Brigitte Pientka

McGill University
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Current position

Assistant Professor
School of Computer Science, McGill University, 2003 — present

Education

Carnegie Mellon University, Dept. of Computer Science, USA, 1998 — 2003
Ph.D. in Computer Science (Dec 2003)

Ph.D. Thesis: *Tabled higher-order logic programming*
Advisor: Frank Pfenning
Thesis committee: Robert Harper, Dana Scott, David S. Warren

Technical University Darmstadt, Germany, 1993 — 1997
Diplom (comparable to M.S.) with honors in Computer Science,
minor in Pedagogics
average grade: 1.04 (highest grade possible: 1.0)

Technical University Darmstadt, Germany, 1990 — 1993
Vordiplom (comparable to B.S.) in Computer Science

Research Grants

Logic and computation
McGill University Grant 50,000 CAD, 2003 – 2004

Efficient verification and validation techniques for logical frameworks
NSERC Grant 25,700 CAD per year, 2004 – 2007

Towards an efficient safety infrastructure
FQRNT Grant 15,400 CAD per year, 2004 – 2007

Infrastructure for evolving and verifying complex medical software systems
CFI Grant, 394,142 CAD total, 2005 – 2009 (awarded in Winter 2005)
(Co-Pis: Joelle Pineau and Martin Robillard)

Inria-McGill Collaboration
Vice-Principal Research Office Grant, 24,0000 CAD 2005-2007

Honors

Invited Tutorial Speaker *21st International Conference on Logic Programming*, 2006
Best Paper Award at *19th International Conference on Logic Programming*, 2003
Siebel Scholar, 2002
Gottlieb Daimler – Karl Benz Fellow, 2001
Graduate Research Fellowship, Carnegie Mellon University, 1998 — 2003
Gottlieb Daimler – Karl Benz Foundation Scholarship, 1997 — 1998

Awards

Conference Scholarship, Association of Logic Programming, 2002
GSA Conference Funds, Carnegie Mellon University, 2002
Woody Bledsoe Travel Award, CADE, 2001
Grace Hopper Conference Scholarship, 2000
Conference Scholarship, Intel Foundation, 1997

Research Projects

Towards an efficient safety infrastructure for proof-carrying code applications
Research group leader, School of Computer Science, McGill University, Aug 2003 – present
– *Efficient verification and validation techniques for logical frameworks*
– *Foundations of logical frameworks*

Tabled higher-order logic programming
Dept. of Computer Science, Carnegie Mellon University
Advisor: F. Pfenning, 1998 — 2003
– *Optimizing higher-order logic programming engine*
– *Termination and reduction checking for higher-order logic programs*

Automating induction proofs in NuPRL
Dept. of Computer Science, Cornell University
Advisors: R. Constable and C. Kreitz, 1997 — 1998

Motivations for choosing careers in engineering (An interdisciplinary study of young people in Germany),
Institute for Professional Education, Technical University Darmstadt
Advisor: A. Paul–Kohlhoff, 1995 — 1996

Automating first-order termination proofs,
Dept. of Computer Science, Technical University Darmstadt
Advisors: C. Walther and J. Giesl, 1994 — 1995

Proof planning
Dept. of Artificial Intelligence, University of Edinburgh (A.Bundy, A. Ireland)
Dept. of Computer Science, Technical University Darmstadt (C. Walther, S.Gerberding)
– *Structured incremental proof planning*
– *Heuristics for case analysis for the existing inductive proof planner*

Supervision of students

Master students:
– Ye Henry Tian (Completed Aug 05)
"Mechanically verifying correctness of CPS compilation"
– Ahmer Ahmedani (jointly supervised with Prof. Verbrugge, completed Oct 06)
" Information flow in a Java intermediate language"
– Jacques le Normand (jointly supervised with Prof. Panangaden, completed Feb 07)
" Guarded Abstract Data-types"
– Xi Li (David) (expected to graduate in Aug 2007)
"Inverse method for logical frameworks"
– Samuli Heilala (expected to graduate in Aug 2008)
"Decision procedures for modal logics"
– Ian Clement (expected to graduate in Aug 2008)
"Constructive description logics"
– Renaud Germain (expected to graduate in Aug 2008)
"Automating proofs in logical frameworks"

