Computer and Information Sciences
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Fredrik Nordvall Forsberg

Curriculum vitae

Employment

2024– **Chancellor's Fellow and Senior Lecturer**, *Computer and Information Sciences*, University of Strathclyde
Head of the Mathematically Structured Programming research group since 2022

2019–2023 **Chancellor's Fellow and Lecturer**, *Computer and Information Sciences*, University of Strathclyde

2018 **Research and KE Fellow**, *Computer and Information Sciences*, University of Strathclyde
Working on the Data Lab project *Multi-Tenant ThinkBigData Domain Specific Language*

2013–2017 **Research Associate**, *Computer and Information Sciences*, University of Strathclyde
Working on EPSRC grant EP/K023837/1, *Logical Relations for Program Verification*

2013 **Postdoctoral Research Fellow**, *School of Computer Science*, University of Birmingham, June–December
Working on EPSRC grant EP/K015214/1, *A Higher-Order Approach to Co-design*

2012 **Short Term Research Fellow**, *Mathematics department*, Ludwig-Maximilians-Universität München, 5 months July–November
Funded by the Marie Curie Initial Training Network in Mathematical Logic — MALOA, PITN-GA-2009-238381.

Education

2022 **PgCert**, *Academic Practice*, University of Strathclyde

2013 **PhD**, *Computer Science*, Swansea University
Funded by EPSRC grant EP/G033374/1, *Theory and applications of induction-recursion*. PhD thesis *Inductive-inductive definitions* supervised by Dr Anton Setzer. Viva date: 24 September 2013. Degree obtained 23 January 2014.

2009 **BSc & MSc**, *Mathematics*, Uppsala university
Master thesis *Constructive aspects of models for non-standard analysis* supervised by Prof. Erik Palmgren.

2006–2007 **ERASMUS exchange year**, *Mathematics, computer science*, Ruprecht-Karls-Universität Heidelberg

Teaching

2023–2024 **Computer Systems and Architecture**, *University of Strathclyde*
Delivering lectures, and designing and marking coursework and examinations.

2020–2022 **Advanced Functional Programming**, *University of Strathclyde*
Delivering lectures, and designing and marking coursework and oral examinations.

2019–2020 **Programming Languages Definition & Implementation**, *University of Strathclyde*
Lecturer together with Prof. Neil Ghani. Delivering lectures, and designing and marking coursework and exams.

2018–2019 **Advanced Functional Programming**, *University of Strathclyde*
Lecturer together with Dr Conor McBride. Delivering lectures, and designing and marking coursework.

2017–2018 **Functional Programming**, *University of Strathclyde*
Lecturer together with Dr Robert Atkey. Delivered lectures and tutorials, and designed and marked coursework. ***Nominated for a Teaching Excellence Award.***

2016–2017 **Functional Programming**, *University of Strathclyde*
Lecturer together with Dr Robert Atkey, Dr James Chapman and Dr Conor McBride. Delivered lectures and tutorials, and designed and marked coursework.

2015–2016 **Computer Systems and Organisation**, *University of Strathclyde*
Lecturer together with Dr Conor McBride. Delivered lectures and tutorials, marked tests. Designed infrastructure for rapid feedback and marking, and designed and marked coursework. ***7 nominations for Teaching Excellence Awards.***

Teaching assistant

2013 **University of Birmingham**, *Foundations of Computer Science*
Teaching assistant and guest lecturer.

2010–2011 **Swansea University**, *Concurrency; Language and Computation*
Teaching assistant, lab demonstrator.

2007–2008 **Uppsala University**, *Linear Algebra; Calculus; Multivariable Calculus*
Tutorial teacher.

2007 **Ruprecht-Karls-Universität Heidelberg**, *Algorithmen und Datenstrukturen*
Tutorial teacher ("Übungsgruppenleiter").

Funding obtained

A Correct-by-Construction Approach to Approximate Computation, EPSRC EP/Y000455/1, £692,875. CoI together with Prof. Radu Mardare and Prof. Neil Ghani. 1 November 2023–31 October 2027.

