Eric Walkingshaw

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Research Overview

My research applies programming language techniques to software engineering problems. I believe that clear and expressive languages are essential for understanding, solving, and explaining difficult problems. My areas of expertise include software variation, strongly typed functional programming, type systems and lightweight program analyses, modularity, human factors of programming languages, and the design and implementation of domain-specific languages.

I am the co-creator of the *choice calculus*, a simple calculus of variation. My collaborators and I have used the choice calculus as the theoretical basis for DSLs and other projects to support developing massively configurable software, modeling dynamic resource environments, optimizing gradually typed programs, improving type error location, and more.

Education

Ph.D. Computer Science, Oregon State University, 2013
M.S. Computer Science, Oregon State University, 2011
B.S. Computer Science, minor in Applied Mathematics, University of Washington, 2006
B.A. English – Creative Writing, University of Washington, 2006
A.A., Edmonds Community College, 2002

Employment History

Senior Software Engineer, Elemental Cognition, Feb 2023–Aug 2024
Software Engineer, Savant Power, Jul 2021–Nov 2022
Assistant Professor, Oregon State University, Sep 2014–Jun 2021
Visiting Researcher, University of Marburg, Aug 2013–Aug 2014
Instructor, Oregon State University, Jan 2013–Jun 2013
Graduate Research Assistant, Oregon State University, Sep 2007–Jun 2013
Software Developer, Institute for Systems Biology, Oct 2006–Jun 2007
Software Developer, Teranode Corporation, Jan 2005–Jun 2006
Student Developer, Applied Physics Lab, University of Washington, May 2003–Dec 2004

Research Grants

Dec 2015–Feb 2020 "IMMoRTALS: Interfaces, Models, and Monitoring for Resource-aware Transformations that Augment the Lifecycle of Systems", from DARPA BAA-15-36: *Building Resource Adaptive Software Systems (BRASS)*. Subcontract from Raytheon BBN Technologies.
PI, OSU Lead. Co-PI: Alex Groce
$870,282 + $25,000 extension (OSU total: $1.6M, award total: $7.7M)

Jul 2017–Jun 2018 "Visual Languages and Human-Centric Computing (VL/HCC) 2017 Graduate Consortium", from NSF (IIS-1740926). **$30,000**.

PUBLICATIONS

Journal Articles

J9. Paul Maximilian Bittner, Alexander Schultheiß, Benjamin Moosherr, Jeffrey M. Young, Leopoldo Teixeira, Eric Walkingshaw, Parisa Ataei, and Thomas Thüm. On the Expressive Power of Languages for Static Variability. *Proc. of the ACM on Programming Languages (PACMPL)* issue $OOPSLA_2$, 2024.

J8. Jeffrey M. Young, Paul Maximilian Bittner, Eric Walkingshaw, and Thomas Thüm. Variational Satisfiability Solving: Efficiently Solving Lots of Related SAT Problems. *Empirical Software Engineering (EMSE)*, 28(14):1–53, 2023.

J7. John Peter Campora III, Sheng Chen, Martin Erwig, and Eric Walkingshaw. Migrating Gradual Types. *Journal of Functional Programming (JFP)*, 32(e14):1–60, 2022.

J6. John Peter Campora III, Sheng Chen, and Eric Walkingshaw. Casts and Costs: Harmonizing Safety and Performance in Gradual Typing. *Proc. of the ACM on Programming Languages (PACMPL)* issue *ACM SIGPLAN Int. Conf. on Functional Programming (ICFP)*, 2:98:1–98:30, 2018.

J5. John Peter Campora III, Sheng Chen, Martin Erwig, and Eric Walkingshaw. Migrating Gradual Types. *Proc. of the ACM on Programming Languages (PACMPL)* issue *ACM SIGPLAN Symp. on Principles of Programming Languages (POPL)*, 2:15:1–15:29, 2018.

J4. Sheng Chen, Martin Erwig, and Eric Walkingshaw. Extending Type Inference to Variational Programs. *ACM Trans. on Programming Languages and Systems (TOPLAS)*, 36(1):1:1–1:54, 2014.

J3. Martin Erwig and Eric Walkingshaw. A Visual Language for Explaining Probabilistic Reasoning. *Journal of Visual Languages and Computing (JVLC)*, 24(2):88–109, 2013.

J2. Martin Erwig and Eric Walkingshaw. The Choice Calculus: A Representation for Software Variation. *ACM Trans. on Software Engineering and Methodology (TOSEM)*, 21(1):6:1–6:27, 2011.

