Fredrik Dahlqvist | CV

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Education

Imperial College London **London**
PhD in Computer Science *2010–2013*
Completeness-via-Canonicity in Coalgebraic Logics. Awarded 1 October 2015.

Birkbeck, University of London **London**
MSc in Computer Science, Distinction *2008–2009*
Part-time evening course. Dissertation on spatial logic.

Imperial College London **London**
MSc in Quantum Fields and Fundamental Forces, Pass *2003–2004*
Dissertation on two-dimensional superconformal field theories.

Université Libre de Bruxelles **Brussels**
Licence en Mathématique, Distinction *2000–2003*
Awarded 75% for the 'Licence' in Mathematics (equivalent to an MSci). Dissertation on sheaf theory.

Université Libre de Bruxelles **Brussels**
Licence en Philosophie, Grande Distinction *2000–2003*
Awarded 80% for the 'Licence' in Philosophy (equivalent to an MA). Dissertation on 'The evolution of the concept of space in contemporary mathematics'.

Danmarks Tekniske Universitet (DTU) **Lyngby, Denmark**
Erasmus Exchange Program *2002*

Université Catholique de Louvain **Louvain-la-Neuve, Belgium**
Candidature en Philosophie *1998–2000*
First two years in philosophy and first year in mathematics.

Employment history

Queen Mary University of London **London**
Lecturer *Sep 2021–current*
Courses taught: *Applied Statistics* (module leader, MSc course), *Databases* (2^{nd} year undergraduate course), PhD supervision, BSc and MSc project mentoring. Research focused on the semantics of probabilistic programs, systems to reason quantitatively about programs, and improving our fundamental understanding of neural networks.

University College London, PPLV team **London**
Senior Research Assistant *2019–2023, 2025*
Worked on my project '*Towards the formal verification of Machine Learning algorithms: Differentiable Probabilistic Programming and its Semantics*, funded through a Leverhulme Project Grant for a duration of 3 years. Supervision of two PhD students and ongoing collaboration with Prof. Alexandra Silva.

Imperial College London, Circuits and Systems Group **London**
Research Assistant *2019–2020*
Collaboration with Prof. George Constantinides on developing a probabilistic approach to quantifying the *accuracy and stability* of numerical routines. The aim is to answer questions like '*what is the worst-case error of a program due to rounding errors with 99.99% probability*' (accuracy) or '*what is the probability of mis-classification by a classifying algorithm due to rounding errors?*' (stability).

University College London, PPLV team **London**
Research assistant, ERC ProFoundNet *Project* *2016–2019*
Collaboration with Prof. Alexandra Silva and her team on the foundations of *probabilistic network programming*. My research focused on both the syntax and the semantics of probabilistic languages.

Cornell University **Ithaca, NY**
Postdoctoral Associate *2017*
Worked with Prof. Dexter Kozen on the development of a *higher order probabilistic programming language*. Parallel to the development of a *syntax and type system*, we have developed the mathematical infrastructure to provide the language with a *denotational semantics* in terms of Banach spaces and linear operators, leading to a paper at *POPL 2020*.

University College London, PPLV team **London**

Research assistant, EPSRC Resource Reasoning *Project* *2014–2016*

Worked with Prof. David Pym on applying the techniques developed in my Ph.D. to the substructural logic underpinning *separation logic* (Boolean Bunched Implication) and its modal extensions. Together we published a coalgebraic *strong completeness result* for all distributive substructural logic and their relational semantics. The technique is modular, and modal extensions are also given a strongly complete semantics.

University of Edinburgh, LFCS **Edinburgh**

Research Assistant, ERC RULE *Project* *2013–2016*

Collaboration with Prof. Vincent Danos and Dr. Ilias Garnier to develop a structural approach to probability theory, in an effort to provide general semantic principles for *probabilistic programming* and *machine learning*. In particular we have shown how Bayesian inversion, the foundation of *Bayesian learning*, arises as an adjoint operation on linear operators.

HSBC Bank Plc **London**

Quantitative Fixed-Income Strategist *2005–2010*

Located on the trading floor, my role was primarily as a researcher, publishing regular quantitative analyses and trade ideas. Specific duties included:

- Coverage of interest rate derivatives markets (futures, options on futures, swaps, cap/floors, swaptions, sovereign CDS, money market) within the Fixed Income Strategy team: formulation of trade ideas, publication of analyses as well as ad-hoc projects for clients.
- Responsible for the development and maintenance of analytical tools for the Fixed Income Strategy team in London: fair value models, pricing and analytics for bonds, STIR futures, volatility products, swaps and CDS, yield curve modelling.
- Five years of programming (C++, C# and VBA) and databases experience.
- In charge of the development of HSBC's Fixed Income Strategy internet platform.

Grants

2025: Research Institute in Verified Trustworthy Software Systems (VeTSS) Research Award, *Probabilistic Precision Tuning*, GBP49,635.72, PI.

2025: Academy of Medical Sciences Networking Grant, *Learning from Each Other, Neural Networks and Finite Automata*, GBP 15,000, PI, Co-I: A. Silva.

2024: Cornell-QMUL Global Strategic Collaboration Award, *Learning from Each Other, Neural Networks and Finite Automata*, GBP 4,000+USD 5,000, PI, Co-I: A. Silva.

