

Meven LENNON-BERTRAND

Post-doctoral researcher—CLASH group, University of Cambridge

@ mgapb2@cam.ac.uk

www.meven.ac

MevenBertrand

Research Experience

Research Associate

Nov. 2022—... University of Cambridge

PhD Student

Supervised by Nicolas Tabareau

Sep. 2019—Sep. 2022 Gallinette team, Nantes

Bidirectional Typing for the Calculus of Inductive Constructions.

Research Intern (M2)

Supervised by Nicolas Tabareau

Feb.—Jul. 2019 Gallinette team, Nantes

Gradualizing the Calculus of Inductive Constructions.

Research Intern (M1)

Supervised by Jurriaan Rot

Jan.—Jul. 2017 Radboud University Nijmegen

Coalgebraic Determinization of Alternating Automata.

Main Publications

Journal Articles

Lennon-Bertrand et al., *Gradualizing the Calculus of Inductive Constructions* (TOPLAS, 2022)

Conference Articles

- Lennon-Bertrand, *Complete Bidirectional Typing for the Calculus of Inductive Constructions* (ITP, 2021)
- Maillard et al., *A Reasonably Gradual Type Theory* (ICFP, 2022)

Refereed Presentations at Workshops

- Lennon-Bertrand, *À bas l'η – Coq's troublesome η-conversion* (WITS, 2022)
- Lennon-Bertrand, *Equivalence between Typed and Untyped Algorithmic Conversions* (Types, 2022)

Interests

Proof Assistants

Logic

Formalization of Mathematics

Dependent Types

Bidirectional Typing

Gradual Typing

Education

Master 2

Fundamental Computer Science

2018—2019 ENS de Lyon

Master 2

Mathematics

2017—2018 ENS de Lyon

Master 1 (Erasmus exchange)

Mathematical Foundations of Computer Science

2016—2017 Nijmegen, NL

Double Bachelor

Computer Science & Mathematics

2015—2016 ENS de Lyon

Teaching and Science Mediation

Teaching Assistant

64 h/year

Sep. 2019—Jun. 2022 Université de Nantes

CHantiers Arts, Sciences et Technologies

2019—2022 Lycée Michelet, Nantes

Collaborated with a maths researcher and two theatre authors on a project with a vocational high-school.

Séminaire de la Détente Mathématique

2018—2019 MMI, Lyon

Animated a weekly popularization seminar, and participated as a presenter.

Category Theory Course

Sept 2018 – Jan 2019 ENS de Lyon

Organized and taught a weekly category theory course to fellow ENS students.

Research Activity

Topic

My research primarily aims at using concepts and ideas originating in programming language theory, by applying them to the specific setting of proof assistants, especially those based on type theory. As proof assistants are very close to programming languages, solutions coming from the general programming language field often apply to solve problems specific to proof assistants. However, difficult technical questions often arise when doing this adaptation, and most of my work focused on solving this kind of questions. The main proof assistant I work on is Coq, and I chiefly focus on its type system, the Calculus of Inductive Constructions.

Main Results

Gradualization of the Calculus of Inductive Constructions

📅 2022

👤 Kenji Maillard, Nicolas Tabareau, Éric Tanter

We proposed a system extending the Calculus of Inductive Constructions to feature a form of dynamic typing, following ideas from the gradual typing research area. We first proved an impossibility theorem, showing that one cannot design a system combining all the desirable properties for such a system. Still, we were able to design a solution where one can modularly choose the property to be abandoned and those to keep. Later on, we extended that system to allow for sound, internal reasoning about gradual programs.

Bidirectional Calculus of Inductive Constructions

📅 2021

Bidirectional typing is an approach to typing which makes explicit in the rules the flow of information present in implementations. While it belongs to the folklore of dependent type systems implementors, there was surprisingly little theoretical work on it. I described in details a bidirectional presentation of the Calculus of Inductive Constructions, and proved its properties, including its equivalence with the standard presentation. I used this equivalence as part of a larger formalization to show the soundness and completeness of the kernel implemented in the METACOQ project. This work also allowed to detect and correct a bug in the kernel of Coq.

Software Development

METACOQ Formalization Project

📅 2020-...