Undergraduate students:
– Xi Li (David) (May 05 - Aug 05)
"Decision procedures for propositional logic and congruence closure"
– Benjamin Azan (May 05 - Sept 05)
"Type systems for Featherweight Java: theory and implementation"
– Samuli Heilala (Honors Theses)(Jan 06 – Aug 06)
"Decision procedures for intuistionistic modal logic"
– Dustin Wehr (Honors Theses, NSERC USRA)(Jan 07 - Aug 07)
"Refinement types for logical frameworks"
– Maja Frydrychowicz (CDMP and NSERC USRA Award)(Jan 07 - Aug 07)
"A logical foundation for enforcing access control"
– Andres Franceschi Larrea (May 07 - Aug 07)
"A practical comparison of LambdaProlog and Twelf"

Exchange student:
– Sabrina Chantrelle (May 05 - Sept 05)
"A focusing prover for bunched implications"
– Floren Pompigne (March 07 - Aug 07)
"Proof-theoretic foundation for magic sets"

External thesis reviewer or committee member

Choon Kyu Kim
PhD Thesis: Parallel semantic tree theorem proving with resolutions

Sam Bakhtiar Sanjabi
Master Thesis: Dataflow analysis of the pi-calculus

Publications (Computer Science)

Refereed Journals

[1] Aleksandar Nanevski, Frank Pfenning, Brigitte Pientka. Contextual Modal Type Theory. accepted Jan 07 *ACM Transactions on Computational Logic* (to appear) (56 pages)

[2] Brigitte Pientka. Verifying termination and reduction properties about higher-order logic programs. *Journal of Automated Reasoning* 34(2):pages 179-207, 2005 (*This is an extended journal version of [16]*)

[3] Christoph Kreitz and Brigitte Pientka. Connection-driven inductive theorem proving. *Studia Logica*, 69(2):pages 293–326, 2001. (*This is an extended journal version of [17]*).

[4] Brigitte Pientka and Christoph Kreitz. Automating inductive specification proofs. *Fundamenta Informatica*, 39(1–2):pages 189–209, 1999. (*This is an extended journal version of [18]*)

Book Chapters and Proceedings

[5] Proceeding of the International Workshop on Logical Frameworks and Meta-Languages: Theory and Practice, Seattle, WA, USA Editors Brigitte Pientka and Alberto Momiglian. Electronic Notes in Theoretical Computer Science (ENTCS), Elsevier, 2006.

[6] Christoph Kreitz, Jens Otten, Stephan Schmitt, and Brigitte Pientka. Matrix-based constructive theorem proving. In Steffen Hölldobler, editor, *Intellectics and Computational Logic. Papers in honor of Wolfgang Bibel*, Applied Logic Series, vol. 19, pages 189–205. Kluwer, 2000.

Refereed Conferences

[7] Brigitte Pientka. Proof Pearl:The power of higher-order encodings in the logical framework LF submitted 2007.

[8] Samuli Heilala and Brigitte Pientka. Bidirectional Decision Procedures for the Intuitionistic Propositional Modal Logic **IS4** submitted 2007.

[9] Brigitte Pientka. Eliminating redundancy in higher-order unification: a lightweight approach In U. Furbach and N. Shankar, editor, *22nd International Conference on Logic Programming, Seattle, USA*, Lecture Notes in Artificial Intelligence(LNAI) 4130, 361 – 377 pages, Springer-Verlag, 2006.

[10] Brigitte Pientka. Overcoming Performance Barriers: Efficient Verification Techniques for Logical Frameworks (Invited Tutorial) In Sandro Etalle and Miroslaw Truszczynski, editor, *22nd International Conference on Logic Programming, Seattle, USA*, Lecture Notes in Computer Science (LNCS) 4079, 3 - 10 pages, Springer-Verlag, 2006.

[11] Susmit Sarkar, Brigitte Pientka and Karl Crary. Small proof witnesses for LF In M. Gabbrielli, G. Gupta, editor, *21th International Conference on Logic Programming, Barcelona, Spain*, Lecture Notes in Computer Science (LNCS), Springer-Verlag, 2005.

[12] Brigitte Pientka. Tabling in higher-order logic programming In R. Niewenhuis, editor, *20th International Conference on Automated Deduction, Talinn, Estonia*, Lecture Notes in Computer Science (LNAI 3632), pages 54 – 69, Springer-Verlag, 2005.

[13] Brigitte Pientka. Higher-order substitution tree indexing (**Best Paper Award**) In C. Palamidessi, editor, *19th International Conference on Logic Programming, Mumbai, India*, Lecture Notes in Computer Science (LNCS 2916), pages 377–391, Springer-Verlag, 2003.