J1. Eric Walkingshaw and Martin Erwig. A Domain-Specific Language for Experimental Game Theory. *Journal of Functional Programming (JFP)*, 19:645–661, 2009.

Peer-Reviewed Book Chapters

B2. Martin Erwig and Eric Walkingshaw. Variation Programming with the Choice Calculus. In *Generative and Transformational Techniques in Software Engineering IV (GTTSE 2011), Revised and Extended Papers*, volume 7680 of *LNCS*, pages 55–99, 2013.

B1. Martin Erwig and Eric Walkingshaw. Semantics-Driven DSL Design. In Marjan Mernik, editor, *Formal and Practical Aspects of Domain-Specific Languages: Recent Developments*, pages 56–80. IGI Global, 2012.

Peer-Reviewed Conference Papers

C24. Parisa Ataei, Fariba Khan, and Eric Walkingshaw. A Variational Database Management System. In *ACM SIGPLAN Int. Conf. on Generative Programming: Concepts and Experiences (GPCE)*, pages 29–42, 2021.

C23. Parisa Ataei, Qiaoran Li, and Eric Walkingshaw. Should Variation Be Encoded Explicitly in Databases? In *Int. Working Conf. on Variability Modelling of Software-Intensive Systems (VaMoS)*, pages 3:1–3:9, 2021.

C22. Jeffrey M. Young, Eric Walkingshaw, and Thomas Thüm. Variational Satisfiability Solving. In *ACM SIGSOFT Int. Systems and Software Product Line Conf. (SPLC)*, pages 18:1–18:12, 2020.

C21. Stephan Adelsberger, Anton Setzer, and Eric Walkingshaw. Declarative GUIs: Simple, Consistent, and Verified. In *ACM SIGPLAN Int. Symp. on Principles and Practice of Declarative Programming (PPDP)*, pages 4:1–4:15, 2018.

C20. Stephan Adelsberger, Anton Setzer, and Eric Walkingshaw. Developing GUI Applications in a Verified Setting. In *Symp. on Dependable Software Engineering: Theories, Tools and Applications (SETTA)*, volume 10998 of *LNCS*, pages 89–107, 2018.

C19. Jeffrey M. Young and Eric Walkingshaw. A Domain Analysis of Data Structure and Algorithm Explanations in the Wild. In *ACM SIGCSE Technical Symp. on Computer Science Education (SIGCSE)*, pages 870–875, 2018.

C18. Meng Meng, Jens Meinicke, Chu-Pan Wong, Eric Walkingshaw, and Christian Kästner. A Choice of Variational Stacks: Exploring Variational Data Structures. In *Int. Work. on Variability Modelling of Software-Intensive Systems (VaMoS)*, pages 28–35. ACM, 2017.

C17. Ştefan Stănciulescu, Thorsten Berger, Eric Walkingshaw, and Andrzej Wąsowski. Concepts, Operations, and Feasibility of a Projection-Based Variation Control System. In *IEEE Int. Conf. on Software Maintenance and Evolution (ICSME)*, pages 323–333, 2016.

C16. Sheng Chen, Martin Erwig, and Eric Walkingshaw. A Calculus for Variational Programming. In *European Conf. on Object-Oriented Programming (ECOOP)*, volume 56 of *LIPIcs*, pages 6:1–6:26, 2016.

C15. Keeley Abbott, Christopher Bogart, and Eric Walkingshaw. Programs for People: What We Can Learn from Lab Protocols. In *IEEE Int. Symp. on Visual Languages and Human-Centric Computing (VL/HCC)*, pages 203–211, 2015.

C14. Eric Walkingshaw, Christian Kästner, Martin Erwig, Sven Apel, and Eric Bodden. Variational Data Structures: Exploring Trade-Offs in Computing with Variability. In *ACM SIGPLAN Symp. on New Ideas in Programming and Reflections on Software (Onward!)*, pages 213–226, 2014.

C13. Eric Walkingshaw and Klaus Ostermann. Projectional Editing of Variational Software. In *ACM SIGPLAN Int. Conf. on Generative Programming: Concepts and Experiences (GPCE)*, pages 29–38, 2014. **Best paper**.

C12. Martin Erwig, Klaus Ostermann, Tillmann Rendel, and Eric Walkingshaw. Adding Configuration to the Choice Calculus. In *Int. Work. on Variability Modelling of Software-Intensive Systems (VaMoS)*, pages 13:1–13:8. ACM, 2013.

C11. Eric Walkingshaw and Martin Erwig. A Calculus for Modeling and Implementing Variation. In *ACM SIGPLAN Int. Conf. on Generative Programming and Component Engineering (GPCE)*, pages 132–140, 2012.

