

Adam M. Smith

Research Engineer, **Microsoft Corporation**
Founder, **Quasilinear Research**

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Education

University of California, Santa Cruz

Ph.D. in Computer Science, December 2012, Advisor: Michael Mateas
Dissertation: *Mechanizing Exploratory Game Design*

B.S. in Computer Science with Honors, June 2005

Research Interests

Artificial Intelligence for Designer-Programmers.

Answer Set Programming, Probabilistic Inference, Probabilistic Programming, Combinatorial Search & Optimization, and Formal Methods for Program Analysis & Synthesis. Design Automation, Design Research, Computational Creativity, Computer Music, Digital Games, and Game-based Education.

Experience

August 2015 – present. Research Engineer, **Microsoft Corporation**.

Recently joined experimental research team in Information Management and Machine Learning (outside of Microsoft Research) to develop programming-by-example (PBE) technologies for application to data wrangling at scale. My research at Microsoft emphasizes probabilistic knowledge representation techniques for specifying the inductive bias when learning well-generalizing programs from just a few, one, or even no explicit user-provided examples at all.

January 2014 – present. Founder, **Quasilinear Research (quasilinear.com)**.

Initiated preliminary research and development for a universal and accessible probabilistic programming system based on machine-code level primitives (extending the open RISC-V ISA). Project combines insights from machine learning, formal verification, electronic design automation, and cryptography. Development of new company paused while I developed a new course at UC Santa Cruz (below).

March – June 2015. Lecturer, **UC Santa Cruz, Department of Computational Media**.

Taught upper-division undergraduate *AI in Games* course with all-new curriculum emphasizing new roles for AI based on research in the last decade. Also supervised independent study in AI-assisted authoring tools for artists using generative grammars.

Sept – Dec 2014. Senior Engineer Consultant, **Enlearn (enlearn.org)**.

Implemented constraint-based symbolic interpreter for a nondeterministic programming language designed to express student's mental models while they solved mathematics exercises. Defining the language as a subset of the ARMv6 instruction set allowed using any higher-level language supported by GCC as a potential modeling language as well as reusing

established development tools. System could perform exhaustive test input generation for programs representing students' mental models.

2012-2014. Postdoctoral Researcher, **Univ. of Washington, Center for Game Science.**

Expanded the theory and practice of AI-based game design automation, prototyped and deployed adaptive level progression systems and mixed-initiative design tools for educational games, mentored graduate students, and started getting back into machine learning. Developed foundations for Markov Answer Set Programming.

Summer 2011. Visiting Researcher, **Univ. of Washington, Center for Game Science.**

Developed AI-based game design tools for an ongoing widely deployed educational game project.

Summer 2011. Instructor, **Stanford AHCRC Summer Institute.**

Taught computer/electrical/mechanical engineering undergraduate (including some new to programming) to program Android tablet applications in Java for scientific computing projects.

2009-2012. Mobile Application Designer-Developer, **Independent.**

Created visual and sonic art software toys for the Android mobile ecosystem reaching an audience of ten million people, directly inspiring software developers and electronic musicians around the world.

Summer 2008. Software Engineering Intern, **Google, Inc.**

Developed language parsers that preserved comments and other source-level metadata and contributed to a company-wide symbol table as part of the Build Tools team in Kirkland, WA.

Summer 2007. Software Engineering Intern, **Google, Inc.**

Developed open-source connectors between the Google Search Appliance and Hosted Apps products for the Enterprise Engineering team in Mountain View, CA.

Summer 2006. Staff Research Assistant, **Los Alamos National Laboratory.**

Developed low-latency image compositor for distributed volume rendering in scientific visualization with a High-Performance Computing team.

2006-2012. Research Assistant, **UC Santa Cruz, Expressive Intelligence Studio.**

Collaborated on interactive generative art installations, slacked off and did statistical machine learning research instead for a while, then got focused again and mechanized exploratory game design. Championed the use of formal methods commonly associated with electronic design automation (EDA) in creative domains like game design.

