Board, *Journal of Logic and Computation*; an Area Scientific Editor, *Journal of Applied Logic*. He was a member of the Program Committee for *Advances in Modal Logic*, 2006, 2008, 2010, 2012, 2014, 2016; *Methods for Modalities (M4M)* 2009; *Tableau 2003*; *International Symposium on Many-Valued Logics*, Warsaw, Poland, 2001; *Tableau 1999*; *Logic in Computer Science*, 1999 *Computer Science Logic*, Brno, Czech Republic, 1998.

**The publications of Professor Melvin Fitting** are impressive and of an outstanding quality. For reasons which have to do with circumstances and time I shall focus on some of his brilliant achievements, only, which are some of his monographs and research books.

Sergei Artemov and Melvin Fitting. *Justification Logic: Reasoning with Reasons*. Cambridge Tracts in Mathematics Book 216. Cambridge University Press, 2019.

Melvin C. Fitting and Brian Rayman, eds. *Raymond Smullyan on Self Reference*. Vol. 14. Outstanding Contributions to Logic. Springer, 2018. ISBN: 978-3-319-68731-5.

Melvin C. Fitting. *Incompleteness in the Land of Sets*. (Portuguese translation, Incompletetude Na Terra dos Conjuntos, by Jaime Ramos, May 6, 2013.) College Publications, 2007.

Melvin C. Fitting and Ewa Orłowska, eds. *Beyond Two: Theory and Applications of Multiple-Valued Logic*. Springer-Verlag, 2003.

Melvin C. Fitting. *Types, Tableaus, and Goedel's God*. Errata at <http://melvinfitting.org/errata/errata.html>. Kluwer, 2002.

Melvin Fitting, Konstantinos Georgatos, and Ram Ramanujam, eds. *Festschrift on the occasion of Prof. Rohit Parikh's sixtieth birthday*. Vol. 96. Annals of Pure and Applied Logic. 1999.

Melvin C. Fitting and Richard Mendelsohn. *First-Order Modal Logic*. Paperback, 1999. Errata at <http://melvinfitting.org/errata/errata.html>. Kluwer, 1998.

Melvin C. Fitting. *First-Order Logic and Automated Theorem Proving*. First edition, 1990. Errata at <http://melvinfitting.org/errata/errata.html>. Springer-Verlag, 1996.

Raymond M. Smullyan and Melvin C. Fitting. *Set Theory and the Continuum Problem*. Revised edition, Dover Publications, 2010. Errata at <http://melvinfitting.org/errata/errata.html>. Oxford University Press, 1996.

Melvin C. Fitting. *Computability Theory, Semantics and Logic Programming*. Japanese edition, Maruzen Co, Tokyo, 1989. Oxford University Press, 1987.

Melvin C. Fitting. *Proof Methods for Modal and Intuitionistic Logics*. Dordrecht: D. Reidel Publishing Co., 1983.

Melvin C. Fitting. *Fundamentals of Generalized Recursion Theory*. Amsterdam: North- Holland Publishing Co., 1981.

**Melvin Fitting's views on logics** and the combination of techniques and tools coming from set theory, mathematical logic, philosophical logics (notably, many-valued logics, modal logics, intuitionistic logics) have had a great influence on the direction of contemporary logics and of their application in automated theorem proving and reasoning, theoretic computer science, recursion theory, in the last fifty years. His work has profoundly impacted the fields in which he has worked and his books and papers are already classics of the domain.

**Having in view all this, the Faculty of Mathematics and Computer Science (Informatics) in concert with the Faculty of Philosophy** consider that by bestowing the degree of Doctor Honoris Causa of the University of Bucharest upon Professor Melvin Fitting, they will contribute to the furtherance of the scientific and academic prestige of our University, by including into the intellectual elites of the recipients of this prestigious honorary degree a first-rate personality of the scientific and academic American community. By conferring this honorary doctorate to Professor Melvin Fitting, I am confident that we will also develop the academic and scientific relationships between the University of Bucharest and City University of New York, the Graduate Center, and Lehman College, as well as the cultural and scientific relationships between Romania and the United States.

Professor Mircea Dumitru  
Rector, University of Bucharest  
Corresponding member of the Romanian Academy  
Fellow, Academia Europaea



• Curriculum vitae | Melvin Fitting

Department of Mathematics  
and Computer Science  
Lehman College  
City University of New York  
Bedford Park Boulevard West  
Bronx, NY 10468-1589  
Emeritus since February, 2013

Departments of Computer Science,  
Philosophy, Mathematics  
The Graduate School and University Center  
City University of New York  
365 Fifth Avenue  
New York, NY 10016-4309  
Emeritus since February, 2013

## E-mail and Telephone

Office Graduate Center: (212) 817-8653  
Home: (914) 461-3475  
Mobile: (914) 548-6655  
E-Mail: melvin.fitting@gmail.com  
melvin.fitting@lehman.cuny.edu  
Web Page: melvinfitting.org

## Education

Rensselaer Polytechnic Institute, B.S. in mathematics, 1963.  
Yeshiva University, M.A., Ph.D. in mathematics, 1968.

## Professional Activities

**Membership** Association for Computing Machinery, Association for Symbolic Logic

**Executive Committee** Philosophy, Graduate Center, from 2008 to 2012

**Executive Committee** Computer Science, Graduate Center, from 1988 to 1991, 1996 to 2002

**Executive Committee** Association for Symbolic Logic, from 1992 to 1995

**Steering Committee** Tableaux Conferences, from 2000 to 2003

### Editor

Editorial Board, *Journal of Logics and their Applications (ifCoLog)*

Editorial Board, *Journal of the IGPL*

Editor, *Studia Logica*, ended 2018

Editorial Board, *Notre Dame Journal of Formal Logic*

Executive Editorial Board, *Journal of Logic and Computation*

Area Scientific Editor, *Journal of Applied Logic*

### Program Committee

Advances in Modal Logic 2016

Advances in Modal Logic 2014

Advances in Modal Logic 2012  
Advances in Modal Logic 2010  
Methods for Modalities (M4M) 2009  
Advances in Modal Logic 2008  
Advances in Modal Logic 2006  
Tableau 2003  
International Symposium on Many-Valued Logics, Warsaw, Poland, 2001  
Tableau 99, 1999  
Logic in Computer Science, 1999  
Computer Science Logic, Brno, Czech Republic, 1998  
Tableau 98, Oisterwijk, the Netherlands, 1998

## Employment

Department of Mathematics and Computer Science, Lehman College, CUNY,  
Asst. and Assoc. Professor, 1968 – 1980.  
Department of Mathematics and Computer Science, Lehman College, CUNY,  
Professor, 1980 – 2013, then Emeritus.  
Department of Computer Science, Graduate School and University Center, CUNY,  
Professor, 1986 – 2013, then Emeritus.  
Department of Philosophy, Graduate School and University Center, CUNY,  
Professor, 1987 – 2013, then Emeritus.  
Department of Mathematics, Graduate School and University Center, CUNY,  
Professor, 1988 – 2013, then Emeritus.

