Emma Tosch

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Research Interests

I work in *applied programming languages (PL) research*, where I treat PL processes, such as building domain-specific languages, as a broader method for scientific inquiry, with applications in computational social science. I am also interested in adversarial modeling of methods, with applications in the computer security community.

Education

Sep. 2020 **PhD**, ***Computer Science***, University of Massachusetts Amherst.
Thesis: System Design for Digital Experiments
Advisors: Profs. David Jensen and J. Eliot B. Moss

May 2011 **MA**, ***Computer Science***, Brandeis University.
Note: Part of a combined post-baccalaureate and MA program in computer science.

Jun. 2008 **BA**, ***English Literature***, Wellesley College.

Academic Appointments

Jan. 2021 – present **Assistant Professor**, *College of Engineering and Mathematical Sciences, University of Vermont*, UVM Center for Security and Privacy.

Publications

Refereed Conferences, Workshops, and Journals

Applied AI Letters 2022 **Measuring and Characterizing Generalization in Deep Reinforcement Learning**, *Sam Witty, Jun Ki Lee,* Emma Tosch*, Akanksha Atrey, Kaleigh Clary, Michael L. Littman, David D. Jensen*, (Wiley).

USENIX 2022 **Stick It to The Man: Correcting for Non-Cooperative Behavior of Subjects in Experiments on Social Networks**, *Kaleigh Clary,* Emma Tosch*, Jeremiah Onaolapo, David D. Jensen*, Proceedings of the 31th USENIX Security Symposium.

OOPSLA 2019 **PlanAlyzer: Assessing Threats to the Validity of Online Experiments**, *Proceedings of the 2019 ACM International Conference on Object Oriented Programming Systems Languages and Applications (OOPSLA)*, *Emma Tosch*, Eytan Bakshy, Emery Berger, David D. Jensen, J. Eliot B. Moss.
Selected as a SIGPLAN research highlight and a CACM research highlight in the Sept. 2021 issue.

NeurIPS Workshop 2018 **ToyBox: Better Atari Environments for Testing Reinforcement Learning Agents**, *John Foley,** Emma Tosch,** Kaleigh Clary, David D. Jensen*, Systems for Machine Learning Workshop at the 32nd Conference on Neural Information Processing Systems (NeurIPS).

NeurIPS Workshop 2018 **Measuring and Characterizing Generalization in Deep Reinforcement Learning**, *Sam Witty, Jun Ki Lee,* Emma Tosch*, Akanksha Atrey, Michael Littman, David D. Jensen*, Critiquing and Correcting Trends in Reinforcement Learning Workshop at the 32nd Conference on Neural Information Processing Systems (NeurIPS).

NeurIPS Workshop 2018 **Let's Play Again: Variability of Deep Reinforcement Learning Agents in Atari Environments**, *Kaleigh Clary,* Emma Tosch*, John Foley, David D. Jensen*, Critiquing and Correcting Trends in Reinforcement Learning Workshop at the 32nd Conference on Neural Information Processing Systems (NeurIPS).

CODE 2015 **Formal Verification and Automated Causal Inference for Internet-Scale Experiments**, Emma Tosch*, E. Bakshy*, Conference on Digital Experimentation (CODE@MIT).

OOPSLA 2014 **SurveyMan: Programming and Debugging Surveys at Scale**, Emma Tosch*, E. Berger*, Proceedings of the 2014 ACM International Conference on Object Oriented Programming Systems Languages and Applications (OOPSLA).
Best Paper Award

GECCO Workshop 2012 **Achieving COSMOS: A metric for determining when to give up and when to reach for the stars**, Emma Tosch*, L. Spector*, Proceedings of the 14th International Conference on Genetic and Evolutionary Computation Conference Companion (GECCO).

ICCS 2011 **Compositional Autoconstructive Dynamics**, *Kyle I. Harrington,* Emma Tosch*, Lee Spector, Jordan Pollack*, Proceedings of the 8th International Conference on Complex Systems.

FLAIRS 2011 **Evaluating Conversational Characters Created through Question Generation**, *Grace Chen,* Emma Tosch*, Ron Artstein, Anton Leuski, David Traum*, Proceedings of the 24th International Florida Artificial Intelligence Research Society Conference (FLAIRS).

Non-Refereed Conferences, Workshops, and Journals

CACM, Sept. 2021 **PlanAlyzer: Assessing Threats to the Validity of Online Experiments**, *Communications of the ACM, Vol. 64, Issue 9*, *Emma Tosch*, Eytan Bakshy, Emery Berger, David D. Jensen, J. Eliot B. Moss.