C10. Sheng Chen, Martin Erwig, and Eric Walkingshaw. An Error-Tolerant Type System for Variational Lambda Calculus. In *ACM SIGPLAN Int. Conf. on Functional Programming (ICFP)*, pages 29–40, 2012.

C9. Martin Erwig and Eric Walkingshaw. Semantics First! Rethinking the Language Design Process. In *ACM SIGPLAN Int. Conf. on Software Language Engineering (SLE)*, volume 6940 of *LNCS*, pages 243–262, 2011.

C8. Duc Le, Eric Walkingshaw, and Martin Erwig. #ifdef Confirmed Harmful: Promoting Understandable Software Variation. In *IEEE Int. Symp. on Visual Languages and Human-Centric Computing (VL/HCC)*, pages 143–150, 2011.

C7. Eric Walkingshaw and Martin Erwig. A DSEL for Studying and Explaining Causation. In *IFIP Working Conf. on Domain-Specific Languages (DSL)*, pages 143–167, 2011.

C6. Martin Erwig and Eric Walkingshaw. Causal Reasoning with Neuron Diagrams. In *IEEE Int. Symp. on Visual Languages and Human-Centric Computing (VL/HCC)*, pages 101–108, 2010.

C5. Martin Erwig and Eric Walkingshaw. Visual Explanations of Probabilistic Reasoning. In *IEEE Int. Symp. on Visual Languages and Human-Centric Computing (VL/HCC)*, pages 23–27, 2009.

C4. Martin Erwig and Eric Walkingshaw. A DSL for Explaining Probabilistic Reasoning. In *IFIP Working Conf. on Domain-Specific Languages (DSL)*, volume 5658 of *LNCS*, pages 335–359, 2009. **Best paper**.

C3. Eric Walkingshaw and Martin Erwig. Varying Domain Representations in Hagl – Extending the Expressiveness of a DSL for Experimental Game Theory. In *IFIP Working Conf. on Domain-Specific Languages (DSL)*, volume 5658 of *LNCS*, pages 310–334, 2009.

C2. Eric Walkingshaw, Paul Strauss, Martin Erwig, Jonathan Mueller, and Irem Tumer. A Formal Representation of Software-Hardware System Design. In *ASME Int. Design Engineering Technical Conf. & Computers and Information in Engineering Conf. (IDETC/CIE)*, pages 1387–1398, 2009.

C1. Martin Erwig and Eric Walkingshaw. A Visual Language for Representing and Explaining Strategies in Game Theory. In *IEEE Int. Symp. on Visual Languages and Human-Centric Computing (VL/HCC)*, pages 101–108, 2008.

Peer-Reviewed Workshop Papers

W7. Thomas Thüm, Leopoldo Teixeira, Klaus Schmid, Eric Walkingshaw, Mukelabai Mukelabai, Mahsa Varshosaz, Goetz Botterweck, Ina Schaefer, and Timo Kehrer. Toward Efficient Analysis of Variation in Time and Space. In *Int. Work. on Variability and Evolution of Software Intensive Systems (VariVolution)*, pages 57–64, 2019.

W6. Parisa Ataei, Arash Termehchy, and Eric Walkingshaw. Managing Structurally Heterogeneous Databases in Software Product Lines. In *VLDB Workshop: Polystores and Other Systems for Heterogeneous Data (Poly)*, 2018.

W5. Parisa Ataei, Arash Termehchy, and Eric Walkingshaw. Variational Databases. In *Int. Symp. on Database Programming Languages (DBPL)*, pages 11:1–11:4. ACM, 2017.

W4. Rahul Gopinath and Eric Walkingshaw. How Good are Your Types? Using Mutation Analysis to Evaluate the Effectiveness of Type Annotations. In *Int. Work. on Mutation Analysis (Mutation)*, pages 122–127. IEEE, 2017. **Best presentation**.

W3. Spencer Hubbard and Eric Walkingshaw. Formula Choice Calculus. In *Int. Work. on Feature-Oriented Software Development (FOSD)*, pages 49–57. ACM, 2016.

W2. Martin Erwig, Eric Walkingshaw, and Sheng Chen. An Abstract Representation of Variational Graphs. In *Int. Work. on Feature-Oriented Software Development (FOSD)*, pages 25–32. ACM, 2013.

W1. Martin Erwig and Eric Walkingshaw. Program Fields for Continuous Software. In *ACM SIGSOFT Workshop on the Future of Software Engineering Research*, pages 105–108, 2010.