[14] Brigitte Pientka and Frank Pfenning. Optimizing higher-order pattern unification In F. Baader, editor, *19th International Conference on Automated Deduction, Miami, Florida, USA*, Lecture Notes in Computer Science (LNCS 2741), pages 473–487, Springer-Verlag, 2003.

[15] Brigitte Pientka. A proof-theoretic foundation for tabled higher-order logic programming. In P. Stuckey, editor, *18th International Conference on Logic Programming, Copenhagen, Denmark*, Lecture Notes in Computer Science (LNCS), pages 271 –286. Springer-Verlag, 2002.

[16] Brigitte Pientka. Termination and reduction checking for higher-order logic programs. In T. Nipkow, R. Gore, A. Leitsch, editor, *First International Joint Conference on Automated Reasoning, Siena, Italy*, Lecture Notes in Artificial Intelligence (LNAI) 2083, pages 401–415. Springer-Verlag, 2001. (*A preliminary version of this paper appeared in [23]*)

[17] Christoph Kreitz and Brigitte Pientka. Matrix-based inductive theorem proving. In R. Dyckhoff, editor, *9th International Conference on Automated Reasoning with Analytic Tableaux and Related Methods (TABLEAUX)*, Lecture Notes in Artificial Intelligence (LNAI) 1847, pages 294–308. Springer Verlag, 2000.

[18] Brigitte Pientka and Christoph Kreitz. Instantiation of existentially quantified variables in inductive specification proofs. In J. Plaza and J. Calmet, editors, *4th International Conference on Artificial Intelligence and Symbolic Computation*, Lecture Notes in Artificial Intelligence (LNAI) 1476, pages 247–258. Springer-Verlag, 1998.

[19] Stefan Gerberding and Brigitte Pientka. Structured incremental proof planning. In Brewka, G. Habel, C. Nebel, B: *Proceedings of the 21st Annual German Conference on Artificial Intelligence (KI-97): Advances in Artificial Intelligence*, Freiburg, Germany, Lecture Notes in Artificial Intelligence (LNAI) 1303, pages 63-74, Springer, 1997.

Refereed Workshops

[20] Brigitte Pientka. Functional Programming with Higher-order Abstract Syntax and Explicit Substitutions In Aaron Stump and Hongwei Xi, editor, *Programming Languages meets Pro-*

gram Verification, Seattle, USA,Electronic Notes in Theoretical Computer Science (ENTCS), pages 87–102, Elsevier, 2006.

[21] Aleksandar Nanevski, Brigitte Pientka and Frank Pfenning. A modal foundation for meta-variables In F. Honsell and M. Miculan and A. Momigliano, editors, *2nd Workshop on Mechanized Reasoning about Languages with Variable Binding (MERLIN'03), Uppsala, Sweden*, ACM Press, pages 159–180, 2003.

[22] Brigitte Pientka. Memoization-based proof search in LF: an experimental evaluation of a prototype. In *Third International Workshop on Logical Frameworks and Meta-Languages (LFM'02), Copenhagen, Denmark*, Electronic Notes in Theoretical Computer Science (ENTCS), Volume 70, Issue 2, pages 1–14, 2002.

[23] Brigitte Pientka and Frank Pfenning. Termination and reduction checking in the logical framework. In C. Schürmann, editor, *Workshop on Automation of Proofs by Mathematical Induction, Pittsburgh, USA*, 2000.

Technical Reports

[24] Brigitte Pientka. Tabled Higher-order Programming. Technical report CMU-CS-03-185, Carnegie Mellon University, Dec 2003.

[25] Brigitte Pientka. Structuring and optimizing incremental proof planning. Master's thesis, Technical University Darmstadt, 1997.

[26] Brigitte Pientka. A heuristic for case analysis. Technical Paper 37, Department of Artificial Intelligence, University of Edinburgh, 1995.

Other Publications (Gender Studies)

[27] Brigitte Pientka. How to prove it. In *Proceeding of the Third International Conference on Women, Work and Computerization, Bonn, Germany*. Springer-Verlag, 1997.

[28] Brigitte Pientka. Ist die Informatik männlich? Eindrücke, Erfahrungen, Forderungen. In A. Paul-Kohlhoff and C. Walter, editors, *"Eine Frau, die Maschinenbau studiert ist kein Wesen vom Mars ..." — Studentinnen motivieren Schülerinnen*, volume 17. Darmstädter Beiträge zur Berufspädagogik, 1996.