2005-2011. Teaching Assistant, **UC Santa Cruz, Department of Computer Science.**

Developed a deep personal attachment to the art of teaching; influenced the development of UCSC's game design degree program.

Summer 2005. Educational Associate, **NASA Ames Research Center.**

Evaluated and integrated indoor motion tracking systems for use in a human-robot collaboration demo featuring JPL's K-9 rover and JSC's Robonaut humanoid robot.

Spring 2005. Undergraduate Research Assistant, **UCSC Computer Vision Lab.**

Developed interactive visualizer and denoising filters for a Canesta depth camera.

Summer 2004. Consultant, **Terracom Communications, SARL.**

Developed internal and external web applications, maintained country-wide web acceleration proxy, created indexed streaming media library, trained staff in network security (while living in Kigali, Rwanda).

Awards & Honors

Best Program Committee Member, Artificial Intelligence in Interactive Digital Entertainment (AIIDE), 2012.

Outstanding Teaching Award, UCSC Graduate Division, 2006. (top 1%)

Excellence in Teaching Award, Baskin School of Engineering, 2006.

Honors in Computer Science (with Bachelors degree), 2005.

Publications

Journals

Adam M. Smith, Michael Mateas. *Answer Set Programming for Procedural Content Generation: A Design Space Approach*. IEEE Transactions on Computational Intelligence and AI in Games, 2011.

Conferences

Oleksander Polozov, Eleanor O'Rourke, **Adam M. Smith**, Luke Zettlemoyer, Sumit Gulwani, Zoran Popović. *Personalized Mathematical World Problem Generation*. In Proceedings of the International Joint Conference on Artificial Intelligence (IJCAI), 2015.

Mike Treanor, Alex Zook, Mirjan P. Eladhari, Julian Togelius, Gillian Smith, Michael Cook, Tommy Thompson, Brian Magerko, John Levine, **Adam M. Smith**. *AI-Based Game Design Patterns*. In Proceedings of the 10th International Conference on the Foundations of Digital Games (FDG), 2015.

Eric Butler, Erik Andersen, **Adam M. Smith**, Sumit Gulwani, Zoran Popović. *Automatic Game Progression Design through Analysis of Solution Features*. To appear in Proceedings of the SIGCHI Conference on Human Factors in Computing (CHI), 2015.

Eric Butler, **Adam M. Smith**, Zoran Popović. *A Mixed-Initiative Tool for Designing Level Progressions in Games*. In Proceedings of the ACM Symposium on User Interface Software and Technology (UIST), 2013.

Adam M. Smith, Eric Butler, Zoran Popović. *Quantifying over Play: Constraining Undesirable Solutions in Puzzle Design*. In Proceedings of the 8th International Conference on the Foundations of Digital Games (FDG), 2013.

Adam M. Smith, Erik Andersen, Michael Mateas, Zoran Popović. *A Case Study of Expressively Constrainable Level Design Automation Tools for a Puzzle Game*. In Proceedings of the 7th International Conference on the Foundations of Digital Games (FDG), 2012.

Adam M. Smith. *Strange Loops in CFML, A Livecoder's Riddle*. In Proceedings of the International Conference on Computer Music (ICMC), 2012.

Adam M. Smith, Michael Mateas. *Knowledge-Level Creativity in Game Design*. In Proceedings of the Second International Conference on Computational Creativity (ICCC), 2011.

Adam M. Smith, Michael Mateas. *Towards Knowledge-Oriented Creativity Support in Game Design*. In Proceedings of the Second International Conference on Computational Creativity (ICCC), 2011.

Adam M. Smith, Mark J. Nelson, Michael Mateas. *Ludocore: A Logical Game Engine For Modeling Videogames*. In Proceedings of the IEEE Conference on Computational Intelligence and Games (CIG), 2010.

Adam M. Smith, Michael Mateas. *Variations Forever: Flexibly Generating Rulesets from a Sculptable Design Space of Mini-Games*. In Proceedings of the IEEE Conference on Computational Intelligence and Games (CIG), 2010.