Department of Philosophy, Graduate School and University Center, CUNY,  
Adjunct Professor, Fall 2013.  
Department of Philosophy, Graduate School and University Center, CUNY,  
Adjunct Professor, Fall 2015.

## Recent Talks (Invited, unless otherwise noted)

New York City, Association for Symbolic Logic, 2019 North American Annual Meeting, Session  
on Proof Theory: Justification Logic, May 2019.

China. Tsinghua meets CUNY, and Asian Workshop on Philosophical Logic (AWPL), Beijing,  
October 2018

Germany, Doxastic Agency and Epistemic Logic, Ruhr-University, Bochum, December 2017.

China. Non-Classical Modal and Predicate Logics. Sun-Yat Sen University, Guangzhou, December  
2017.

Russia. Workshop on Proof Theory, Modal Logic, and Reflection Principles. Steklov Institute,  
Moscow, October 2017. Also National Research University Higher School of Economics –  
School of Philosophy, October 2017.

Poland. Concurrency, Specification, and Programming Workshop, Special Session – memorial of Helena Rasiowa, September 2017.

Taiwan. Academia Sinica, Taipei, February 24, 2017. National Chung-Cheng University, Chiayi, March 1, 2017.

Łódź, Poland, Eighth International Conference on Non-Classical Logics, Theory and Applications, September 5 – 7, 2016.

Helsinki, Finland, Modalities, Conditionals, and Values, A Symposium on Philosophical Logic in Celebration of the Centenary of Georg Henrik von Wright, May 23-25, 2016.

Tbilisi, Republic of Georgia, TbiLLC 2015: Eleventh International Tbilisi Symposium on Language, Logic and Computation, September 21 – 26, 2015.

Boğaziçi University, Department of Philosophy, Istanbul, Turkey, June 29, 2015.

UNILOG 2015, University of Istanbul, Istanbul, Turkey, June 20 - 30, 2015.

Logica 2015, Hejnice, Czech Republic, June 15 - 19, 2015.

Mexico City, Mexico; Proof Theory, Modal Logic and Reflection Principles Workshop, September 29 - October 2, 2014.

Vienna, Austria; Vienna Summer of Logic; Logic, Algebra, and Truth Degrees, June 18, 2014.

Roskilde, Denmark; Mathematical Reflections, May 20, 2014.

Lund, Sweden; Modality and Modalities, May 24, 2014.

Bucharest, Romania, Simion Institute of Mathematics of the Romanian Academy, March 26, 2014. University of Bucharest, Faculty of Philosophy, March 27, 2014.

Logical Foundations of Computer Science, San Diego, CA, January, 2013.

Kanazawa, Japan, November 2, 2012.

Taiwan, October 17, 18, 19, 2012.

Computational Logic, A 70th Birthday Celebration Honoring Melvin Fitting, Graduate Center, CUNY, October 2012.

The Constructive in Logic and Applications, A Conference in Honor of the 60th Birthday of Sergei Artemov, Graduate Center, CUNY, May 2012.

Colloquium, Bern Switzerland. September 2012.

Evening Lecture, ESSLLI (European Summer School on Logic, Language, and Information), Opole, Poland, August 2012.

Birkbeck College, Seminar on Computation and Intensional Logic, London, England, June 2012.

Workshop on Explicit Mathematics, Operational Set Theory, and Justification Logics, Bern, Switzerland, June 2012.

M4M (Mathematics for Modalities), Osuna, Spain, November 2011.

Gentzen Systems and Beyond, Workshop with Tableaux 2011, Bern, Switzerland, July 2011.

Department of Philosophy, Tsing-Hua University, Hsinchu City, Taiwan, June 2010.

Department of Philosophy, Chung-Cheng University, Chiayi City, Taiwan, June 2010.

This Conference Needs No Title, a 90th Birthday Celebration Honoring Raymond Smullyan, CUNY Graduate Center, December, 2009.

Automated Deduction Day, Loria, Nancy, France, July 2009.

Roskilde University, Computer Science Department, Roskilde, Denmark, April 2009.

University of Bucharest, Philosophy Department, Bucharest, Romania, October 2008.

Computer Science Russia, Moscow, Russia, June 2008, contributed.

International Workshop on Truth Values, Dresden, Germany, May-June 2008.

Kripke Center Opening, Graduate Center, CUNY, May 2008.

The Tenth International Symposium on Artificial Intelligence and Mathematics, Fort Lauderdale, Florida, January 2008.

Logical Foundations of Computer Science, New York City, NY, June 2007, contributed.

Towards Mathematical Philosophy, Trends in Logic IV, Torun, Poland, September 2006.

International Computer Science Symposium in Russia, St. Petersburg, Russia, June 2006.

India Institute of Technology, Winter School, Mumbai, India, January 2006.

PLS, 5<sup>th</sup> Panhellenic Logic Symposium, Athens, Greece, July 2005.

WoLLIC, 12<sup>th</sup> Workshop on Logic, Language, Information and Computation, Florianópolis, Brazil, July 2005.

Logica Conference, Czech Republic, June 2004.

University of Liverpool, Liverpool, UK, June 2004.

Tel Aviv, Israel, March, 2004

## Grants

NSF Award, Justification Logics and Applications, CCF-0830450, with Sergei Artemov and Elena Nogina, 2008 – 2011, \$374,996.

CUNY Collaborative Incentive Research Grant, CIRG 1424, Justification Logic and Applications, with Sergei Artemov of the Graduate Center, 2007 – 2008, \$40,000.

PSC-CUNY Award 664330, Many-Valued Non-Monotonic Logics, 1993 – 1994, \$2519.

NSF Award CCR-9104015, Theory and Applications of Bilattices, 1991 – 1993, \$118,818.

NSF Award CCR-8901489, Bilattice Based Logic Programming Languages, 1989 – 1991, \$124,923.

PSC-CUNY Award 668283, Logic Programming Generalizations, 1988 – 1989, \$11,997.

NSF Award CCR-8702307, Semantics of Logic Programming, 1987 – 1989, \$109,968.

PSC-CUNY Award 667295, Semantics of Logic Programming, 1987 – 1988, \$3200.

PSC-CUNY Award 666396, Proflog, 1986 – 1987, with Ken McAloon, \$4200.

## Awards

Faculty Award for Research and Scholarship, Lehman College, 1993, \$1000

Lehman College Foundation Faculty Advancement Award, 1999–2000, \$15,000

Herbrand Award, 2012, “in recognition of his outstanding contributions to tableau-based theorem proving in classical and non-classical logics, as well as to many other areas of Automated Reasoning, Logic Programming, and Philosophical Logic.”

## PhD Students

Jan Andrzej Plaza, Fully Declarative Programming with Logic–Mathematical Foundations, 1990

Ruili Ye, Belief, Names and Modes of Presentation: A First-Order Logic Formalization, 1999

## Speeches

- [1] Melvin C. Fitting. *Raymond Merrill Smullyan*. Internet at [https://www.researchgate.net/publication/319171690\\_Raymond\\_Merrill\\_Smullyan](https://www.researchgate.net/publication/319171690_Raymond_Merrill_Smullyan). Eulogy given at *Remembering Raymond*, April 27, 2017, CUNY Graduate Center. 2017. DOI: 10.13140/RG.2.2.26513.53605.
- [2] Melvin C. Fitting. *CADE Speech*. Internet at <http://melvinfitting.org/FittingCADESpeech.pdf> and [https://www.researchgate.net/publication/312976559\\_Herbrand\\_Award\\_acceptance\\_speech](https://www.researchgate.net/publication/312976559_Herbrand_Award_acceptance_speech). Given on the occasion of receiving the Herbrand Award. 2012. DOI: 10.13140/RG.2.2.26780.69765.

