Talia Lily Ringer

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https://dependenttyp.es
https://github.com/tlringer

ACADEMIA

University of Illinois Urbana-Champaign *2021 – Present*
Assistant Professor (2 YOE)

University of Washington *2015 – 2021*
Ph.D. in Computer Science (advised by Dan Grossman).
Ph.D. Thesis: Proof Repair. Defense video.

University of Maryland, College Park *2008 – 2012*
B.S. in Mathematics and Computer Science. (advised by Larry Washington).
Honors Thesis: An Elliptic Curve Threshold Key Establishment Scheme

INDUSTRY

Industrial Research (1 YOE)
Visiting Researcher, Google (N2Formal) *Summer 2022 – Winter 2023*
Research Scientist Intern, Amazon (Automated Reasoning Group) *Summer 2016*

- Worked on machine learning tools for proof assistants at Google.
- Developed a solver-aided language for automated test input generation at Amazon.

Software Engineering (4 YOE)
Software Development Engineer II, Amazon *2015*
Software Development Engineer I, Amazon *2012 – 2014*
Software Development Engineer Intern, Amazon *Summer 2011*
Software Intern, Carr Astronautics *2010 – 2011*

- Helped launch Amazon Business.
- Wrote customer-facing code used company-wide at Amazon.
- Deleted more lines of code during my time as an engineer at Amazon than I added. :)

INTERNATIONAL PROGRAMS FOUNDED

I am the **founder and president** of the **Computing Connections Fellowship**, which provides institution-independent transitional funding and research visits for computer science Ph.D. students seeking healthier environments. Our two year pilot is in programming languages.

I am also the **founder and previous chair** of **SIGPLAN-M,** a cross-institutional long-term mentoring program for the programming languages research community. It currently reaches more than **200 mentors** and **300 mentees** across more than **41 countries**, and has been described by mentees as **“life changing”** and **“a career saver**.**”**

RESEARCH IMPACT

My work introduced proof repair, which has since been implemented and adapted at **Amazon** and **NASA**, and is the subject of a **DARPA** AI Exploration, a grant for which I am primary PI.

RESEARCH VISION

How can we build a world in which programmers of **all skill levels** across **all domains** can prove the absence of costly or dangerous bugs in software systems---that is, **formally verify** them? I lead a group that builds **proof engineering** technologies to make that world a reality. My group loves to use the whole toolbox---everything from **dependent type theory** to **program transformations** to **neural proof synthesis**---all in service of **real humans**.

CURRENT ADVISING

Dependent Type Theory and Proof Repair:
- **Cosmo Viola** (Ph.D., 2021 – Present)
- **Max Fan** (undergraduate, 2022 – Present)

Proof Compilation:
- **Chris Lam** (Ph.D., 2021 – Present)

Verified Secure Computer Architectures (with Christopher Fletcher):
- **Hannah Leung** (Ph.D., 2022 – Present)
- **Eeshan Zele** (undergraduate, 2022 – Present)
- **Sankar Gopalkrishna** (undergraduate, 2022 – Present)

Learning Semantic Relations (with Maxim Raginsky):
- **Dylan Zhang** (Ph.D., 2022 – Present)

Machine Learning for Proofs:
- **Arpan Agrawal** (visiting research programmer, 2022 – Present)
- **Thomas Reichel** (masters student, 2022 – Present)
- **Timothy Zhou** (undergraduate, 2021 – Present)

STUDENTS ADVISED

Taylor Blau (undergraduate, coadvised with Dan Grossman, 2019 – 2020)
Verifying Strong Eventual Consistency in δ-CRDTs (senior thesis)

Jasper Hugunin (undergraduate, coadvised with Dan Grossman, 2018 – 2019)
Constructing Inductive-Inductive Types in Cubical Type Theory (FOSSACS 2019)

GRANTS AWARDED

PLATO: Enriched Tactic Prediction Models for Proof Synthesis & Repair. DARPA PEARLS AI Exploration. PI: **Talia Ringer** (UIUC). Co-PIs: Yuriy Brun (UMass Amherst) and Alex Sanchez-Stern (UMass Amherst). Budget: $1,000,000.

POLYMORPH: Promotion to Optimal Languages Yielding Modular Operator-driven Replacements and Programmatic Hooks. DARPA V-SPELLS. Primary PIs: Galois. Co-PIs: Northeastern, UW, **UIUC**, Alabama, and Syracuse. Budget: $11,342,650.

Neurosymbolic Proof Synthesis & Repair. Amazon Research Awards 2022. PI: **Talia Ringer** (UIUC). Budget: $40,000.

INVITED TALKS

Concrete Problems in Proof Automation *2022*
AI for Theorem Proving (AITP), EuroProofNet Large Libraries of Proofs

You and Your Environment *2022*
Programming Languages Mentoring Workshop (PLMW) at POPL

Proof Engineering Tools for a New Era *2021*
Caltech, UCLA, UMass Amherst, Aarhus, Vermont, Illinois, Virginia, Tufts

Proof Repair Across Type Equivalences *2020 – 2021*
Cornell, CMU, NUS

Proof Transformation *2020*
Logic Supergroup Seminar Series

Proof Engineering Tools for a New Era *2019*
Rising Stars in CS Lecture Series at UMass Amherst

INVITED SEMINARS AND WORKSHOPS

Dagstuhl Seminar *Fall 2023*
Automated Mathematics: Integrating Proofs, Algorithms, and Data

Career Path Panel *Summer 2023*
Programming Languages Mentoring Workshop (PLMW) at PLDI.