Doctoral Consortia

D2. Eric Walkingshaw. Managing Variation in Explanation-Oriented Languages. In *Doctoral Consortium at IEEE Int. Symp. on Visual Languages and Human-Centric Computing (VL/HCC)*, pages 247–248, 2010.

D1. Eric Walkingshaw. Designing Explanation-Oriented Languages. In *Doctoral Consortium at IEEE Int. Symp. on Visual Languages and Human-Centric Computing (VL/HCC)*, pages 274–275, 2008.

Theses and Other Papers

T3. Eric Walkingshaw. *The Choice Calculus: A Formal Language of Variation*. PhD thesis, Oregon State University, 2013. `http://hdl.handle.net/1957/40652`.

T2. Eric Walkingshaw. Domain-Specific Language Support for Experimental Game Theory. Master's thesis, Oregon State University, 2011. `http://hdl.handle.net/1957/26757`.

T1. Eric Walkingshaw. Features and Feature Models: A Survey of Variation Representations. In *Compendium of Computer Science Doctoral Qualifying Exams*. Oregon State University, 2010. `http://hdl.handle.net/1957/19243`.

Honors and Awards

Best Reviewer of 2018, Journal of Software and Systems Modeling
Best Paper Award, GPCE 2014
Achievement Rewards for College Scientists (ARCS) Scholar, 2009–2012
Best Paper Award, DSL 2009
University of Washington CSE Academic Scholarship, 2005
University of Washington CSE Award for Academic Excellence, 2004

Teaching and Advising

Curriculum Development

Led restructure and expansion of graduate-level programming languages sequence (OSU).
Developed a new course on modularity in programming languages (OSU).
Developed two new discussion seminars (Marburg).

Courses Taught, Oregon State University

CS 261 – Data Structures (2013)
CS 271 – Computer Architecture and Assembly Language (2013)
CS 381 – Programming Language Fundamentals (7 times, 2015–2021)
CS 581 – Programming Languages I (7 times, 2015–2020)
CS 583 – Advanced Functional Programming (4 times, 2014–2021)
CS 589 – Special Topics in Programming Languages: Modularity (2017, 2019)

Courses Taught, University of Marburg

Discussion Seminar: Human Factors in Programming Languages (2013)
Discussion Seminar: Modular Extensibility (2014)

Faculty Advising of Student Organizations

Founder and co-advisor of the Programming Languages Reading Group.
Faculty advisor of the OSU Functional Programming Club.

Students Graduated as Major Advisor

Parisa Ataei, Ph.D. 2021
Dissertation: "Theory and Implementation of a Variational Database Management System"

Jeffrey M. Young, Ph.D. 2021
Dissertation: "Variational Satisfiability Solving"

Fariba Khan, M.S. 2021
Thesis: "Formal Verification of the Variational Database Management System"

Ghadeer Alkubaish, M.S. 2020
Thesis: "Integrating Side Effects in Variational Programs Using Algebraic Effects"

Qiaoran Li, M.S. 2019
Thesis: "Application of the Variational Database Management System to Schema Evolution and Software Product Lines"

Alexander Grasley, M.S. 2018
Thesis: "Imperative Programming with Variational Effects"

Michael McGirr, M.S. 2018
Project: "The Ownership Monad"

Keeley Abbott, M.S. 2017
Thesis: "Formative Work Toward a Mixed-Initiative Programming Language"

Meng Meng, M.S. 2017
Thesis: "Implementation Techniques for Variational Data Structures"

Miles Van de Wetering, Honors B.S. 2017
Thesis: "View-Based Editing of Variational Code"

Shujin Wu, M.S. 2017
Project: "A Template CoprHD Storage Driver Based on the Southbound SDK"

Spencer Hubbard, M.S. 2016
Thesis: "A Formal Foundation for Variational Programming Using the Choice Calculus"

Other Students Advised

Spencer Mitchell, RELU, 2018–2019
Nasrin Sanati, M.Eng., 2018–2019
Caleb Wilson, STEM Leaders, 2018–2019
Victor Campa, STEM Leaders, 2016–2017

Committee Member

Alex Grejuc, Honors B.S. 2021
Yu-Jung Chu, M.S. 2020
Abtin Khodadadi, M.S. 2019
Sruti Srinivasa Ragavan, Ph.D. 2019
Mihai Dan, M.S. 2019
Aidan Carson, Honors B.S. 2019
Evgenia V. Chunikhina, Ph.D. 2018
Karl Smeltzer, Ph.D. 2018
Xiaofei Guo, M.S. 2018
Sruti Srinivasa Ragavan, M.S. 2018
Deepthi Kumar, M.S. 2017
Parisa Ataei, M.S. 2017
Islam Almusaly, Ph.D. 2017
Rahul Gopinath, Ph.D. 2017
Cole Crawford, M.A. English 2017 (GCR)