## Publications — Books

- [1] Sergei Artemov and Melvin Fitting. *Justification Logic: Reasoning with Reasons*. Cambridge Tracts in Mathematics Book 216. Cambridge University Press, 2019.
- [2] Melvin C. Fitting and Brian Rayman, eds. *Raymond Smullyan on Self Reference*. Vol. 14. Outstanding Contributions to Logic. Springer, 2018. ISBN: 978-3-319-68731-5.
- [3] Melvin C. Fitting. *Incompleteness in the Land of Sets*. (Portugese translation, *Incomplete-tude Na Terra dos Conjuntos*, by Jaime Ramos, May 6, 2013.) College Publications, 2007.
- [4] Melvin C. Fitting and Ewa Orłowska, eds. *Beyond Two: Theory and Applications of Multiple-Valued Logic*. Springer-Verlag, 2003.
- [5] Melvin C. Fitting. *Types, Tableaus, and Gödel’s God*. Errata at <http://melvinfitting.org/errata/errata.html>. Kluwer, 2002.

- [6] Melvin Fitting, Konstantinos Georgatos, and Ram Ramanujam, eds. *Festschrift on the occasion of Prof. Rohit Parikh's sixtieth birthday*. Vol. 96. Annals of Pure and Applied Logic. 1999.
- [7] Melvin C. Fitting and Richard Mendelsohn. *First-Order Modal Logic*. Paperback, 1999. Errata at <http://melvinfitting.org/errata/errata.html>. Kluwer, 1998.
- [8] Melvin C. Fitting. *First-Order Logic and Automated Theorem Proving*. First edition, 1990. Errata at <http://melvinfitting.org/errata/errata.html>. Springer-Verlag, 1996.
- [9] Raymond M. Smullyan and Melvin C. Fitting. *Set Theory and the Continuum Problem*. Revised edition, Dover Publications, 2010. Errata at <http://melvinfitting.org/errata/errata.html>. Oxford University Press, 1996.
- [10] Melvin C. Fitting. *Computability Theory, Semantics and Logic Programming*. Japanese edition, Maruzen Co, Tokyo, 1989. Oxford University Press, 1987.
- [11] Melvin C. Fitting. *Proof Methods for Modal and Intuitionistic Logics*. Dordrecht: D. Reidel Publishing Co., 1983.
- [12] Melvin C. Fitting. *Fundamentals of Generalized Recursion Theory*. Amsterdam: North-Holland Publishing Co., 1981.
- [13] Melvin C. Fitting. *Intuitionistic Logic Model Theory and Forcing*. Amsterdam: North-Holland Publishing Co., 1969.

## Publications — Book Chapters

- [1] Melvin C. Fitting. “Ewa Orłowska on Relational Methods in Logic and Computer Science”. In: ed. by Joanna Golińska-Pilarek and Michał Zawidzki. Vol. 17. Outstanding Contributions to Logic. Cham, Switzerland: Springer, 2018. Chap. Tableaus and Dual Tableaus (chapter 5), pp. 105–128.
- [2] Melvin C. Fitting. “Introduction to Formal Philosophy”. In: ed. by Sven Ove Hansson and Vincent F. Hendricks. Springer Undergraduate Texts in Philosophy. Cham, Switzerland: Springer, 2018. Chap. Necessity and Possibility (chapter 15), pp. 323–331.
- [3] Melvin C. Fitting. “Raymond Smullyan on Self Reference”. In: ed. by Melvin Fitting and Brian Rayman. Vol. 14. Outstanding Contributions to Logic. Springer, 2017. Chap. Introduction, pp. 1–22.
- [4] Melvin C. Fitting. “Raymond Smullyan on Self Reference”. In: ed. by Melvin Fitting and Brian Rayman. Vol. 14. Outstanding Contributions to Logic. Springer, 2017. Chap. Russell’s paradox, Gödel’s theorem, pp. 47–66.
- [5] Melvin C. Fitting. “Elementary!” In: *Four Lives, A Celebration of Raymond Smullyan*. Ed. by Jason Rosenhouse. Dover Publications, 2014, pp. 77–86.
- [6] Sergei N. Artemov and Melvin C. Fitting. *Justification Logic*. Ed. by Edward N. Zalta. 2011, revised 2015. URL: <http://plato.stanford.edu/entries/logic-justification/>.
- [7] Melvin C. Fitting. “Epistemic Logic”. In: *Epistemic Logic, 5 Questions*. Ed. by Olivier Roy Vincent F. Hendricks. Automatic Press, 2010. Chap. 8, pp. 83–92.
- [8] Melvin C. Fitting. “Modal Proof Theory”. In: *Handbook of Modal Logic*. Ed. by Patrick Blackburn, Johan van Benthem, and Frank Wolter. Elsevier, 2007. Chap. 2, pp. 85–138. URL: <http://www.csc.liv.ac.uk/~frank/MLHandbook/>.

- [9] Melvin C. Fitting. “Bilattices are nice things”. In: *Self-Reference*. Ed. by Thomas Bolander, Vincent Hendricks, and Stig Andur Pedersen. Center for the Study of Language and Information, 2006. Chap. 3, pp. 53–77.
- [10] Melvin C. Fitting. *Intensional Logic*. Ed. by Edward N. Zalta. 2006, revised 2015. URL: <http://plato.stanford.edu/entries/logic-intensional/>.
- [11] Melvin C. Fitting. “Formal Methods”. In: *Formal Philosophy*. Ed. by Vincent F. Hendricks and John Symons. Automatic Press, 2005. Chap. 4, pp. 27–33.
- [12] Melvin C. Fitting. “Intensional Logic—Beyond First Order”. In: *Trends in Logic: 50 Years of Studia Logica*. Ed. by Vincent F. Hendricks and Jacek Malinowski. Kluwer Academic Publishers, 2003, pp. 87–108.
- [13] Melvin C. Fitting. “First Order Alethic Modal Logic”. In: *A Companion to Philosophical Logic*. Ed. by Dale Jacquette. Malden, MA: Blackwell, 2002. Chap. 27, pp. 410–421. ISBN: 0-631-21671-5.
- [14] Melvin C. Fitting. “Introduction”. In: *Handbook of Tableau Methods*. Ed. by Marcello D’Agostino et al. Oxford University Press, 1998. Chap. Introduction, pp. 1–43.
- [15] Melvin C. Fitting. “Basic modal logic”. In: *Handbook of Logic in Artificial Intelligence and Logic Programming*. Ed. by Dov M. Gabbay, C. J. Hogger, and J. A. Robinson. Vol. 1. Oxford University Press, 1993, pp. 368–448.
- [16] Melvin C. Fitting. “Modal logic should say more than it does”. In: *Computational Logic, Essays in Honor of Alan Robinson*. Ed. by Jean-Louis Lassez and Gordon Plotkin. Cambridge, MA: MIT Press, 1991, pp. 113–135.