Contributions to Software Systems

Major contributions to the **Twelf** system and developer of **Twelf 1.5R1** a tabled higher-order logic programming environment.
The system is one of the most successful systems in supporting specification of formal systems and proofs about them. Among the universities and research groups using Twelf are: Carnegie Mellon University, Princeton, Yale, Cornell University, University of Pennsylvania,

Teaching Experience

Undergraduate Course: COMP-302 Programming Languages and Paradigms
Fall'05, Winter'06, Winter'07 School of Computer Science, McGill University
Advanced undergraduate level course in the area of programming languages and paradigms, developed course outline, weekly lectures (25 lectures, 1h30min each), 5 home work assignments, this course is centered typed functional programming in SML and theoritical foundations of programming languages.

Undergraduate Course: COMP-426 Automated reasoning
Fall'04, Fall'05, Fall'06 School of Computer Science, McGill University
Advanced undergraduate level course in the area of theorem proving and logical foundations, developed course outline, weekly lectures (25 lectures, 1h30min each), 5 home work assignments, this course is centered around a series of implementations of theorem provers.

Graduate Course: COMP-523 Language-based security
Winter 05, Winter'06, School of Computer Science, McGill University
Graduate level course in the area of type-systems, operational semantics of programming languages, logic and computation, and logical frameworks. Developed course outline, weekly lectures (25 lectures, 1h30 each), 8 home work assignments (4 theory and 4 implementation), this course is centered around a series of implementations of type-checkers and evaluators using advanced programming languages such as SML and Twelf.

Graduate Course: COMP 762B Computation and deduction
Winter 04, Fall 06, School of Computer Science, McGill University
Advanced graduate level course in the area of logical frameworks and their applications in programming languages, developed course outline, weekly lectures(25 lectures, 1h30min, 4 home work assignments, final project).

Teaching fellow, Eberly Center for Teaching Excellence, Carnegie Mellon University, May 2001 — Aug 2003,
Co-teacher in seminars at the Eberly Center for Teaching Excellence, conducted micro-observations of other graduate students

Documentation of teaching development, Future faculty development program, Eberly Center for Teaching Excellence, Carnegie Mellon University, May 200 – present,
Participated in seminars on teaching and had two classroom observations

Teaching assistant at Carnegie Mellon University
graduate course *Computation and Deduction* (Prof. F. Pfenning), Spring 01
interdisciplinary undergraduate course, *Constructive Logic* (Prof. S. Awody), Fall 01
advanced undergraduate course *Programming Languages* (Prof.S. Brooks), Fall 99

Professional Service

Organizer of the "International Workshop on Logical Frameworks and Meta-Languages: theory and practice (LFMTP)", Bremen, Germany, 2007

Program chair of the "International Workshop on Logical Frameworks and Meta-Languages: theory and practice (LFMTP)", Seattle, USA, 2006

Publicity chair for the 20th International Conference of Automated Deduction, 2005

Program committe member
– International Workshop on Logical Frameworks and Meta-Languages(LFMTP), 2007
– Programming Languages meets Program Verification, 2007
– 22nd International Conference on Logic Programming, 2006
– International Workshop on Logical Frameworks and Meta-Languages (LFMTP) 2006
– ACM Workshop on Programming Languages and Analysis for Security, 2006
– 21st Conference on the Mathematical Foundations of Programming Semantics, 2005
– 6th ACM International Conference on Principles and Practice of Declarative, 2004

Co-organizer of the Quebec Programming Languages Seminaire (QCPLS)
– Nov 12 2004, McGill University, Invited Speaker: Anindya Banerjee, Kansas State
– April 26, 2004, Universite de Montreal, Invited Speaker: Amy Felty, University of Ottawa

Area editor (Theorem proving) for the Association of Logic Programming Newsletter (appointed in May 2005)

Journal reviewer: Journal of Higher-Order Symbolic Computation (HOSC), Theory and Practice of Logic Programming (TPLP)

Conference reviewer: LICS, PPDP, ASIAN, IJCAR, CLS, RTA, FOSSACS, LPAR, TLCA

University and Community Service

Chair of the Undergraduate committee, Jan 07 – present
– Responsible for all undergraduate matters
– Organization of the open house, Undergraduate advising, Hiring of lecturer

Hiring Committee (Faculty of Education)
– Consulting for an assistant professor position with concentration on teaching mathematics