Trusted Systems Funded by NPL. CoI together with Dr Conor McBride (PI) and Prof. Neil Ghani. £595,485.

A library for compositional game theory, Carnegie Vacation Scholarship, £2500. Funding for an undergraduate intership summer 2019.

Second Symposium on Compositional Structures, SICSA Research Theme Event Sponsorship, £900, *applicant*, and £1000 in sponsorship from Cambridge Quantum Computing. Funding for a workshop with 63 participants, 17–18 December 2018.

Data-parallel programming with Higher Inductive Types, SICSA PECE bursary, £5,201, *PI*. Funding for a two-month visit to Dr Dan Licata at Wesleyan University, USA, January–March 2017.

Scottish Programming Languages Seminar, SICSA Research Theme Event Sponsorship £800, *co-applicant* together with Dr James Chapman and Dr Robert Atkey. Funding for a workshop with 61 participants, 9 November 2016.

Agda Implementors' Meeting XXIII, SICSA Research Theme Event Sponsorship £1,400, *co-applicant* together with Dr James Chapman. Funding for a week-long meeting with 22 participants from across Europe, 20–26 April 2016.

Homotopy Type Theory: Programming and Verification EPSRC EP/M016951/1, £499,631, *co-writer* assisting Prof. Neil Ghani. 1 April 2015–31 March 2019.

Organisational duties

2024 **Scottish Programming Languages and Verification Summer School**, *29 July–2 August, co-organiser*

2022 **5th International Conference on Applied Category Theory**, *18–22 July, co-organiser*

2019 **Scottish Programming Languages and Verification Summer School**, *5–9 August, co-organiser*

2018 **Second Symposium on Compositional Structures**, *17–18 December, local organiser*

2017 **First Open Games Workshop**, *10–11 July, co-organiser*

2016 **Agda Implementor's Meeting XXIII**, *20–26 April, co-organiser*

2014–2019 **MSP101 seminar**, *Strathclyde, organiser*

2014–2016 **ScotCats**, *Scottish Category Theory Seminar, co-organiser*

2010–2013 **Proof, Complexity and Verification seminar**, *Swansea, co-organiser*

2011–2012 **Categorical logic seminar**, *Swansea, organiser*

2012–2013 **Realizability seminar**, *Swansea, organiser*

Program Committee Membership

2024 **APLAS**, *Asian Symposium on Programming Languages and Systems*

2024 **CMCS**, *Coalgebraic Methods in Computer Science*

2023 **HOPE**, *Higher-Order Programming with Effects*

2023 **FICS**, *Fixed Points in Computer Science*

2022 **ACT**, *Applied Category Theory*

2022 **CMCS**, *Coalgebraic Methods in Computer Science*

2022 **CSL**, *Computer Science Logic*

2021 **TYPES**, *Types for Proofs and Programs*

2020 **MSFP**, *Mathematically Structured Functional Programming*

2019 **TYPES**, *Types for Proofs and Programs*

2018 **CAPNSS**, *Compositional Approaches in Physics, NLP, and the Social Sciences*

2017 **TYPES**, *Types for Proofs and Programs*

2016 **CoALP-Ty**, *Workshop on Coalgebra, Horn Clause Logic Programming and Types*

2016 **CMCS**, *Coalgebraic Methods in Computer Science*

2015 **MFPS**, *Mathematical Foundations of Programming Semantics*

Refereeing

Journals Annals of Pure and Applied Logic, Archive for Mathematical Logic (×2), Computability, Journal of Functional Programming Journal of Logic and Computation (×2), Journal of Logical and Algebraic Methods in Programming, Journal of the ACM, Logical Methods in Computer Science (×8), Post-proceedings of the workshop on Coalgebra, Postproceedings of TYPES 2019, Postproceedings of TYPES 2021, Progress in Informatics, Theoretical Computer Science (×2).