## Publications — Articles

- [1] Melvin C. Fitting. “A Family of Strict/Tolerant Logics”. In progress. 2019.
- [2] Melvin C. Fitting. “De Re, De Dicto, and Binding Modalities”. To appear. 2019.
- [3] Melvin C. Fitting. “The Strict/Tolerant Idea and Bilattices”. To appear in Springer series on Outstanding Contributions to Logic, Arnon Avron. 2019.
- [4] Melvin C. Fitting. “What Are Justification Logics?” In: *Fundamenta Informaticae* 165 (2019), pp. 193–203. DOI: DOI10.3233/FI-2019-1782.
- [5] Melvin C. Fitting. “In Memory of Raymond Smullyan”. In: *Logic Around the World*. Ed. by Massoud Pourmahdian and Ali Sadegh Daghighi. Annual Conference of the Iranian Association for Logic. Tehran: Amirkabir University of Technology, 2017, pp. 141–146.
- [6] Melvin C. Fitting. “On Modalities and quantifiers”. In: *Fundamenta Informaticae* 156 (2017). Paper in memory of Prof. Helena Rasiowa, pp. 1–34. DOI: 10.3233/FI-2017-1599.
- [7] Melvin C. Fitting. “Paraconsistent Logic, Evidence, and Justification”. In: *Studia Logica* 105.6 (2017). Special Issue: 40 Years of FDE., pp. 1149–1166. DOI: 10.1007/s11225-017-9714-3.
- [8] Melvin C. Fitting. “Rohit Parikh on Logic, Language and Society”. In: ed. by R. Ramanujam C. Başkent L. Moss. Vol. 11. Outstanding Contributions to Logic. Springer, 2017. Chap. 13 On Height and Happiness, pp. 235–258.
- [9] Melvin C. Fitting. “Modal Logics, Justification Logics, and Realization”. In: *Annals of Pure and Applied Logic* 167 (2016), pp. 615–648. DOI: 10.1016/j.apal.2016.03.005. URL: <http://www.sciencedirect.com/science/article/pii/S016800721630029X>.

- [10] Melvin C. Fitting. “Quasi-Realization”. In: *Logic, Language, and Computation*. Ed. by Helle Hvid Hansen et al. Vol. 10148. Lecture Notes in Computer Science. 11th International Tbilisi Symposium, Tbilisi, Georgia, September 21-26, 2015. Springer, 2016, pp. 313–332.
- [11] Melvin C. Fitting. “Realization using the Model Existence Theorem”. In: *Journal of Logic and Computation* 26.1 (2016). First published online, 16 July 2013., pp. 213–234. DOI: 10.1093/logcom/ext025.
- [12] Melvin C. Fitting. “Cut-Free Proof Systems for Geach Logics”. In: *IfCoLog Journal of Logics and their Applications* 2.2 (2015), pp. 17–64.
- [13] Melvin C. Fitting. “Nested sequents for intuitionistic logics”. In: *Notre Dame Journal of Formal Logic* 55.1 (2014), pp. 41–61.
- [14] Melvin C. Fitting. “Possible World Semantics for First Order Logic of Proofs”. In: *Annals of Pure and Applied Logic* 165 (2014), pp. 225–240. DOI: 10.1016/j.apal.2013.07.011. URL: <http://www.sciencedirect.com/science/article/pii/S0168007213001103>.
- [15] Melvin C. Fitting. “Prefixed tableaux and nested sequents”. In: *Annals of Pure and Applied Logic* 163 (2012), pp. 291–313. DOI: 10.1016/j.apal.2011.09.004. URL: <http://dx.doi.org/10.1016/j.apal.2011.09.004>.
- [16] Melvin C. Fitting. “Proving completeness for nested sequent calculi”. In: *Logic Without Frontiers, Festschrift for Walter Alexandre Carnielli on the occasion of his 60th Birthday*. Ed. by Jean-Yves Béziau and Marcelo Esteban Coniglio. Tributes. London: College Publications, 2011, pp. 145–154.
- [17] Melvin C. Fitting. “Reasoning About Games”. In: *Studia Logica* 99.1 (2011), pp. 143–169. DOI: 10.1007/s11225-011-9358-7. URL: <http://dx.doi.org/10.1007/s11225-011-9358-7>.
- [18] Melvin C. Fitting. “The Realization Theorem for S5, A Simple, Constructive Proof”. In: *Games, Norms and Reasons*. Ed. by Johan van Benthem, Amitabha Gupta, and Eric Pacuit. Synthese Library. Springer, 2011. Chap. 4, pp. 61–76.
- [19] Melvin C. Fitting. “Justification Logics and Hybrid Logics”. In: *Journal of Applied Logic* 8 (2010). Electronic version at <http://dx.doi.org/10.1016/j.jal.2010.08.007>, pp. 356–370. DOI: 10.1016/j.jal.2010.08.007.
- [20] Melvin C. Fitting. “How true it is = Who says it’s true”. In: *Studia Logica* 91.3 (2009), pp. 335–366. DOI: 10.1007/s11225-009-9178-1.
- [21] Melvin C. Fitting. “Realizations and LP”. In: *Annals of Pure and Applied Logic* 161.3 (2009). DOI number doi:10.1016/j.apal.2009.07.010, pp. 368–387.
- [22] Melvin C. Fitting. “Reasoning With Justifications”. In: *Towards Mathematical Philosophy*. Ed. by David Makinson, Jacek Malinowski, and Heinrich Wansing. Trends in Logic 28. Springer, 2009. Chap. 6, pp. 107–123.
- [23] Melvin C. Fitting. “A Quantified Logic of Evidence”. In: *Annals of Pure and Applied Logic* 152.1-3 (2008), pp. 67–83.
- [24] Melvin C. Fitting. “Explicit Logics of Knowledge and Conservativity”. In: *Proceedings, Tenth International Symposium on Artificial Intelligence and Mathematics*. 2008. URL: <http://isaim2008.unl.edu/PAPERS/SS1-AI+Logic/MFitting-ss1.pdf>.
- [25] Melvin C. Fitting. “Justification Logics, Logics of Knowledge, and Conservativity”. In: *Annals of Mathematics and Artificial Intelligence* 53 (2008), pp. 153–167. DOI: DOI:10.1007/s10472-009-9112-2.

