Levin Hornischer

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LMU Munich // Munich Center for Mathematical Philosophy
Ludwigstr. 31 (Room 123) // 80539 München // Germany
+49 152 36351553 // `levin.hornischer@lmu.de` // Website

EMPLOYMENT

- Assistant professor at the *Munich Center for Mathematical Philosophy* (MCMP), *LMU Munich* (Jan 2023–present).

- Postdoc at the Institute for Logic, Language and Computation (ILLC), *University of Amsterdam* (Oct 2021–Dec 2022).

- PhD Candidate at ILLC, *University of Amsterdam* (Sep 2017–Sep 2021). My PhD project was funded by my grant (within the *PhD in the Humanities* programme) awarded by the *Dutch Research Council* (NWO).

EDUCATION

- PhD, *University of Amsterdam* (2021). Thesis: "Dynamical Systems via Domains: Toward a Unified Foundation of Symbolic and Non-symbolic Computation". Supervisors: Prof. Dr. M. van Lambalgen (University of Amsterdam) and Prof. Dr. F. Berto (St Andrews, University of Amsterdam). Doctorate Committee:
  - Prof. S. Abramsky (University of Oxford),
  - Prof. Dr. J.F.A.K. van Benthem (University of Amsterdam, Stanford University, Tsinghua University Beijing),
  - Prof. Dr. A. Betti (University of Amsterdam),
  - Dr. L. Incurvati (University of Amsterdam),
  - Prof. DDr. H. Leitgeb (LMU Munich), and
  - Prof. Dr. S.J.L. Smets (University of Amsterdam, University of Bergen).

- MSc. Logic, *University of Amsterdam* (2017). Cum laude (GPA 9.09, "excellent").

- B.Sc. Mathematics, *Heidelberg University* (2017). "Very good" (1.3).

- B.A. Philosophy, *Heidelberg University* (2015). "Very good" (1.1).

RESEARCH AREAS

- *Specialization*: Philosophy of AI, theory of AI, interpretability, dynamical systems, domain theory, social choice for AI, philosophical logic, philosophy of language, formal epistemology.

- *Competence*: Mathematical logic, category theory, theoretical computer science, philosophy of relativity theory, psychology of reasoning.

GRANTS, SCHOLARSHIPS, AWARDS

- *NTU-LMU Joint Seed Funding* for the project "Synonomy in AI" together with Shawn Standefer (National Taiwan University).

- Fellowship at the *Institute for Advanced Studies* at the *University of Amsterdam* for a project on "Logic and AI" together with Johan van Benthem, Baldern ten Cate, Frank van Harmelen, Thomas Icard, und Sara Magliacane.

- Awarded grant "PhDs in the Humanities" by the *Dutch Research Council* (NWO) for my project "Foundations of Analogical Thinking: The Source of Intelligence in Minds and Machines".

- Alumnus of the *Amsterdam Science Talent Scholarship* awarded by the Faculty of Science of the *University of Amsterdam* for obtaining the *Master of Logic* at ILLC.

- Alumnus of *Studienstiftung des deutschen Volkes* (*German Academic Scholarship Foundation*; a prestigious scholarship awarding foundation supporting outstanding students in Germany).

- Visiting stipend for the workshop "Ground I: Yablo on Aboutness" (Universität Hamburg).

- Studies abroad in Philosophy and Mathematics, *University of Oslo*, Norway.

PUBLICATIONS

- L. Hornischer and F. Berto. "The Logic of Dynamical Systems is Relevant" (forthcoming). In: Mind.

- L. Hornischer. "Iterating Both and Neither: With Applications to the Paradoxes" (2025). in: *Notre Dame Journal of Formal Logic*, Advance Publication, pp. 1–43.

- P. Hawke, L. Hornischer, and F. Berto. "Truth, Topicality, and Transparency: One-Component Versus Two-Component Semantics" (2024). In: *Linguistics and Philosophy* 47, pp. 481–503.