Conferences Advances in Modal Logic, Applied Category Theory, Asian Symposium on Programming Languages and Systems, Classical Logic and Computation, Coalgebraic Methods in Computer Science, Computability in Europe (×2), Computer Science Logic, European Symposium on Programming, Foundations of Software Science and Computation Structures Horn Clause Logic Programming and Types, Interactive Theorem Proving, Logic In Computer Science (×7), Mathemathical Foundations of Computer Science, Mathematical Foundations of Programming Semantics (×2), Mathematically Structured Functional Programming (×2), Typed Lambda Calculus and Applications, Types for Proofs and Programs, Workshop on Logic, Language, Information and Computation.

Professional Activities and Visits

- Visitor at the Hausdorff Research Institute for Mathematics and participant in the Trimester programme *Prospects of Formalized Mathematics*, May 2024.
- External examiner for Maria Oikonomidi's MRes at Swansea University, Wales, December 2023.
- APLAS Best Paper Award, October 2023.
- Invited participant at the CIRM conference *Théorie des types, mathématiques constructives et logique géométrique*, May 2023.
- Invited participant/speaker at the *Augsburg mini-workshop on internal methods*, December 2022.
- Invited lecturer at *Proofs and Computation* 2022.
- Invited speaker at the *Proof and Computation 2022 Colloqium in honour of Prof. Helmut Schwichtenberg*, June 2022.
- Invited speaker at the *Topos Institute 2nd Workshop on Polynomial Functors*, March 2022.
- Invited speaker at the *HOTTEST seminar*, March 2022.
- External examiner for András Kovács's PhD *"Type-Theoretic Signatures for Algebraic Theories and Inductive Types"* at the Eötvös Loránd University, Budapest, February 2022.
- Applied Category Theory 2021 *Distinguished Presentation* Award, July 2021.
- Invited speaker at the *Topos Institute Workshop on Polynomial Functors*, March 2021.
- External examiner for Jakob von Raumer's PhD *"Higher Inductive Types, Inductive Families, and Inductive-Inductive Types"* at the University of Nottingham, December 2019.
- Invited speaker at *Foundations and Applications of Univalent Mathematics*, December 2019.
- Invited opening speaker at *Types in Munich* workshop, June 2019.
- Invited lecturer *EUTypes Summer School 2018*, Ohrid, Macedonia, 8–12 August 2018. Teaching *Introduction to Homotopy Type Theory*.
- Visitor at LMU Munich, Germany, 23 April–2 May 2018. Hosted by Dr Chuangjie Xu.
- Editor TYPES 2017 post-proceedings, 2017.
- Invited participant *Proof and Computation* Autumn school, Herrsching, Germany, September 2017.
- Reviewer for *Mathematical Reviews* since 2017.
- Visiting scholar at Wesleyan University, USA, 23 January–23 March 2017. Hosted by Dr Daniel Licata.
- Invited participant *Proof and Computation* Autumn school, Fischbachau, Germany, October 2016.
- Visitor at University of Ljubljana, Slovenia, 16–20 May 2016. Hosted by Prof. Alex Simpson.
- Invited participant *Mathematics for Computation* workshop, Niederalteich, Germany, May 2016.
- European Association for Theoretical Computer Science ETAPS Best Theory Paper Award, April 2016.
- Invited speaker *Mathematically Structured Functional Programming* workshop, Eindhoven, the Netherlands, April 2016.
- Visitor at Carnegie-Mellon University, Pittsburgh, USA, 25 August–24 September 2014. Hosted by Prof. Steve Awodey.
- Visitor at University of Nottingham, UK, 16–20 June 2014. Hosted by Dr Thorsten Altenkirch.
- Visitor at Stockholm University, Sweden, 9–13 June 2014. Hosted by Prof. Erik Palmgren.
- Invited attendee at Dagstuhl Seminar 11411 *Computing with Infinite Data: Topological and Logical Foundations*, October 2011.
- Visitor at University of Leicester, UK, 3–4 September 2011. Hosted by Prof. Alexander Kurz.