2020: Research Institute in Verified Trustworthy Software Systems (VeTSS) Research Award, *Quantitative Algebraic Reasoning for Hybrid Programs: reasoning precisely about imprecisions*, GBP 77,542. Co-I, PI: A. Silva.

2019-2022: Leverhulme Research Project Grant, GBP 203,928. PI, Co-I: A. Silva.

- Title: 'Towards the formal verification of Machine Learning algorithms: Differentiable Probabilistic Programming and its Semantics'.
- To finance a senior post-doc (Dahlqvist) for 3 years and travel expenses.

2010-2013: Awarded a 3 year EPSRC DTA fellowship by the Computer Science Department at Imperial College. Funding was subsequently awarded a 6 month extension.

Selected Publications

- G. Mason-Williams, I. Mason-Williams and F. Dahlqvist, *Data Free Metrics Are Not Reparameterisation Invariant Under the Critical and Robust Layer Phenomena*, High-dimensional Learning Dynamics 2025.
- G. Constantinides, F. Dahlqvist, Z. Rakamaric, and R. Salvia *Automated roundoff error analysis of probabilistic floating-point computations*, ACM Transactions on Probabilistic Machine Learning, 2025
- G. Mason-Williams, F. Dahlqvist *What makes a good prune? Optimal Unstructured Pruning for Maximal Cosine Similarity*, ICLR 2024.
- F. Dahlqvist, A. Silva and W. Smith *Deterministic stream-sampling for probabilistic programming: semantics and verification*, LiCS 2023.
- F. Dahlqvist and R. Neves, *A Complete $\mathcal{V}$-Equational System for Graded λ-Calculus*, MFPS 2023.
- F. Dahlqvist and R. Neves, *An Internal Language for Categories Enriched over Generalised Metric Spaces*, CSL 2022.
- F. Dahlqvist and T. Schmid, *How to write a coequation*, CALCO 2021.
- G. Constantinides, F. Dahlqvist, Z. Rakamaric and R. Salvia. *Rigorous Roundoff Error Analysis of Probabilistic Floating-Point Computations*, to appear at CAV 2021.

- F. Dahlqvist and D. Kozen *Semantics of Higher-Order Probabilistic Programs with Conditioning*, 47th ACM SIGPLAN Symposium on Principles of Programming Languages (POPL 2020).
- F. Dahlqvist, L. Parlant and A. Silva. *Layer by Layer - Combining Monads*, International Colloquium on Theoretical Aspects of Computing (ICTAC), 2018.
- F. Dahlqvist, V. Danos, I. Garnier, and A. Silva. *Borel kernels and their approximation, categorically*, Electronic Notes in Theoretical Computer Science, 341, 91-119.

Community

Conferences and workshops

- VeriProP (CAV workshop on the Verification of Probabilistic Programs) 2021-2026: organiser and steering commitee member
- CMCS (International workshop on Coalgebraic Methods in Computer Science) 2018, 2022, 2024: PC member
- TTCS (Topics in Theoretical Computer Science) 2020: PC member
- Dalí (Dynamic Logic: new trends and applications) 2017, 2019, 2020: PC member
- CALCO (Conference on Algebra and Coalgebraic in Computer Science) 2011: organisation

Outreach

- 2023, 2024, 2025: Royal Institution masterclass '*An introduction to probability theory and limit laws.*'

Refereeing

I am involved in conference and journal paper refereeing on a very regular basis, including reviews for ICLR, LICS, FoSSACS, ICALP, ESOP, MFPS, CMCS, Calco, etc., and the journals *Mathematical Structures in Computer Science*, *Information and Computation* and *Journal of Logical and Algebraic Methods in Programming*.

Other services to the community

I have arranged for Queen Mary to join the consortium behind the Southern amd Midlands Seminar (SMLS) series. Thanks to my funding, Queen Mary hosted their first SMLS in December 2025 with a good attendance from all five sites (UCL, Birmingham, Bath, Sussex and QM).
I co-organise and fund the 'Foundations of AI' reading group at Queen Mary, a fornightly gathering of about 15 researchers interested in going through foundational papers in machine learning.
For several years I organised the weekly PPLV seminar at UCL.

Visits

I have spent the summer of 2017 as a postdoc in Cornell univeristy, working with Prof. Dexter Kozen. I regularly visit Vincent Danos at ENS, and Thomas Ehrhard at IRIF in Paris. I have attended PropProgSchool 2017, the 1st School on Foundations of Programming and Software systems: Probabilistic programming.

Languages

- French, *native*
- English, *fluent*
- Swedish, *conversational*
- Danish, *conversational*

Additional Information

- Two daughters.
- Keen piano player, qualifications include English piano grade eight exam and music theory grade five exam.
- Dual Belgian/Swedish citizenship.

References

- Prof. Alexandra Silva
  Department of Computer Science
  Cornell Univerity
  email: alexandra.silva@cornell.edu

- Prof. Dexter Kozen
  Department of Computer Science
  Cornell University
  email: kozen@cs.cornell.edu
- Prof. Vincent Danos
  Equipe Antique
  Ecole Normal Supérieure, Paris
  email: vincent.danos@gmail.com
- Prof. George Constantinides
  Department of Electrical and Electronic Engineering
  Imperial College London
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