- [26] Melvin C. Fitting. “S4LP and Local Realizability”. In: *Third International Computer Science Symposium in Russia, CSR 2008, Moscow, Russia, June 7–12, 2008, Proceedings*. Ed. by Edward A. Hirsch et al. Vol. 5010. Lecture Notes in Computer Science. Springer-Verlag, 2008, pp. 168–179.
- [27] Melvin C. Fitting. “Correction to *FOIL Axiomatized*”. In: *Studia Logica* 85.2 (2007), p. 275. URL: <http://dx.doi.org/10.1007/s11225-007-9032-2>.
- [28] Melvin C. Fitting. “Realizations and LP”. In: *Logical Foundations of Computer Science — New York ’07*. Ed. by Sergei Artemov and Anil Nerode. Lecture Notes in Computer Science, 4514. Springer-Verlag, 2007, pp. 212–223.
- [29] Melvin C. Fitting. “FOIL Axiomatized”. In: *Studia Logica* 84.1 (2006). See Correction, [27], pp. 1–22. URL: <http://dx.doi.org/10.1007/s11225-006-9000-2>.
- [30] Melvin C. Fitting. “A Logic of Explicit Knowledge”. In: *The Logica Yearbook 2004*. Ed. by Libor Běhounek and Marta Bílková. Prague: Filosofia, 2005, pp. 11–22.
- [31] Melvin C. Fitting. “A Mistake on My Part”. In: *We Will Show Them! Essays in honour of Dov Gabbay*. Ed. by Sergei Artemov et al. Vol. 1. College Publications, 2005, pp. 665–669.
- [32] Melvin C. Fitting. “A Quantified Logic of Evidence (short version)”. In: *WoLLIC 2005 Proceedings*. Ed. by Ruy de Queiroz, Angus Macintyre, and Guilherme Bittencourt. Electronic Notes in Theoretical Computer Science. Elsevier, 2005, pp. 59–71.
- [33] Melvin C. Fitting. “The Logic of Proofs, Semantically”. In: *Annals of Pure and Applied Logic* 132 (1 2005), pp. 1–25.
- [34] Melvin C. Fitting. “First-Order Intensional Logic”. In: *Annals of Pure and Applied Logic* 127 (2004), pp. 171–193.
- [35] Melvin C. Fitting. “Bisimulations and Boolean vectors”. In: *Advances in Modal Logic*. Ed. by Philippe Balbiani, Nobu-Yuki Suzuki, and Michael Zakharyashev. Vol. 4. King’s College Publications, 2003, pp. 97–125.
- [36] Melvin C. Fitting. “Fixpoint Semantics for Logic Programming—A Survey”. In: *Theoretical Computer Science* 278 (2002), pp. 25–51.
- [37] Melvin C. Fitting. “Interpolation for first-order S5”. In: *Journal of Symbolic Logic* 67 (2002), pp. 621–634.
- [38] Melvin C. Fitting. “Modal logics between propositional and first-order”. In: *Journal of Logic and Computation* 12 (2002), pp. 1017–1026.
- [39] Melvin C. Fitting. “Databases and Higher Types”. In: *Computational Logic—CL 2000*. Ed. by John Lloyd et al. Springer Lecture Notes in Artificial Intelligence, 1861, 2000, pp. 41–52.
- [40] Melvin C. Fitting. “Modality and Databases”. In: *Automated Reasoning with Analytic Tableaux and Related Methods*. Ed. by Roy Dyckhoff. Springer Lecture Notes in Artificial Intelligence, 1847, 2000, pp. 19–39.
- [41] Melvin C. Fitting. “A simple propositional S5 tableau system”. In: *Annals of Pure and Applied Logic* 96 (1999). Originally in *The Parikh Project, Seven papers in honour of Rohit*, Uppsala Prints and Reprints in Philosophy, 1996 Number 18, pp. 107–115.
- [42] Melvin C. Fitting. “Barcan Both Ways”. In: *Journal of Applied Non-Classical Logics* 9 (1999), pp. 329–344.
- [43] Melvin C. Fitting. “Handbook of Tableau Methods”. In: ed. by Marcello D’Agostino et al. Kluwer Academic Publishers, 1999. Chap. Introduction, pp. 1–43.

- [44] Melvin C. Fitting. “Herbrand’s theorem for a modal logic”. In: *Logic and Foundations of Mathematics*. Ed. by Andrea Cantini, Ettore Casari, and Pierluigi Minari. Vol. 280. Synthese. Kluwer Academic Publishers, 1999, pp. 219–225.
- [45] Melvin C. Fitting. “On quantified modal logic”. In: *Fundamenta Informaticae* 39 (1999), pp. 105–121.
- [46] Melvin C. Fitting. “A tribute to Professor Helena Rasiowa”. In: *Logic at Work*. Ed. by Ewa Orłowska. Physica-Verlag, 1998, pp. v–viii.
- [47] Melvin C. Fitting. “Bertrand Russell, Herbrand’s theorem, and the assignment statement”. In: *Artificial Intelligence and Symbolic Computation*. Ed. by Jacques Calmet and Jan Plaza. Springer Lecture Notes in Artificial Intelligence, 1476, 1998, pp. 14–28. URL: <http://dx.doi.org/10.1007/BFb0055899>.
- [48] Melvin C. Fitting. “Higher-Order Modal Logic—A Sketch”. In: *Automated Deduction in Classical and Non-Classical Logics*. Ed. by Ricardo Caferra and Gernot Salzer. Springer Lecture Notes in Artificial Intelligence, 1761, 1998, pp. 23–38.
- [49] Melvin C. Fitting. “LeanTaP Revisited”. In: *Journal of Logic and Computation* 8 (1998), pp. 33–47.
- [50] Melvin C. Fitting. “A Theory of Truth that prefers falsehood”. In: *Journal of Philosophical Logic* 26 (1997), pp. 477–500.
- [51] Melvin C. Fitting. “A Modal Herbrand Theorem”. In: *Fundamenta Informaticae* 28 (1996), pp. 101–122.
- [52] Melvin C. Fitting. “A Program to Compute Gödel-Löb Fixpoints”. In: *Bulletin EATCS* 58 (1996), pp. 118–130.
- [53] Melvin C. Fitting. “Annotated Revision Specification Programs”. In: *Logic Programming and Non-Monotonic Reasoning*. Ed. by V. W. Marek, A. Nerode, and M. Truszczyński. Springer Lecture Notes in Computer Science 928, 1995, pp. 143–155.
- [54] Melvin C. Fitting. “Tableaus for Many-Valued Modal Logic”. In: *Studia Logica* 55 (1995), pp. 63–87.
- [55] Melvin C. Fitting. “Kleene’s three-valued logics and their children”. In: *Fundamenta Informaticae* 20 (1994), pp. 113–131.
- [56] Melvin C. Fitting. “Metric Methods, three examples and a theorem”. In: *Journal of Logic Programming* 21 (1994), pp. 113–127.
- [57] Melvin C. Fitting. “On Prudent Bravery and Other Abstractions”. Unpublished. On web page, <http://comet.lehman.cuny.edu/fitting>. 1994.
- [58] Melvin C. Fitting. “Tableaux for Logic Programming”. In: *Journal of Automated Reasoning* 13 (1994), pp. 175–188.
- [59] Melvin C. Fitting. “The family of stable models”. In: *Journal of Logic Programming* 17 (1993), pp. 197–225.
- [60] Melvin C. Fitting. “Editorial”. In: *Journal of Logic and Computation* 2.2 (1992), pp. 107–110.
- [61] Melvin C. Fitting. “Kleene’s Logic, Generalized”. In: *Journal of Logic and Computation* 1 (1992), pp. 797–810.