Invited seminar presentations

2024/09/12 **NPL Data Science Seminar**, National Physical Laboratory, UK. *LabMate: a prospectus for types for MATLAB.*

2022/10/14 **FP Lunch**, University of Nottingham, UK. *A Demo of TypOS.*

2022/10/06 **Computer Science Theory Seminar**, Tallinn University of Technology, Estonia. *Constructive taboos for ordinals.*

2021/04/23 **FP Lunch**, University of Nottingham, UK. *Functorial adapters in bidirectional type systems.*

2021/03/31 **Budapest type theory seminar**, Eötvös Loránd University, Hungary. *Quantitative type theory and data types.*

2020/02/04 **LFCS Seminar**, University of Edinburgh, UK. *Ordinal notation systems for ordinals below ε_0 in modern type theories.*

2018/04/30 **Oberseminar Mathematische Logik**, LMU Munich, Germany. *Mutual data types with equalities: quotient inductive-inductive types.*

2017/05/03 **Proofs, Constructions, and Computations Seminar**, University of Leeds, UK. *Variations on inductive-recursive definitions.*

2016/05/16 **Foundations Seminar**, University of Ljubljana, Slovenia. *Applications and theory of Higher inductive types.*

2016/05/03 **LFCS Seminar**, University of Edinburgh, UK. *Comprehensive parametric polymorphism.*

2016/03/11 **Logic and Semantics Seminar**, University of Cambridge, UK. *Comprehensive parametric polymorphism.*

2015/04/29 **LFCS Seminar**, University of Edinburgh, UK. *Inductive-inductive definitions in Type Theory.*

2014/09/22 **POP Seminar**, Carnegie-Mellon University, Pittsburgh, US. *Towards a Presentation of General Higher Inductive Types.*

2014/06/11 **Stockholm Logic Seminar**, Stockholm University, Sweden. *Inductive-inductive definitions in Intuitionistic Type Theory.*

2012/11/27 **Oberseminar Theoretische Informatik**, LMU Munich, Germany. *Internalizing inductive-inductive definitions in Martin-Löf Type Theory.*

2012/07/11 **Oberseminar Mathematische Logik**, LMU Munich, Germany. *Inductive-inductive definitions in dependent type theory.*

2011/11/03 **CLOG seminar**, University of Leicester, UK. *Data types in dependent type theory.*

2011/10/28 **Theoretical computer science seminar**, University of Birmingham, UK. *Inductive-inductive definitions: axiomatisation and categorical semantics.*

2010/07/29 **Mathematically Structured Programming seminar**, University of Strathclyde, Glasgow, UK. *Inductive-inductive definitions as initial dialgebras.*

2010/11/12 **Functional Programming Lab seminar**, University of Nottingham, UK. *Interpreting inductive-inductive definitions as indexed inductive definitions.*

Research supervision

Georgi Nakov	PhD	since 2019
Sean Watters	PhD	since 2021

Languages

○ Swedish **Native** ○ English **Fluent** ○ German **Good**

Computer skills

Languages: Haskell, SML, Scheme, LaTeX, C, Java.

Proof assistants: Agda, Coq, Minlog.

Development: Contributed to the development of Agda (anonymous pattern matching functions, warning system) and Minlog (program extraction to Haskell).

Publications

Note that my surname is "Nordvall Forsberg" (with a space); it is standard in my discipline to order authors alphabetically. The important method of dissemination in computer science is through conference publications.