- F. Berto and L. Hornischer. "Cognitive synonymy: a dead parrot?" (2023). In: *Philosophical Studies* 180, pp. 2727–2752.

- L. Hornischer. "Dynamical Systems via Domains: Toward a Unified Foundation of Symbolic and Non-symbolic Computation" (2021). PhD Thesis, University of Amsterdam, Institute for Logic, Language and Computation.

- L. Hornischer. "The Logic of Information in State Spaces" (2021). In: *The Review of Symbolic Logic* 14(1), pp. 155–186.

- L. Hornischer. "Logics of Synonymy" (2020). In: *Journal of Philosophical Logic* 49, pp. 767–805.

- L. Hornischer. "Toward a Logic for Neural Networks" (2019). In: *The Logica Yearbook 2018*. Ed. by I. Sedlár and M. Blicha. London: College Publications, pp. 133–148.

- V. Capraro, J. Sippel, B. Zhao, L. Hornischer, M. Savary, Z. Terzopoulou, P. Faucher, S.F. Griffioen, "People making deontological judgments in the Trapdoor dilemma are perceived to be more prosocial in economic games than they actually are" (2018). In: *PLoS One*, 13(10), p. e0205066.

- Preprints:
    - L. Hornischer and H. Leitgeb. "Explaining Neural Networks with Reasons". Preprint at arXiv:2505.14424.
    - L. Hornischer and Z. Terzopoulou. "Learning How to Vote With Principles: Axiomatic Insights Into the Collective Decisions of Neural Networks". Preprint at arXiv:2410.16170.

- Under review/in preparation (selected):
    - "Robustness and Trustworthiness in AI: A No-Go Result From Formal Epistemology".
    - "Domain-theoretic Semantics for Dynamical Systems: From Analog Computers to Neural Networks".
    - "Universal Analog Computation: Fraïssé limits of dynamical systems".
    - "Are vague predicates not what we think they are?".
    - "The Structure of Hyperintensionality".

SELECTED TALKS

- Workshop "Formal Epistemology Meets Philosophy of AI" at LMU Munich, Munich Center for Mathematical Philosophy. *Explaining Neural Networks with Reasons*. 5–6 July 2025.

- LMU Munich, Munich Center for Mathematical Philosophy. Logic Colloquium. *Universal analog computation*. 12 June 2025.

- Workshop "Epistemology and Theory of Machine Learning" at LMU Munich, Munich Center for Mathematical Philosophy. *Robustness and Trustworthiness in AI: A No-Go Result From Formal Epistemology* . 30–31 May 2025.

- Workshop "Social Choice for AI Ethics and Safety 2025" (SC4AI'25) in Detroid, Michigan, USA. Part of the 24th International Conference on Autonomous Agents and Multiagent Systems (AAMAS 2025). Detroit. *Learning How to Vote With Principles: Axiomatic Insights Into the Collective Decisions of Neural Networks*. 19 May 2025.

- NTU-LMU Workshop on Synonymy in AI and Logic (National Taiwan University). *Learning How to Vote With Principles: Axiomatic Insights Into the Collective Decisions of Neural Networks*. 11 April 2025.

- Workshop on Learning and Logic (LeaLogCSL) in Amsterdam, The Netherlands. Part of the 33rd EACSL Annual Conference on Computer Science Logic (CSL 2025). *Learning How to Vote With Principles: Axiomatic Insights Into the Collective Decisions of Neural Networks*. 10 February 2025.

- Research Seminar in Decision and Action Theory (LMU Munich). *Learning How to Vote With Principles: Axiomatic Insights Into the Collective Decisions of Neural Networks*. 13 November 2024.

- University of Cambridge, Department of Applied Mathematics and Theoretical Physics. *Domain-theoretic Semantics for Dynamical Systems: From Analog Computers to Neural Networks*. 7 November 2024.

- University of Groningen. *Universal Analog Computation: Fraïssé limits of dynamical systems*. 25 September 2024.