👤 The METACOQ team

This large collaborative project aims at formalizing Coq in Coq itself, and to allow manipulating Coq terms in Coq in order to develop certified meta-programming tools. I mainly contribute to the theoretical aspect, and currently my largest addition is the formalization of my work on bidirectional typing, in order to prove the correctness of the type-checking algorithm implemented as part of the project.

Contributions to the Community

Artefact Evaluation for ICFP

📅 2022

Evaluation of artefacts (code, formalization, supplementary material, etc.) attached to articles accepted at the conference.

Proof Assistants Stack Exchange

📅 2022-...

This website, currently in beta-testing phase, aims to answer questions around proof assistants in a community-based manner. I am in the top 10 most reputable users.

Publications

Journal

- 2022 Gradualizing the Calculus of Inductive Constructions
Meven Lennon-Bertrand, Kenji Maillard, Nicolas Tabareau and Éric Tanter. *ACM Transactions on Programming Languages and Systems*, 82 pp.

Conference

- 2022 A Reasonably Gradual Type Theory
Kenji Maillard, Meven Lennon-Bertrand, Nicolas Tabareau and Éric Tanter. *International Conference on Functional Programming*, 29 pp.
- 2021 Complete Bidirectional Typing for the Calculus of Inductive Constructions
Meven Lennon-Bertrand. *12th International Conference on Interactive Theorem Proving*, 19 pp.

Preprint

- 2018 Coalgebraic Determinization of Alternating Automata
Meven Bertrand and Jurriaan Rot. *arXiv*.

Talks

All workshops are peer-reviewed. The speaker is always the first author.

- 2022 Equivalence between Typed and Untyped Algorithmic Conversions
Meven Lennon-Bertrand. *28th International Conference on Types for Proofs and Programs*.
- 2022 Bidirectional Dependent Types, Bidirectional Elaboration, Bidirectional Conversion
Meven Lennon-Bertrand. *Ljubljana Foundations Seminar*.
- 2022 À bas l'η – Coq's troublesome η-conversion
Meven Lennon-Bertrand. *1st Workshop on the Implementation of Type Systems*.
- 2022 The Curious Case of Case: Correct & Efficient Representation of Case Analysis in Coq and MetaCoq
Matthieu Sozeau, Meven Lennon-Bertrand and Yannick Forster. *1st Workshop on the Implementation of Type Systems*.

Teaching and Science Mediation

Teaching Assistant (64 hrs/year)

📅 Sep. 2019–Jun. 2022

📍 Université de Nantes

During my 3 years as a Ph.D. student, I also served as a teaching assistant at the University of Nantes. As much as possible, I tried varying my experiences. I thus taught various levels (1st to 3rd Bachelor years), themes (mathematics, applied and fundamental computer science), formats (lectures, exercise and computer sessions), and public (specialists and non-specialists).

CHantiers Arts, Sciences et Technologies

📅 2019–2022

📍 Théâtre Athénor & Lycée Professionnel Michelet, Nantes

Together with maths researcher Bertrand Michel and theatre authors Rémi Checchetto and Sylvain Renard, we collaborated with a team of vocational high-school teachers to build workshops for their students around the theme of “Artificial Intelligence”, in a broad sense. I implemented some activities directly inspired by the *Computer Science Unplugged* project, and designed some of my own. These workshops culminated in an exposition, created by the students, based on the content of the workshops.

Séminaire de la Détente Mathématique

📅 2018–2019

📍 Maison des Mathématiques et de l'Informatique, Lyon

A weekly mathematic/computer science seminar, aimed at being “relaxed” and accessible to both students and faculty, with talks often on unusual and/or fun topics. Many students would also give their first actual talk there. I organized the seminar with a team of other students, and participated as an orator.

Category Theory Course

📅 Sept 2018 – Jan 2019

📍 ENS de Lyon

During my Master 2, I organized a category theory course for students of the ENS de Lyon. Due to the absence of an actual course dedicated to a subject that was nonetheless used in some master courses, other students that did not know of the topic encouraged me and a fellow student to set up a course on it, as we were familiar with it through our previous internships. Although it was not integrated as a proper course to the curriculum, we still tried to stay as close as possible to a “real” course: it lasted for a semester of one 2 hour lecture per week (split between us two), and was mostly based on Awodey’s *Category theory*.