Journal papers

1. Daniel Ritter, Fredrik Nordvall Forsberg and Stefanie Rinderle-Ma. **Responsible Composition and Optimization of Integration Processes under Correctness Preserving Guarantees**. In *Information Systems*, Volume 124, Elsevier, 2024.
2. Nicolai Kraus, Fredrik Nordvall Forsberg and Chaungjie Xu. **Type-theoretic approaches to ordinals**. In *Theoretical Computer Science*, Volume 957, Elsevier, 2023.
3. Conor McBride, Georgi Nakov and Fredrik Nordvall Forsberg. **Measuring with confidence: leveraging expressive type systems for correct-by-construction software**. In *Acta IMEKO*, Volume 12, Number 1, 2023.
4. Neil Ghani, Fredrik Nordvall Forsberg and Federico Orsanigo. **Universal properties for universal types in bifibrational parametricity**. In *Mathematical Structures in Computer Science*, Volume 29, Issue 6, pages 810–827, Cambridge University Press, 2019.
5. Neil Ghani, Clemens Kupke, Alasdair Lambert and Fredrik Nordvall Forsberg. **A Compositional Treatment of Iterated Open Games**. In *Theoretical Computer Science*, Volume 741, pages 48–57, Elsevier, 2018.
6. Neil Ghani, Lorenzo Malatesta and Fredrik Nordvall Forsberg. **Positive Inductive-Recursive Definitions**. In *Logical Methods in Computer Science*, 11(1:13), 2015.
7. Ulrich Berger, Andrew Lawrence, Fredrik Nordvall Forsberg and Monika Seisenberger. **Extracting verified decision procedures: DPLL and Resolution**. In *Logical Methods in Computer Science*, 11(1:6), 2015.

Conference papers

8. Clemens Kupke, Fredrik Nordvall Forsberg and Sean Watters. **A Fresh Look at Commutativity: Free Algebraic Structures via Fresh Lists**. To appear in the *Asian Symposium on Programming Languages and Systems*, 2023. ***Best Paper Award***.
9. Tom de Jong, Nicolai Kraus, Fredrik Nordvall Forsberg and Chaungjie Xu. **Set-theoretic and type-theoretic ordinals coincide**. In *Logic in Computer Science*, IEEE Computer Society, 2023.
10. Georgi Nakov and Fredrik Nordvall Forsberg. **Quantitative Polynomial Functors**, In *Types for Proofs and Programs*, 2022.
11. Matteo Capucci, Neil Ghani, Clemens Kupke, Jeremy Ledent and Fredrik Nordvall Forsberg. **Infinite Horizon Extensive Form Games, Coalgebraically**, In *Mathematics for Computation*, 2022.
12. Nicolai Kraus, Fredrik Nordvall Forsberg and Chuangjie Xu. **Connecting Constructive Notions of Ordinals in Homotopy Type Theory**. In *Mathematical Foundations of Computer Science*, 2021.
13. Matteo Capucci, Neil Ghani, Jeremy Ledent and Fredrik Nordvall Forsberg. **Translating Extensive Form Games to Open Games with Agency**. In *Applied Category Theory*, 2021. ***Distinguished Presentation Award***.
14. Conor McBride and Fredrik Nordvall Forsberg. **Type systems for programs respecting dimensions**. In *Advanced Mathematical and Computational Tools in Metrology and Testing XII*, 2021.
15. Robert Atkey, Bruno Gavranović, Neil Ghani, Clemens Kupke, Jeremy Ledent and Fredrik Nordvall Forsberg. **Compositional Game Theory, compositionally**. In *Applied Category Theory*, 2020.