Xiangyu Wang, M.S. 2017
Prathamesh Patkar, M.S. 2016
Sheng Chen, Ph.D. 2014
Keying Xu, M.S. 2014
20+ M.Eng. exams, 2015–2018

Master's Student Work Project Advisor, University of Marburg

Jonathan Brachthäuser, 2013–2014
Christoph Weygand, 2013–2014

Co-Mentor, Apprenticeships in Science and Engineering

David Wen, Summer 2012
Miles Van de Wetering, Summer 2011
Ben McMorran, Summer 2010

Professional Service

Conference and Workshop Organization

VariVolution 2020 – Int. Work. on Variability and Evolution of Software-Intensive Systems
Program Co-Chair

FOSD 2017 – Int. Work. on Feature-Oriented Software Development
Organizer and Program Co-Chair

DSLDI 2017 – Int. Work. on Domain-Specific Language Design and Implementation
Program Co-Chair

VL/HCC 2017 – IEEE Symp. on Visual Languages and Human-Centric Computing
Graduate Consortium Chair

SPLASH 2017 – ACM SIGPLAN Conf. on Systems, Programming, Languages and Applications: Software for Humanity
Web and Publicity Co-Chair

DSLDI 2016 – Int. Work. on Domain-Specific Language Design and Implementation
Organizer and Program Co-Chair

VL/HCC 2015 – IEEE Symp. on Visual Languages and Human-Centric Computing
Showpieces Co-Chair

Program Committees

- WGT 2020– ACM SIGPLAN Work. on Gradual Typing
- GPCE 2019, 2017– ACM SIGPLAN Int. Conf. on Generative Programming: Concepts and Experiences
- VL/HCC 2019, 2017, 2016, 2015– IEEE Int. Symp. on Visual Languages and Human-Centric Computing
- SPLC 2019– Int. Systems and Software Product Line Conf.
- SLE 2018, 2017, 2016– Int. Conf. on Software Language Engineering
- PNW-PLSE 2018– Pacific Northwest Programming Languages and Software Engineering Work.
- ICSME-NIER 2017– IEEE Int. Conf. on Software Maintenance and Evolution, New Ideas and Emerging Results Track
- PEPM 2016– ACM SIGPLAN Work. on Partial Evaluation and Program Manipulation
- HuFaMo 2016– Int. Work. on Human Factors in Modeling
- VaMoS 2015– Int. Work. on Variability Modeling of Software Intensive Systems

External Reviewer

- TOPLAS 2020– ACM Trans. on Programming Languages and Systems
- JFP 2018– Journal of Functional Programming
- SoSyM 2018– Journal of Software and Systems Modeling
- JVLC 2016– Journal of Visual Languages and Computing
- GPCE 2016, 2014, 2013– Int. Conf. on Generative Programming and Component Engineering
- VLDB 2015– Int. Conf. on Very Large Databases
- JLAMP 2014– Journal of Logic and Algebraic Methods in Programming
- FOSD 2014, 2012– Int. Work. on Feature-Oriented Software Development
- VaMoS 2013, 2012, 2011– Int. Work. on Variability Modeling of Software Intensive Systems
- PPDP 2012– Int. Symp. on the Principles and Practice of Declarative Programming
- PEPM 2012– ACM SIGPLAN Work. on Partial Evaluation and Program Manipulation
- VL/HCC 2011, 2010– IEEE Int. Symp. on Visual Languages and Human-Centric Computing
- IFL 2011, 2009, 2008– Int. Symp. on Implementation and Application of Functional Languages
- PADL 2011– Int. Symp. on Practical Aspects of Declarative Languages
- DSL 2009– IFIP Working Conf. on Domain Specific Languages
- IDETC 2009– ASME Int. Design Engineering Tech. Conf.
- Book chapter for *Formal and Practical Aspects of Domain-Specific Languages: Recent Developments*, 2012

Other Service

NSF Proposal Review Panel, 2017
NSF Proposal Review Panel, 2016
Graduate Consortium Panel, VL/HCC 2015
Student Volunteer, VL/HCC 2009

University Service

Activist Council and Organizing Committee, United Academics of OSU, 2016–2020
Computer Science Hiring Committee, 2017–2020
Computer Science Undergraduate Curriculum Committee, 2014–2015, 2016–2017, 2018–2021
Computer Science Graduate Curriculum Committee, 2015–2016