- [62] Melvin C. Fitting. “Many-valued modal logics, II”. In: *Fundamenta Informaticae* 17 (1992), pp. 55–73.
- [63] Melvin C. Fitting. “Many-valued non-monotonic modal logics”. In: *Logical Foundations of Computer Science — Tver '92*. Ed. by Anil Nerode and Mikhail Taitslin. Springer Lecture Notes in Computer Science, 620, 1992, pp. 139–150.
- [64] Melvin C. Fitting. “Modal logics – a summary of the well-behaved”. In: *Atti Degli Incontri di Logica Matematica* 6 (1992), pp. 1–14.
- [65] Melvin C. Fitting. “Bilattices and the semantics of logic programming”. In: *Journal of Logic Programming* 11 (1991), pp. 91–116.
- [66] Melvin C. Fitting. “Many-valued modal logics”. In: *Fundamenta Informaticae* 15 (1991), pp. 235–254.
- [67] Melvin C. Fitting. “Well-founded semantics, generalized”. In: *Logic Programming, Proceedings of the 1991 International Symposium*. Ed. by Vijay Saraswat and Kazunori Ueda. Cambridge, MA: MIT Press, 1991, pp. 71–84.
- [68] Melvin C. Fitting. “Bilattices in logic programming”. In: *The Twentieth International Symposium on Multiple-Valued Logic*. Ed. by George Epstein. IEEE, 1990, pp. 238–246.
- [69] Melvin C. Fitting. “Destructive modal resolution”. In: *Journal of Logic and Computation* 1 (1990), pp. 83–97.
- [70] Melvin C. Fitting. “Bilattices and the theory of truth”. In: *Journal of Philosophical Logic* 18 (1989), pp. 225–256.
- [71] Melvin C. Fitting. “Negation as refutation”. In: *Proceedings of the Fourth Annual Symposium on Logic in Computer Science*. Ed. by Rohit Parikh. IEEE, 1989, pp. 63–70.
- [72] Melvin C. Fitting. “First-order modal tableaux”. In: *Journal of Automated Reasoning* 4 (1988), pp. 191–213.
- [73] Melvin C. Fitting. “Logic programming on a topological bilattice”. In: *Fundamenta Informaticae* 11 (1988), pp. 209–218.
- [74] Melvin C. Fitting. “Pseudo-Boolean valued Prolog”. In: *Studia Logica* 47 (1988), pp. 85–91.
- [75] Melvin C. Fitting. “Enumeration operators and modular logic programming”. In: *Journal of Logic Programming* (1987), pp. 11–21.
- [76] Melvin C. Fitting. “Intuitionistic resolution”. In: *Atti Degli Incontri di Logica Matematica* 4 (1987), pp. 59–62.
- [77] Melvin C. Fitting. “Partial models and logic programming”. In: *Theoretical Computer Science* 48 (1987), pp. 229–255.
- [78] Melvin C. Fitting. “Resolution for Intuitionistic logic”. In: *Proceedings of the ACM SIGART International Symposium on Methodologies for Intelligent Systems 1987*. Ed. by Zbigniew W. Ras and Maria Zemankova. Amsterdam: North-Holland, 1987, pp. 400–407.
- [79] Melvin C. Fitting. “Logic programming semantics using a compact data structure”. In: *Proceedings of the ACM SIGART International Symposium on Methodologies for Intelligent Systems*. Ed. by Zbigniew W. Ras and Maria Zemankova. 1986, pp. 247–255.
- [80] Melvin C. Fitting. “Notes on the mathematical aspects of Kripke’s theory of truth”. In: *Notre Dame Journal of Formal Logic* 27 (1986), pp. 75–88.

- [81] Melvin C. Fitting. “A Deterministic Prolog fixpoint semantics”. In: *Journal of Logic Programming* (1985), pp. 111–118.
- [82] Melvin C. Fitting. “A Kripke/Kleene semantics for logic programs”. In: *Journal of Logic Programming* 2 (1985), pp. 295–312.
- [83] Melvin C. Fitting. “A Symmetric approach to axiomatizing quantifiers and modalities”. In: *Synthese* 60 (1984), pp. 5–20.
- [84] Melvin C. Fitting. “Linear Reasoning in modal logic”. In: *Journal of Symbolic Logic* 49 (1984), pp. 1363–1378.
- [85] Melvin C. Fitting. “Apple Writer on the Franklin Ace”. In: *Creative Computing* 9 (1983), pp. 202–204.
- [86] Melvin C. Fitting. “A Generalization of elementary formal systems”. In: *Universal Algebra and Applications*. Vol. 9. Warsaw, Poland: Banach Center Publications, 1982, pp. 89–96.
- [87] Melvin C. Fitting. “Propositional logic using elementary algebra”. In: *Mathematics and Computer Education* 16 (1982). Formerly The Matyc Journal, pp. 204–207.
- [88] Melvin C. Fitting. “An Axiomatic approach to computers”. In: *Theoria* 45 (1979), pp. 97–113.
- [89] Melvin C. Fitting. “Elementary formal systems for hyperarithmetical relations”. In: *Zeitschrift für mathematische Logik und Grundlagen der Mathematik* 24 (1978), pp. 25–30.
- [90] Melvin C. Fitting. “Subformula results in some propositional modal logics”. In: *Studia Logica* 37 (1978), pp. 387–391.
- [91] Melvin C. Fitting. “A Tableau system for propositional S5”. In: *Notre Dame Journal of Formal Logic* 18 (1977), pp. 292–294.
- [92] Melvin C. Fitting. “A Modal logic epsilon-calculus”. In: *Notre Dame Journal of Formal Logic* 16 (1975), pp. 1–16.
- [93] Melvin C. Fitting. “A Modal logic analog of Smullyan’s fundamental theorem”. In: *Zeitschrift für mathematische Logik und Grundlagen der Mathematik* 19 (1973), pp. 1–16.
- [94] Melvin C. Fitting. “Model existence theorems for modal and intuitionistic logics”. In: *Journal of Symbolic Logic* 38 (1973), pp. 613–627.
- [95] Melvin C. Fitting. “An Epsilon-calculus system for first-order S4”. In: *Conference in Mathematical Logic, London ‘70*. Ed. by Wilfred Hodges. *Springer Lecture Notes in Mathematics*, No. 255. 1972, pp. 103–110.
- [96] Melvin C. Fitting. “Epsilon-calculus based axiom systems for some propositional modal logics”. In: *Notre Dame Journal of Formal Logic* 13 (1972), pp. 381–384.
- [97] Melvin C. Fitting. “Non-classical logics and the independence results of set theory”. In: *Theoria* 38 (1972), pp. 133–142.
- [98] Melvin C. Fitting. “Tableau methods of proof for modal logics”. In: *Notre Dame Journal of Formal Logic* 13 (1972), pp. 237–247.
- [99] Melvin C. Fitting. “A Tableau proof method admitting the empty domain”. In: *Notre Dame Journal of Formal Logic* 12 (1971), pp. 219–224.
- [100] Melvin C. Fitting. “An Embedding of classical logic in S4”. In: *Journal of Symbolic Logic* 35 (1970), pp. 529–534.