16. Fredrik Nordvall Forsberg, Chuangjie Xu and Neil Ghani. **Three Equivalent Ordinal Notation Systems in Cubical Agda**. In *Certified Programs and Proofs*, 2020.
17. Neil Ghani, Clemens Kupke, Alasdair Lambert and Fredrik Nordvall Forsberg. **Compositional Game Theory with Mixed Strategies: Probabilistic Open Games Using a Distributive Law**. In *Applied Category Theory*, 2019.
18. Daniel Ritter, Fredrik Nordvall Forsberg, Norman May and Stefanie Rinderle-Ma. **Optimization Strategies for Integration Pattern Compositions**. In *Distributed and Event-based Systems*, 2018.
19. Thorsten Altenkirch, Paolo Capriotti, Gabe Dijkstra, Nicolai Kraus and Fredrik Nordvall Forsberg. **Quotient Inductive-Inductive Types**. In *Foundations of Software Science and Computation Structures*, 2018.
20. Neil Ghani, Conor McBride, Fredrik Nordvall Forsberg and Stephan Spahn. **Variations on inductive-recursive definitions**. In *Mathematical Foundations of Computer Science*, volume 83 of *Leibniz International Proceedings in Informatics*, pages 63:1–63:13, Schloss Dagstuhl–Leibniz-Zentrum für Informatik, 2017.
21. Neil Ghani, Fredrik Nordvall Forsberg and Alex Simpson. **Comprehensive parametric polymorphism: categorical models and type theory**. In *Foundations of Software Science and Computation Structures*, volume 9634 of *Lecture Notes in Computer Science*, pages 3–19, Springer, 2016. ***Best ETAPS Theory Paper Award***.
22. Neil Ghani, Fredrik Nordvall Forsberg and Federico Orsanigo. **Proof relevant parametricity**. In *A List of Successes that can Change the World*, volume 9600 of *Lecture Notes in Computer Science*, pages 109–131, Springer, 2016.
23. Neil Ghani, Patricia Johann, Fredrik Nordvall Forsberg, Federico Orsanigo and Tim Revell. **Bifibrational functorial semantics of parametric polymorphism**. In *Mathematical Foundations of Programming Semantics XXXI*, volume 319 of *Electronic Notes in Theoretical Computer Science*, pages 165–181, Elsevier, 2015.
24. Robert Atkey, Neil Ghani, Fredrik Nordvall Forsberg, Tim Revell and Sam Staton. **Models for Polymorphism over Physical Dimensions**. In *Typed Lambda Calculi and Applications*, volume 38 of *Leibniz International Proceedings in Informatics*, pages 45–59, Schloss Dagstuhl–Leibniz-Zentrum für Informatik, 2015.
25. Neil Ghani, Fredrik Nordvall Forsberg and Federico Orsanigo. **Parametric polymorphism — universally**. In *Workshop on Logic, Language, Information and Computation*, volume 9160 of *Lecture Notes in Computer Science*, pages 81–92, Springer, 2015.
26. Neil Ghani, Lorenzo Malatesta and Fredrik Nordvall Forsberg. **Positive Inductive-Recursive Definitions**. Invited paper in *Conference on Algebra and Coalgebra in Computer Science*, volume 8089 of *Lecture Notes in Computer Science*, pages 19–33, Springer, 2013.
27. Neil Ghani, Lorenzo Malatesta, Fredrik Nordvall Forsberg and Anton Setzer. **Fibred Data Types**. In Logic in Computer Science, pages 243–252, IEEE Computer Society, 2013.
28. Kenji Miyamoto, Fredrik Nordvall Forsberg and Helmut Schwichtenberg. **Program Extraction from Nested Definitions**. In *Interactive Theorem Proving*, volume 7998 of *Lecture Notes in Computer Science*, pages 370–385, Springer, 2013.
29. Fredrik Nordvall Forsberg and Anton Setzer. **A finite axiomatisation of inductive-inductive definitions**. In *Logic, Construction, Computation*, volume 3 of Ontos Mathematical Logic, De Gruyter, 2012.
30. Thorsten Altenkirch, Peter Morris, Fredrik Nordvall Forsberg, and Anton Setzer. **A categorical semantics for inductive-inductive definitions**. In *Conference on Algebra and Coalgebra in Computer Science*, volume 6859 of *Lecture Notes in Computer Science*, pages 70–84, Springer, 2011.

31. Fredrik Nordvall Forsberg and Anton Setzer. **Inductive-inductive definitions**. In *Computer Science Logic*, volume 6247 of *Lecture Notes in Computer Science*, pages 454–468, Springer, 2010.

Editing of Conference Proceedings

32. Ambrus Kaposi, Fredrik Nordvall Forsberg and Andreas Abel. **23rd International Conference on Types for Proofs and Programs (TYPES 2017)**. Volume 104 of *Leibniz International Proceedings in Informatics*, Schloss Dagstuhl–Leibniz-Zentrum für Informatik, 2018.

Theses

33. Fredrik Nordvall Forsberg. **Inductive-inductive definitions**. PhD thesis. Swansea University, 2014.
34. Fredrik Nordvall Forsberg. **Constructive aspects of models for non-standard analysis**. Master thesis. *U.U.D.M. Project report 2009:10*, Uppsala University, 2009.