Research Experience

May 2018 – Aug. 2020 **Research Assistant**, *University of Massachusetts Amherst*, Knowledge Discovery Lab, Supervisor: David Jensen.
Developed tools and methods to evaluate autonomous black-box agents for the DARPA Explainable AI (XAI) program.

Summer 2015 **Research Intern**, *Facebook, Inc. Menlo Park, CA*, Core Data Science – Economic Research Team, Statistics and Decision Science Team, Supervisor: Eytan Bakshy.
Static Analysis for the PlanOut DSL

May 2013 – Dec. 2016 **Research Assistant**, *University of Massachusetts Amherst*, PLASMA Lab, Supervisor: Emery Berger.
Developed a domain specific programming language and runtime system to design, debug, and deploy scientific surveys on the web, at scale.

Sep. 2011 – Jan. 2013 **Research Assistant**, *University of Massachusetts Amherst*, Computational Intelligence Lab, Supervisor: Lee Spector.
Devised a new measure for evaluating parameters of evolutionary search based on techniques from nonparametric statistics.

Summer 2010 **Research Intern**, *Institute for Creative Technologies. Playa Vista, CA*, Supervisor: Ron Artstein.
Natural language generation and question-answering system for virtual humans

Honors, Scholarships, and Awards

2021 CACM Research Highlight
2020 SIGPLAN Research Highlight
2015 WPI STEM Faculty Launch participant and travel grant
2015 NCWIT Symantec Student Seed Funding (for UMass CS Women)
2015 UMass Amherst School of Computer Science Outstanding Synthesis Award
2014 OOPSLA Best Paper Award
2014 PLDI ACM Student Research Competition (1st Place)
2013 Future of Software Engineering Symposium Scholarship at Microsoft Research
2013 Programming Languages Mentoring Workshop Scholarship
2012 ACM-W conference scholarship (attended SIG-EVO)
2010 Grace Hopper Celebration of Women in Computing Scholarship
2005 Humanities Foundation Award in English Literature

Teaching Experience

Spring 2022 **Instructor**, *Artificial Intelligence*, University of Vermont, Upper Undergraduate/Graduate.

Fall 2021 **Instructor**, *Systems for Knowledge Discovery*, University of Vermont, Upper Undergraduate/Graduate.

Spring 2021 **Instructor**, *Reinforcement Learning*, University of Vermont, Upper Undergraduate/Graduate.

Spring 2018 **Instructor**, *Reasoning Under Uncertainty*, University of Massachusetts Amherst, Undergraduate.
Co-taught with Luis Pineda

Fall 2017 **Teaching Assistant**, *Advanced Logic*, University of Massachusetts Amherst, Upper Undergraduate/Graduate.
Taught by Prof. Neil Immerman

Spring 2017 – Spring 2013 **Teaching Assistant, Guest Lecturer**, *Reasoning Under Uncertainty*, University of Massachusetts Amherst, Undergraduate.
Taught by Prof. Andrew McGregor

Spring 2011 **Teaching Assistant, Guest Lecturer**, *Introduction to Theory of Computation*, Brandeis University, Undergraduate.
Taught by Dr. Antonella DiLillo

Fall 2010 **Teaching Assistant**, *Structure and Interpretation of Computer Programs*, Brandeis University, Undergraduate.
Taught by Prof. Harry Mairson

Spring 2010 **Teaching Assistant**, *Data Structures*, Brandeis University, Undergraduate.
Taught by Dr. Antonella DiLillo

Advising and Mentoring Experience

Spring 2022 –present **PhD Advisor**, *Safe and Auditable Digital Experimentation Pipelines*, Ratang Sedimo, University of Vermont, PhD 2027 (expected).

Fall 2022 –present **Independent research project supervisor**, *Balancing security and privacy in digital surveys with quantitative information flow and differential privacy*, Michael McConnell, University of Vermont, PhD 2027 (expected).

Summer 2016 **Mentor**, *Project on detecting adversarial behavior amongst online survey-takers*, Rosario Huamani Carpio, Pomona College, B.A. 2018.
REU Program, PLASMA Lab, University of Massachusetts Amherst

Summer 2015 **Mentor**, *Project for developing a SurveyMan graphical interface in React*, Prakhar Srivastav, Columbia University, M.S. 2016.
Google Summer of Code, PLASMA Lab, University of Massachusetts Amherst

Summer 2013 – Spring 2014 **Mentor**, *Early-stage research project on developing tools for writing sound online surveys*, Molly McMahon, University of Massachusetts Amherst, B.A. 2015.
REU Program & Independent Study, PLASMA Lab, University of Massachusetts Amherst

Teaching Training

Fall 2015. Active Learning Training with Rachel Rybaczuk.
Fall 2015. CIRTL Course. Diversity in College Classroom: Teaching the STEM Undergraduate.