- [101] Melvin C. Fitting. “Intuitionistic model theory and the Cohen independence proofs”. In: *Intuitionism and Proof Theory, Proceedings of the Summer Conference at Buffalo, N.Y. 1968*. Ed. by John Myhill, Akiko Kino, and Richard Vesley. North-Holland, 1970, pp. 219–226.
- [102] Melvin C. Fitting. “Logics with several modal operators”. In: *Theoria* 35 (1969), pp. 259–266.

## Publications — Joint Articles

- [1] Sergei Artemov and Melvin Fitting. *Justification Logic: Reasoning with Reasons*. Cambridge Tracts in Mathematics Book 216. Cambridge University Press, 2019.
- [1] Melvin C. Fitting and Felipe Salvatore. “First-order justification logic with constant domain semantics”. To appear in *Annals of Pure and Applied Logic*. 2017.
- [2] Melvin C. Fitting and Roman Kuznets. “Modal Interpolation via Nested Sequents”. In: *Annals of Pure and Applied Logic* 166 (2015), pp. 274–305.
- [3] Ruili Ye and Melvin C. Fitting. “Belief, Names, and Modes of Presentation”. In: *Advances in Modal Logic*. Ed. by Frank Wolter et al. Vol. 3. World Scientific, 2002, pp. 389–408.
- [4] Melvin C. Fitting, Lars Thalmann, and Andrei Voronkov. “Term-Modal Logics”. In: *Studia Logica* 69 (2001), pp. 133–169.
- [5] Melvin C. Fitting, Lars Thalmann, and Andrei Voronkov. “Term-Modal Logics”. In: *Automated Reasoning with Analytic Tableaux and Related Methods*. Ed. by Roy Dyckhoff. Springer Lecture Notes in Artificial Intelligence, 1847, 2000, pp. 220–236.
- [6] Melvin C. Fitting, Wiktor Marek, and Mirosław Truszczyński. “The Pure Logic of Necessitation”. In: *Journal of Logic and Computation* 2 (1992), pp. 349–373.
- [7] Melvin C. Fitting and Miriam Ben-Jacob. “Stratified, weak stratified, and three-valued semantics”. In: *Fundamenta Informaticae* 13 (1990), pp. 19–33.
- [8] Melvin C. Fitting and Miriam Ben-Jacob. “Stratified and three-valued logic programming semantics”. In: *Logic Programming, Proc. of the Fifth International Conference and Symposium*. Ed. by Robert A. Kowalski and Kenneth A. Bowen. 1988, pp. 1054–1069.

## Publications — Technical Reports

- [1] Melvin C. Fitting. *Justification Logics and Realization*. Tech. rep. TR-2014004. CUNY Ph.D. Program in Computer Science, 2014. URL: [http://academicworks.cuny.edu/gc\\_cs\\_tr/](http://academicworks.cuny.edu/gc_cs_tr/).
- [2] Melvin C. Fitting. *Realization Implemented*. Tech. rep. TR-2013005. CUNY Ph.D. Program in Computer Science, 2013. URL: [http://academicworks.cuny.edu/gc\\_cs\\_tr/](http://academicworks.cuny.edu/gc_cs_tr/).
- [3] Melvin C. Fitting. *Possible World Semantics for First Order LP*. Tech. rep. TR-2011010. CUNY Ph.D. Program in Computer Science, 2011. URL: [http://academicworks.cuny.edu/gc\\_cs\\_tr/](http://academicworks.cuny.edu/gc_cs_tr/).
- [4] Melvin C. Fitting. *Reasoning About Games*. Tech. rep. TR-2010002. CUNY Ph.D. Program in Computer Science, 2010. URL: [http://academicworks.cuny.edu/gc\\_cs\\_tr/](http://academicworks.cuny.edu/gc_cs_tr/).
- [5] Melvin C. Fitting. *Justification Logics and Conservative Extensions*. Tech. rep. TR-2007015. CUNY Ph.D. Program in Computer Science, 2007. URL: [http://academicworks.cuny.edu/gc\\_cs\\_tr/](http://academicworks.cuny.edu/gc_cs_tr/).

- [6] Melvin C. Fitting. *Realizing Substitution Instances of Modal Theorems*. Tech. rep. TR-2007006. CUNY Ph.D. Program in Computer Science, 2007. URL: [http://academicworks.cuny.edu/gc\\_cs\\_tr/](http://academicworks.cuny.edu/gc_cs_tr/).
- [7] Melvin C. Fitting. *S4LP and Local Realizability*. Tech. rep. TR-2007020. CUNY Ph.D. Program in Computer Science, 2007. URL: [http://academicworks.cuny.edu/gc\\_cs\\_tr/](http://academicworks.cuny.edu/gc_cs_tr/).
- [8] Melvin C. Fitting. *A Replacement Theorem for LP*. Tech. rep. TR-2006002. CUNY Ph.D. Program in Computer Science, 2006. URL: [http://academicworks.cuny.edu/gc\\_cs\\_tr/](http://academicworks.cuny.edu/gc_cs_tr/).
- [9] Melvin C. Fitting. *Quantified LP*. Tech. rep. TR-2004019. CUNY Ph.D. Program in Computer Science, 2004. URL: [http://academicworks.cuny.edu/gc\\_cs\\_tr/](http://academicworks.cuny.edu/gc_cs_tr/).
- [10] Melvin C. Fitting. *Semantics and Tableaus for LPS4*. Tech. rep. TR-2004016. CUNY Ph.D. Program in Computer Science, 2004. URL: [http://academicworks.cuny.edu/gc\\_cs\\_tr/](http://academicworks.cuny.edu/gc_cs_tr/).
- [11] Melvin C. Fitting. *A Semantic Proof of the Realizability of Modal Logic in the Logic of Proofs*. Tech. rep. TR-2003010. CUNY Ph.D. Program in Computer Science, 2003. URL: [http://academicworks.cuny.edu/gc\\_cs\\_tr/](http://academicworks.cuny.edu/gc_cs_tr/).
- [12] Melvin C. Fitting. *A Semantics for the Logic of Proofs*. Tech. rep. TR-2003012. CUNY Ph.D. Program in Computer Science, 2003. URL: [http://academicworks.cuny.edu/gc\\_cs\\_tr/](http://academicworks.cuny.edu/gc_cs_tr/).

September 27, 2019



Articol | Melvin Fitting

# Logics, Big and Small

In the nineteenth and early twentieth centuries philosophy often came in big, comprehensive systems: Fichte, Hegel, Schopenhauer, even Marx and Freud, and others. Perhaps the post-modernists can be counted as late outliers in this tradition. Big scale philosophers aspired to a complete world view. In the popular mind this approach was simply identified with philosophy. In 1940, Richard Rodgers and Lorenz Hart wrote a Broadway Musical called “Pal Joey,” perhaps their best. In it one character, based on the exotic dancer Gypsy Rose Lee, sings a song that contains the lines, “I was reading Schopenhauer last night, And I think that Schopenhauer was right.” The assumption was that a Broadway audience would at least know a little of what Schopenhauer was about—or at least had heard the name.