Kathleen Tuite, Noah Snively, Dun-Yu Hsiao, **Adam M. Smith**, Zoran Popović. *Reconstructing the World in 3D: Bringing Games with a Purpose Outdoors*. In Proceedings of the 5th International Conference on the Foundations of Digital Games (FDG), 2010.

Adam M. Smith, Mark J. Nelson, Michael Mateas. *Computational Support for Play Testing Game Sketches*. In Proceedings of the 5th Artificial Intelligence for Interactive Digital Entertainment Conference (AIIDE), 2009.

Zachary Pousman, Mario Romero, **Adam M. Smith**, Michael Mateas. *Living with Tableau Machine: A Longitudinal Investigation of a Curious Domestic Intelligence*. In Proceedings of the 10th International Conference on Ubiquitous Computing (UbiComp 08), 2008.

Adam M. Smith, Manfred K. Warmuth. *Learning Rotations*. In Proceedings of the 12th Annual Conference on Learning Theory (COLT), 2008.

Workshops & Symposia

Adam M. Smith. *ASP versus EAs: What Are We Really Searching for in PCG?* In Report from Dagstuhl Seminar 15051, *Artificial and Computational Intelligence in Games: Integration*, 2015.

Adam M. Smith. *MCTS for PCG*. In Report from Dagstuhl Seminar 15051, *Artificial and Computational Intelligence in Games: Integration*, 2015.

Adam M. Smith. *Open Problem: Reusable Gameplay Trace Samplers*. In Proceedings of the Second Workshop on Artificial Intelligence in the Game Design Process (IDP), 2013.

Kathleen Tuite, **Adam M. Smith**. *Emergent Remix Culture in an Anonymous Collaborative Art System*. In Proceedings of the First International Workshop on Human Computation in Digital Entertainment (HCIDE), 2012.

Kate Compton, **Adam M. Smith**, Jim Whitehead. *Anza Island: Novel Gameplay Using ASP*. In Proceedings of the Third International Workshop of Procedural Content Generation in Games (PCGames), 2012.

Adam M. Smith, Michael Mateas. *Computational Caricatures: Probing the Game Design Process with AI*. In Proceedings of the First International Workshop on Artificial Intelligence in the Game Design Process (IDP), 2011.

Adam M. Smith. *Two Methods for Voxel Detail Enhancement*. In Proceedings of the Second International Workshop of Procedural Content Generation in Games (PCGames), 2011.

Sherol Chen, **Adam M. Smith**, Michael Mateas, Noah Wardrip-Fruin, Arnav Jhala. *RoleModel: Towards a Formal Model of Dramatic Roles for Story Generation*. In Proceedings of the Intelligent Narrative Technologies III Workshop (INT3), 2010.

Adam M. Smith, Mario Romero, Zachary Pousman, Michael Mateas. *Tableau Machine: A Creative Alien Presence*. In Proceedings of the 2008 AAAI Spring Symposium on Creative Intelligent Systems, 2008.

Technical Reports

Adam M. Smith, Chris Lewis, Kenneth Hullet, Gillian Smith, Anne Sullivan. *An Inclusive Taxonomy of Player Modeling*. Technical Report UCSC-SOE-11-13, 2011.

Adam M. Smith, Manfred K. Warmuth. *Learning Rotations Online*. Technical Report UCSC-SOE-10-08, 2010.

Adam M. Smith, James Skorupski, James Davis. *Transient Rendering*. Technical Report UCSC-SOE-08-26, 2008.

Demos and Posters

Adam M. Smith. *Towards Probabilistic Programming at the Machine Code Level*. RISC-V Workshop, 2015.

Adam M. Smith, Chris Lewis, Kenneth Hullett, Gillian Smith, Anne Sullivan. *An Inclusive View of Player Modeling*. Poster at the 6th International Conference on the Foundations of Digital Games (FDG), 2011.

Adam M. Smith, Michael Mateas, *Variations Forever: A Game of Exploring Game Design Spaces*, Demonstration at the Fourth International Conference on the Foundations of Digital Games (FDG), 2009.

Adam M. Smith, Mark J. Nelson, Michael Mateas. *Prototyping Games with BIPED*. Demonstration at the Fifth Artificial Intelligence for Interactive Digital Games Conference (AIIDE), 2009.