Other Relevant Work Experience

Summer 2017 **Project Assistant**, *University of Massachusetts Amherst*, Prof. Charles Weems, Amherst, MA.

Fall 2014 **Software Engineering Intern**, *Google, Inc.*, Mountain View, CA.

2008 – 2009 **Data Warehouse Analyst**, *Recombinant Data Corp.*, Newton, MA.

Selected Talks and Presentations

Programming Languages and Experimentation

23 Oct. 2019 **Oral Presentation (full)**, *OOPSLA 2019*, Athens, Greece.

9 Dec. 2016 **Invited talk**, *Wellesley College*, Wellesley, MA.

31 May 2016 **Oral presentation (full)**, *NEPLS Spring 2016*, Amherst, MA.

17 Oct. 2015 **Poster presentation**, *CODE@MIT*, Cambridge, MA.

Software Infrastructure for Machine Learning

7 Dec. 2018 **Poster presentation**, *NeurIPS Systems for ML Workshop*, Montreal, QC.

4 Oct. 2018 **Oral presentation (full)**, *IBM AI Systems Day*, Cambridge, MA.

Programming and Debugging Surveys

8 Nov. 2016 **Invited talk**, *SPLASH-I*, Amsterdam, Netherlands.

1 Oct. 2015 **Invited talk**, *Union College*, Schenectady, NY.

13 May 2015 **Invited talk**, *Google, Inc.*, Cambridge, MA.

22 Oct. 2014 **Oral pressentation (full)**, *OOPSLA 2014*, Portland, OR.

11 Jun. 2014 **Oral presentation (short)**, *PLDI Student Research Competition*, Edinburgh, Scotland.

25 Jan. 2014 **Oral presentation (full)**, *POPL OBT Workshop*, San Diego, CA.

Professional Activities and Service

2021 **Organizer**, *Virtual PhD recruiting*, `https://phd-recruiting.com`.

2022 **Program Committee Member**, *ECOOP 2022*.

2021 **Reviewer**, *NSF Software and Hardware Foundations Virtual Panel (NSF SMALL)*.

2021 **External Program Committee Member**, *OOPSLA 2021*.

2021 **Program Committee Member**, *Dynamic Languages Symposium 2021*.

2021 **Reviewer**, *The Programming Journal*, Volume 6.

2020 **Organizer**, *Virtual PhD recruiting*, `https://2020.phd-recruiting.com`.

2019 **Evaluator**, *SLE Artifact Evaluation Committee*.

2018 **Evaluator**, *ECOOP Artifact Evaluation Committee*.

Jan. 2016 – Jan. 2017 **Graduate Representative**, *University of Massachusetts Amherst, College of Information and Computer Sciences Faculty*.

2016 **Student Volunteer**, *PLDI Conference*.

Jun. 2016 – Jan. 2017 **Webmaster**, *CS Women*, University of Massachusetts Amherst, College of Information and Computer Sciences.

Jan. 2016 – May 2016 **Treasurer**, *UMass CS Women*, University of Massachusetts Amherst, College of Information and Computer Sciences.

Jan. 2015 – Jan. 2016 **Co-Chair**, *UMass CS Women*, University of Massachusetts Amherst, College of Information and Computer Sciences.

2016 **Reviewer**, *PLDI External Review Committee*.

2016 **Reviewer**, *ECOOP External Review Committee*.

2016 **Reviewer**, *POPL OBT Workshop Program Committee*.

2015 **Participant**, *WPI STEM Faculty Launch*.

2015 **Participant**, *ACM-W Early Career Mentoring Workshop*.

2016 **Reviewer**, *ECOOP DSLDI Workshop Program Committee*.

2016 **Evaluator**, *PLDI Artifact Evaluation Committee*.

2014 **Reviewer**, *NCWIT Aspirations Scholarship*.

2015 **Reviewer**, *POPL Artifact Evaluation Committee*.

2014 **Student Volunteer**, *SPLASH Conference*.

Sep. 2011 – May 2014 **Steward**, *Graduate Employee Organization, UAW 2322*, University of Massachusetts Amherst.