- Logic and AI (Institute for Advanced Study, University of Amsterdam). *Semantics for Non-symbolic Computation: Including Neural Networks and Analog Computers*. 16 July 2024.

- Topology, Algebra, and Categories in Logic (TACL) 2024 (University of Barcelona). *Semantics for Non-symbolic Computation: Including Neural Networks and Analog Computers*. 16 July 2024.

- Work in Progress Seminar at the MCMP (LMU Munich). *The Logic of Dynamical Systems is Relevant*. 7 December 2023.

- Machine Learning meets Mathematical Philosophy (LMU Munich). *Semantics for Sub-symbolic Computation*. 16 June 2023.

- Logik Kolloquium (University of Konstanz). *Semantics for Sub-symbolic Computation*. 24 April 2023.

- Workshop on Logic and Philosophy of Mathematics (LMU Munich). *Iterating Both and Neither: With Applications to the Paradoxes*. 22 April 2023.

- Colloquium Logicum 2022 of the DVMLG (University of Konstanz). *Dynamical Systems via Domains: Semantics for Non-symbolic Computation*. 26–28 September 2022.

- Applied Category Theory Conference 2022 (University of Strathclyde, Glasgow, Scotland). *Dynamical Systems via Domains* (distinguished presentation). 18–22 July 2022 (video recording available).

- University of Amsterdam. The ILLC Colloquium. *Logic in Explainable AI*. 10 June 2022.

- University of Amsterdam, ILLC. Meaning, Logic, and Cognition (MLC) Seminar. *Stability: Fitch's lemma and AI-safety*. 13 May 2022.

- University of St Andrews, Arché. Metaphysics & Logic Seminar. *The Structure of Hyperintensionality*. 20 April 2020. (Online.)

- LMU Munich, Munich Center for Mathematical Philosophy. Logic Colloquium. *Logics of Synonymy*. 5 December 2019.

- University of Amsterdam, ILLC. Logic of Conceivability Seminar. *Stability: A novel interpretation of Fitch's lemma*. 2 October 2019.

- University of Vienna, Gödel's Legacy Conference. *Stability of foundational concepts: Gödelian arguments from general relativity*. 25–27 July 2019.

- Utrecht University, Department of Philosophy and Religious Studies. TULIPS. *Analyzing the Behavior of Transition Systems*. 2 April 2019.

- University of Amsterdam, ILLC. Algebra|Coalgebra Seminar. *Trajectory domains: analyzing the behavior of transition systems*. 13 March 2019.

- University of Oxford, Department of Computer Science. OASIS: The Oxford Advanced Seminar on Informatic Structures. *Trajectory domains: describing the behavior of computing systems*. 30 November 2018.

- LMU Munich, Munich Center for Mathematical Philosophy. Logic Colloquium. *HYPE, Information, and Dynamical Systems*. 8 November 2018.

- Czech Academy of Sciences, Prague. Machine learning and explanation in cognitive science. *Towards a domain-theoretic framework for describing the behavior of neural networks*. 15 October 2018.

- LOGICA 2018, Hejnice monastery. *A Logic of State Spaces*. 18–22 June 2018.

- University of Amsterdam, ILLC. Logic of Conceivability Seminar. *Logics of Synonymy*. 21 February 2018.

- Ghent University, Centre for Logic and Philosophy of Science. Hyperintensional Logics and Truthmaker Semantics. *Logics of Synonymy*. 15 December 2017.

RESEARCH VISITS

- National Taiwan University, visiting Dr. Shawn Standefer (April 2025), as part of our *NTU-LMU Joint Seed Funding* project on "Synonomy in AI".

- University of St Andrews, Arché Research Centre, visiting Prof. F. Berto (planned April 2020, canceled due to the pandemic).

- LMU Munich, Munich Center for Mathematical Philosophy, visiting Prof. DDr. H. Leitgeb and the institute (Nov 2019–Jan 2020).