Adam M. Smith, James Skorupski, James Davis. *Understanding Video at 30 Billion Frames Per Second with Transient Rendering*. Poster at the Bay Area Vision Meetup (BAVM), 2009.

Invited Talks

2014, **Microsoft Research, Redmond.**

Mechanizing Exploratory Game Design with Formal Design Space Models.

2014, **North Carolina State University, Department of Computer Science.**

Mechanizing Exploratory Game Design with Formal Design Space Models.

2013, **University of Bath, Department of Computer Science.**

Research through/into/for Games and Game-based Education.

2013, **University of Bath, Department of Computer Science.**

Mechanizing Exploratory Game Design with Formal Design Space Models.

2013, **Oxford University, Department of Computer Science.**

Mechanizing Exploratory Game Design with Formal Design Space Models.

2013, **Goldsmiths University of London, Department of Computing.**

Mechanizing Exploratory Game Design with Formal Design Space Models.

2011, **University of Washington, Graphics and Imaging Laboratory.**

Building the Intelligent Game Designer: A Creative Machine.

Teaching Experience

Instructorships

AI in Games (update to existing Game AI course) at UC Santa Cruz, Spring 2015.

Scientific Computing on Android Tablets at Stanford AHPCRC Summer Inst., Summer 2011.

Teaching Assistantships and Equivalent Volunteering

UC Santa Cruz, 2005-2011

- Computer Literacy (CMPS 2 with Paulo Franca)
- Game Design Fundamentals (CMPS 80K with Noah Wardrip-Fruin)
- Advanced Analysis of Algorithms (CMPS 102 with Manfred Warmuth)
- Computer Graphics (CMPS 160 with James Davis)
- Scientific Visualization, Computer Animation, *and Games* (CMPS 161 with Alex Pang)
- Game Engines (CMPS 164 with Alex Pang, later Arnav Jhala)
- Game Design Studio (CMPS 172 with Michael Mateas)

Guest Lectures

UC Santa Cruz, 2005-2014

- Game Programming with Python
- The Spectrum of Game Engine Architectures

- Designing a Framework for Simple Physics Games
- Digital Image Compositing
- Non-photorealistic Rendering
- Programmer-oriented Tools for Creativity in Graphics
- Livecoding for Music, Sculpture, and Poetry
- Overlapping Notions of Time in Programming Languages
- Answer Set Programming for Procedural Content Generation
- The Design Spaces Approach to Game Design Automation

The Evergreen State College, 2013

- Design Grammars for Creative Programmers

Mentoring

Undergraduates at UC Santa Cruz

- Erica Woolley, BS in Computer Science: Computer Game Design, 2011.
- Vivian Wong, BS in Computer Science: Computer Game Design, 2011.
- Leif Myer, BS in Computer Science: Computer Game Design, 2015.

Graduate students at University of Washington

- Rahul Banerjee, PhD in Computer Science & Engineering, 2012-2014.
- Aaron Bauer, PhD in Computer Science & Engineering, 2012-2014.
- Eric Butler, PhD in Computer Science & Engineering, 2012-2014.

Professional Activities

University Service: Graduate Admissions Reviewer, University of Washington, Department of Computer Science and Engineering, 2012 and 2013.

Conference Organization: Doctoral Mentoring Program Co-chair, AIIDE 2013.

Workshop Organization: *Artificial Intelligence in the Game Design Process* at AIIDE 2011 and AIIDE 2013.

Senior Program Committee: Foundations of Digital Games (FDG).

Conference Reviewing: AAAI Conference on Artificial Intelligence (AAAI), Foundations of Digital Games (FDG), Artificial Intelligence in Interactive Digital Entertainment (AIIDE), IEEE Conference on Computational Intelligence in Games (CIG)

Journal Reviewing: IEEE Transactions on Computational Intelligence and AI in Games (TCIAIG), IEEE Transactions on System, Man and Cybernetics (TSMC).

Student Volunteering: ACM SIGGRAPH, 2007.

Citizenship

United States.