Big philosophy is no longer in fashion. For one thing, it’s hard to know when you’re right. Current philosophy, by and large, is much more fragmented. Papers and books are on specialized topics and few, if any, try to be universal. For instance, a few years ago I heard Saul Kripke give a very nice, witty, and informative lecture on the word “the.” In fact, there is much to be said about the word “the”, but clearly this is at the opposite extreme from the big approaches of former times.

Formal logic follows the same curve as philosophy in general. In the late nineteenth and early twentieth centuries Frege, and especially Russell and Whitehead, created big logics. For mathematics, indeed for the sciences generally, they created large, all encompassing formal systems. Richard Montague is a late twentieth century outlier in this tradition, having developed a kind of universal formal logic that could embrace intensional as well as extensional concepts.

But from the later period of the twentieth century to today, formal logic has fragmented. There are now many, many small logics, decidable if at all possible, each designed to treat a narrow area of human thought and its applications. You may perhaps know some of the items in the list. Modal Logics. Epistemic Logics. Temporal Logics. Many-Valued Logics. Many-Valued Modal Logics. Non-Monotonic Logics, Substructural Logics.

Paraconsistent Logics. Dynamic Logics. Logics of Communication. Game Logics. Fuzzy Logics. Justification Logics. This is hardly a complete list, but it is long, and it is growing steadily. And those I mentioned are not even single logics, but families of logics. Each family is devoted to a narrow aspect of reasoning and to a specific intended subject matter, which is then further narrowed down by a choice of logic from within the family.

I'm not slighting the ubiquitous First-Order Logic. It is central, but in terms of my big/small classification, it's not quite one and not quite the other. It is not decidable so it's not small. But it is surprisingly tractable in a pragmatic sense, so it's not big either. And I'm sure we all know the saying, "First-order logic, and then order beer."

The move to multiple specialized logics is a natural. Any huge, general, "logic to rule them all" is complex, difficult to work with, impossible to automate. With a divide and conquer strategy we fragment the world of logic into more docile bits. (At least to some extent.) Even so, there are problems. Proof methods that work splendidly for one general variety of logic may be inapplicable to another. Even decidable logics can have decision procedures that render the fact of decidability essentially useless. Still, progress is being made. And we are certainly—well, probably—moving closer to the way we reason ourselves.

When we do mathematics, what is the role of a big system such as *Principia Mathematica*, or Martin-Löf type theory, or Zermelo-Frankel set theory? It certainly tells us the minimum general assumptions that are needed for what we do. That's important, but in mathematical practice we don't actually start from there. We work in, say, group theory, or projective geometry, or topos theory, or functional analysis, and we start with assumptions and methods of reasoning peculiar to that area, plus some general machinery which we grab as needed. We don't begin by asking, "what reasoning machinery must we use?" Instead we decide what we are reasoning about, start in, and pick the machinery as we go along. If this is so in mathematics, how much more so in everyday life where, all appearances to the contrary, we do apply reason.

The fundamental question we must address, in the face of this fragmentation of logics, is how to put it all back together. Think of the array of logics we work with as formal representations of ways we

sometimes think. How do we manage to function daily, act coherently, and not explode periodically? Well, perhaps that's a bit too much to ask, but let's try anyway.

We could look for principles that allow logics to be combined, then combine the whole bunch once and for all. In fact there already exists some formal machinery for combining logics, but its primary use is to combine small logics into another manageable small logic. I don't think anybody has pushed things much beyond that. As such this is a useful tool for the creation of logics on a small scale. But combine them all somehow? The outcome must be yet another big logic of the classic kind, but more complicated than anything previously considered. This does not seem to be a promising direction at all. And it does not seem to be how we behave ourselves, as what L. Frank Baum (the author of *The Wizard of Oz*) rather gruesomely called "meat men," (in contrast with his "tin man").

We seem to operate pragmatically in the presence of multiple ways of reasoning. Somehow we evaluate what method is most appropriate and go with it. (Or perhaps we wind up with a method that is 'appropriate enough'.) We ignore ways of reasoning that seem, on their face, useless to the particular job. I have two grandchildren, and I've watched both in the process of learning how to do this. Perhaps they will tell me about it someday, for I have forgotten the details. More likely they will not because it is not something that rises to the level of conscious thought. It is a kind of subroutine in our operating systems, routing problems to appropriate solution mechanisms. Or perhaps this itself is simply a plausible answer that my appropriate solution mechanism has come up with.

However it is done, we still have two basic problems for our understanding. What do we do when different, but still appropriate, reasoning mechanisms produce different results? And the second problem is a special case: what do we do when a reasoning mechanism produces a result that is discovered to be false? (This is a special case because the world is a kind of logic, with experiments understood as searches for counter-examples.) Again, I don't know how we handle this. Perhaps each of us has different ways of coping with such problems. I don't believe we have one superior internal system that judges—this would be the one universal system of logic once again. It seems more likely that it all remains a local matter. Somehow two conflicting results

fight it out. Our overall rational behavior, such as it is, is the outcome of a constant divide-and-conquer, strongest solution prevails, battleground. At least, it's the best understanding I can come up with.

But it does suggest a challenge for the coming generations of formal logicians and especially for researchers in automated deduction. We now have many reasoning systems, of varying degrees of strength, of diverse areas of applicability. How do we fit them together? And it should not be by our brute force. I don't think we are up to the task of deciding, once and for all, what problems are appropriate for what mechanisms and what prevails under conflicts. We need to devise a learning strategy that can allot tasks, adjudicate conflicts, and accommodate the addition of new ways of reasoning. This itself would not be a logic, but something more akin to an operating system that learns by experience. One might begin with a few well-understood formal logics, and see what is needed to combine them, not formally, but pragmatically, operationally. They should remain separate, but things should be so managed that each problem encountered is, somehow, routed to the more appropriate logic, or logics if that is appropriate, conflicts between logics and between them and the world are somehow resolved, and the management system learns from its mistakes. What is learned is not logic, but how to choose which logic.

What sort of input would be required? At its best, it would be the description of a problem that somehow requires reasoning, stated in natural language. And what sort of output? Either a proof, or at least a convincing argument, or a description of a counter-model, ideally in natural language. Below the surface the right formal logic would be selected, or battled for, and its output made appropriate use of. Instead of a "marketplace of ideas", I am describing a "marketplace of logics." Silly? Perhaps. Idealistic? Perhaps. Naïve? Perhaps.

(Are all these really the same thing? Perhaps.) But at least I have had a good life spent, in part, in thinking about these issues. Thinking about the logics that could possibly constitute the basic construction materials for such a project has been a pleasure. I do think that those of us who toil in the vineyard should at least enjoy the wine.

(This was adapted from a speech given to CADE – International Conference On Automated Deduction, in 2012.)

© Direcția Comunicare, Relații Publice și Marketing  
Universitatea din București

Tipărit la Editura Universității din București

2019  
**Universitatea din București**  
Virtute et Sapientia

Șos. Panduri, nr. 90–92, sector 5 / 050663, București, ROMÂNIA  
Tel: [+40] 21 305 97 30  
Fax: [+40] 21 313 17 60