Organizer of Freshman Interests Groups (FIG), Fall 2006
– Offered a Freshman Interest Group for U0 students
– Part of a Faculty of Science initiative of mentoring U0 students

Chair of the "Women@SOCS" committee, May 2005 – present
– Developed outreach roadshow to attract computer science students to McGill
– Co-organized an orientation day and an open house of the research labs
– Mentoring of our women undergraduate and graduate students

Co-founder of School of Computer Science Colloquium, Aug 2004 – present
– Weekly speakers series which features established researchers such as Kenneth Birman (Cornell University)or Gregor Kiczales(University of British Columbia.
– On average 60 students and faculty members from McGill, Universite de Montreal, and Concordia University attended

Co-founder of the Undergraduate Summer Research Symposium in the School of Computer Science, McGill University, Aug 2004
– Founded the research symposium together with Prof. Bruce Reed
– Featured 14 talks by undergraduate students
– Awarded "Undergraduate Research Excellence Prize"

PhD Committee in School of Computer Science, McGill University, Aug 2003 – present
– Designed a proposal for the PhD comprehensive exam
– Reviewed PhD applicants, attended oral PhD comprehensive exams, and PhD orals

Founding member of *Women@SCS*, and the *Women in School of Computer Science Advisory Committee (WSCSAC)*, Carnegie Mellon University, Sep 1999 – Jul 2003
– Established the annual graduate women's potluck and the Women@scs lecture series
– Helped shape the proposal on *Expanding the IT pipeline to the graduate level and beyond* which is now funded by the Sloan Foundation and lead by Prof. Lenore Blum

Member of the Election Commission, Technical University Darmstadt, 1996 — 1997

Equal Opportunity Officer, Technical University Darmstadt, 1995 — 1996

Invited Presentations (Computer Science)

Tabled higher-order logic programming
– Mobile Code Safety and Program Verification Using Computational Logic Tools
Workshop at the International Conference of Logic Programming (ICLP)
Barcelona, Spain, 2005

Contextual Modal Type Theory: A Foundation for Meta-variables
(joint work with F. Pfenning and A. Nanevski)
– Logic Seminar, University of Saarbruecken, Apr 2006
– Workshop on Deduction and Applications, Schloß Dagstuhl, Germany, Oct 2005
– Workshop on Implementations of Proof Search (WIPS'05)
University of Minnesota, Minneapolis, USA, 2005

Overcoming performance barriers: efficient proof search in logical frameworks
– Invited Tutorial, 22nd International Conference on Logic Programming, Seattle, USA, 2006
– Parsifal Seminar, Ecole Polytechnique/INRIA Futurus, May 2005
– Computer Science Colloquium, University of Vermont, March 2005
– Computer Science Colloquium, Clarkson University, Jan 2005
– Computer Science Colloquium, McGill University, Apr 2003
– Computer Science Colloquium, Toyota Technology Institute/U. of Chicago, Apr 2003
– Computer Science Colloquium, Johns Hopkins University, Apr 2003
– Computer Science Colloquium, University of Indiana, Bloomington, Mar 2003
– Computer Science Colloquium, University of Toronto, Mar 2003
– Computer Science Colloquium, McMaster University, Mar 2003

Termination and reduction in the logical framework
– Seminar, German Center for Artificial Intelligence, Saarbrücken, Germany, Dec 2000
– AIDA-Seminar (Artificial Intelligence Darmstadt),
Dept. of Computer Science, Technical University Darmstadt, Germany, Jan 2001

Designing an inverse method theorem prover using focusing proofs
– AIDA-Seminar (Artificial Intelligence Darmstadt),
Dept. of Computer Science, Technical University Darmstadt, Germany, Jan 2000

Finding substitutions for meta-variables in specification proofs
– PRL-Seminar (Proof/Program Refinement Logic),
Dept. of Computer Science, Cornell University, USA, May 1998
– POP-Seminar (Principles of Programming Languages),
Dept. of Computer Science, Carnegie Mellon University, USA, Feb 1998

Termination and reduction in higher-order logic programming
– Workshop on Deduction, Schloß Dagstuhl, Germany, Mar 2001

Invited Presentations (Gender Studies)

Grace Hopper Celebration of Women in Computing, Cape Cod, Sep 2000
Participant on the panel *"Women in Computer Science: The Carnegie Mellon Experience"*

‘ International Conference on Women, Work and Computerization, Bonn, Germany, May 1997
How to prove it

Languages : German (native language), English (fluent), French (basic knowledge), Latin

References : available upon request