- University of Oxford, Department of Computer Science, visiting Prof. S. Abramsky and his group (Nov 2018).

SUPERVISION

- *On Performance and Trustworthiness of AI: From inverse problems to Artificial General Intelligence.* External examiner for PhD Thesis at the University of Cambridge, Faculty of Mathematics.

- *Paraconsistent metatheories for paraconsistent logics.* Master Thesis (second reader). 2024.

- *Sheaf-theoretic Contextuality and Paradox.* Master Thesis. 2023-24.

- *Formal Learning Theory meets Statistical Learning Theory — Ockham's Razor and VC Dimension.* Master Thesis (second reader). 2024.

- *Applications of the generalized Cantor theorem.* Student project. 2023-24.

- *Duality in Domain theory.* Student project. 2023.

- *The Logic of Counterfactual Explanations in AI.* Student project. 2022-23.

- *A Sheaf-theoretic Approach to Dynamical Systems.* Student project. 2022-23.

- *A Program Logic for Dynamical Systems.* MSc Thesis. 2022-23.

- *Ornstein Theory and the Golden Mean Shift.* Student project. Fall 2020.

- *Analogical Reasoning.* Student project. 2019.

- *Topologies on Classes of Spacetimes.* Student project. 2018.

TEACHING

- *Interfaces between Logic and AI.* Stanford University. Guest lecture (online) in the 'Logic Spring Seminar (PHIL 359)' cotaught by Johan van Benthem and Thomas Icard.

- *Advanced Topics in the Foundations of AI.* LMU Munich. Research seminar for master's students. Summer 2023, summer 2024, summer 2025.

- *Philosophical Logic.* LMU Munich. Research seminar for master's students. Summer 2023, summer 2024, summer 2025.

- *Philosophy and Theory of Artificial Intelligence*. LMU Munich. Research seminar for master's students. Winter 2023/24, winter 2024/25.

- *Duality Theory: Connecting Logic, Algebra, and Topology*. LMU Munich. Research seminar for master's students. Winter 2023/24, winter 2024/25.

- *Rationality, Cognition and Reasoning*. University of Amsterdam. Spring 2022. A seminar for master's students primarily on the use of formal models in the psychology of reasoning. Restricted to ≈ 20 students to enable seminar discussions. 3 hours per week. The students write a final paper.

- *Philosophy and AI*. University of Amsterdam. Spring 2022. A mandatory course for 3rd-year bachelor students of the AI programme. The course has ≈ 130 students and I manage a group of 7 TAs. 4 hours per week lectures plus 2 hours per week tutorials. The students have weekly homeworks, take a midterm exam, and write a final essay. My detailed slides are available on request.

- *Philosophical Logic*. University of Amsterdam. Fall 2021. A course in the Master of Logic at ILLC which is mandatory for the philosophy track. 4 hours per week lectures plus 2 hours per week tutorials. I prepared weekly graded homeworks and a final exam. My lecture notes (≈ 120 pages) are available on request.

- *Kant, Logic, and AI*. University of Amsterdam. With Michiel van Lambalgen. Spring 2021.

- *Time*. University of Amsterdam. With Michiel van Lambalgen. Spring 2021. Lectures on philosophy of time and relativity theory.

- *Rationality, Cognition and Reasoning*. University of Amsterdam. With Michiel van Lambalgen. Fall 2020. Lectures on logic programming and cognitive modeling.

- *Kant and AI*. University of Amsterdam. With Michiel van Lambalgen. Student project. Spring 2020.

- *Time*. University of Amsterdam. With Michiel van Lambalgen. Spring 2020. Lectures on philosophy of time and relativity theory.

- *Rationality, Cognition and Reasoning*. University of Amsterdam. With Michiel van Lambalgen. Fall 2019. Lectures on logic programming and cognitive modeling.

- *Member of the defense committee* of the Master of Logic student Anna Franchini. Thesis on "Space and the Continuum from Kant to Poincaré" (4 July 2019).

- *Logic Programming and Learning*. University of Amsterdam. With Ronald de Haan. Student project. June 2019.

- *Time*. University of Amsterdam. With Michiel van Lambalgen. Spring 2019. Lectures on philosophy of time and relativity theory.

- *Member of the defense committee* of the Master of Logic student David O'Connell. Thesis on "Lorentzian Structures on Branching Spacetimes" (28 Feb. 2019).

- *Reasoning in autism spectrum disorders*. University of Amsterdam. With Michiel van Lambalgen. Student project. January 2019.

- *Kant, Logic and Cognition*. University of Amsterdam. With Michiel van Lambalgen. Spring 2018.

- *Time*. University of Amsterdam. With Michiel van Lambalgen. Spring 2018. Lectures on special and general relativity theory.

- *Rationality, Cognition and Reasoning*. University of Amsterdam. With Michiel van Lambalgen. Fall 2017. Lectures on logic programming.

- *MasterClass Logic*. University of Amsterdam, ILLC. Teaching (mathematical) logic to secondary school students and supervising their projects. 2017.

- *Introduction to Set Theory*. Heidelberg University. Teaching assistant of Prof. Dr. Kai Hauser. Summer 2015.

- *Mathematical Logic*. Heidelberg University. Teaching assistant of Prof. Dr. Klaus Ambos-Spies. Winter 2014.

- *Introduction to Set Theory*. Heidelberg University. Teaching assistant of Prof. Dr. Kai Hauser. Summer 2014.

SELECTED ACTIVITIES

- Refereeing for journals:
    - American Philosophical Quarterly
    - Australasian Journal of Logic
    - Journal of Logic and Computation
    - Journal of Philosophical Logic
    - Mathematical Structures in Computer Science
    - Mind & Language
    - Philosophical Quarterly
    - Review of Symbolic Logic
    - Synthese
    - Theoria

- Refereeing for conferences:
    - CILC 2020 (Italian Conference on Computational Logic)

- ICALP 2020 (Int. Coll. on Automata, Languages and Programming)
    - TbiLLC2023 (Tbilisi Symposium on Logic, Language and Computation)
- Refereeing for grants and prizes:
    - Swiss National Science Foundation
    - VvL thesis prize 2024
    - AI-HUBLMU Prize for the Best Master's Thesis Project in the Field of AI
- Representative in the steering committee of the *AI-HUB@LMU*, coordinating AI-related research across the different departments at LMU Munich.
- Co-organizing the Summer School for Widening Participation in Mathematical Philosophy (formerly the Summer School on Mathematical Philosophy for Female Students). We have received several internal grants to fund the event. Summer 2024, summer 2025.
- Co-organizing, with Dr. Vanessa Carr, an *inclusivity workshop* at the MCMP. We have received an internal grant of EUR 1.063 to fund the event.
- Flash talks for the committee evaluating ILLC research (3–4 Dec 2018) and for the deans of the faculties of humanities and science at the University of Amsterdam (21 Jan 2019).
- Welcoming talk for the new Master of Logic students (30 Aug 2019).
- Allocating teaching assistants to the master courses offered by ILLC.
- Co-organizing the conference "Foundation of Mathematics: Modern Views" (4–7 April, 2018 in Munich, Germany). We acquired funding from the German Federal Academic Scholarship Foundation, the Max Weber-Programme of the Free State of Bavaria, the Munich Center for Mathematical Philosophy (MCMP), the Evert Willem Beth Foundation, the Association for Symbolic Logic (ASL), and the German Society for Analytic Philosophy (GAP).
- Member of the *PhD council* at ILLC (2018–2020).
- *Student mentor* at ILLC (2016/17).

LANGUAGES

- English (Toefl®: 115/120), German (native), Dutch (A2 language course and subsequent self-study), French (solid), Latin proficiency exam.