NeurIPS Queer in AI Workshop: Queerness and Faculty Panel *Winter 2022*
Invited Panel

NeurIPS Workshop on MATH-AI: Toward Human-Level Math Reasoning *Winter 2022*
Invited Panel

ICML Workshop on Human-Machine Collaboration and Teaming *Summer 2022*
Invited Panel: Human-Machine Teams for Mathematicians

Dagstuhl Seminar *Canceled (COVID-19)*
Static Methods for Correctness of Model and Program Transformations

Coq Users and Developers Workshop *Summer 2018, 2019*
An Event for Understanding, Improving, and Extending Coq

Rising Stars *Fall 2019*
An Academic Career Workshop for Women in EECS

REFEREED CONFERENCE & JOURNAL PUBLICATIONS

Tom Reichel, R. Wesley Henderson, Andrew Touchet, Andrew Gardner*, Talia Ringer*.
Proof Repair Infrastructure for Supervised Models: Building a Large Proof Repair Dataset.
To appear in ITP 2023.

Emily First, Markus Rabe, Talia Ringer, Yuriy Brun.
Baldur: Whole-Proof Generation and Repair with Large Language Models.
To appear in ESEC/FSE 2023.

Alex Sanchez-Stern*, Emily First*, Timothy Zhou, Zhanna Kaufman, Yuriy Brun, Talia Ringer.
Passport: Improving Automated Formal Verification Using Identifiers.
To appear in TOPLAS. 2023.

Arpan Agrawal, Emily First, Zhanna Kaufman, Tom Reichel, Shizhuo Zhang, Timothy Zhou, Alex Sanchez-Stern, Talia Ringer, Yuriy Brun.
Proofster: Automated Formal Verification.
ICSE Demo 2023. Demo video, tool website.

Emily Ruppel*, Sihang Liu*, Elba Garza, Sukyoung Ryu, Alexandra Silva, Talia Ringer.
Long-Term Mentoring for Computer Science Researchers.
Communications of the ACM (CACM): Volume 66: No. 5, pp 33-35. May 2023.

Talia Ringer, RanDair Porter, Nathaniel Yazdani, John Leo, Dan Grossman.
Proof Repair Across Type Equivalences.
PLDI 2021. Talk video, PUMPKIN Pi tool repository.

Talia Ringer, Alex Sanchez-Stern, Dan Grossman, Sorin Lerner.
REPLICA: REPL Instrumentation for Coq Analysis.
CPP 2020. Talk video.

Talia Ringer, Karl Palmskog, Ilya Sergey, Milos Gligoric, Zachary Tatlock.
QED at Large: A Survey of Engineering of Formally Verified Software.
Foundations and Trends® in Programming Languages: Vol. 5: No. 2-3, pp 102-281. 2019.
Project website.

Talia Ringer, Nathaniel Yazdani, John Leo, Dan Grossman.
Ornaments for Proof Reuse in Coq.
ITP 2019. Talk video, DEVOID tool repository.

Talia Ringer, Nathaniel Yazdani, John Leo, Dan Grossman.
Adapting Proof Automation to Adapt Proofs.
CPP 2018. Talk video, PUMPKIN PATCH tool repository.

Talia Ringer, Dan Grossman, Daniel Schwartz-Narbonne, Serdar Tasiran.
A Solver-Aided Language for Test Input Generation.
OOPSLA 2017. Talk video.

Talia Ringer, Dan Grossman, Franziska Roesner.
AUDACIOUS: User-Driven Access Control with Unmodified Operating Systems.
CCS 2016. Talk video.

WORKSHOP PUBLICATIONS

Hannah Leung, Talia Ringer, Christopher Fletcher.
Towards Formally Verified Path ORAM in Coq.
CoqPL 2023.

Seth Poulsen, Matthew West, Talia Ringer.
Autogenerating Natural Language Proofs for Proof Education.
The Coq Workshop 2022.

PUBLICATION DRAFTS

Dylan Zhang, Curt Tigges, Stella Biderman, Maxim Raginsky, Talia Ringer.
Can Transformers Learn to Solve Problems Recursively?
Under Submission.

Dylan Zhang, Emily First, Talia Ringer.
Getting More out of Large Language Models for Proofs.
Under Submission.

Audrey Seo*, Chris Lam*, Dan Grossman, Talia Ringer.
Correct Compilation of Proofs about Embedded Programs.
Under Submission.

LEADERSHIP, DIVERSITY, & SERVICE

International Programs:

- Computing Connections Fellowship, Founder & President *2022 – Present*
- SIGPLAN-M (long-term mentoring), Founder & Previous Chair *2021 – Present*

Conferences & Workshops:

- Beyond Bayes Workshop Co-Chair *2022*
- Coq Workshop Co-Chair *2022*
- SPLASH Hybridization Committee (first major hybrid conference in my field) *2021*
- ICFP Programming Languages Mentoring Workshop (PLMW) Co-Chair *2020*
- ICFP Mentoring Chair *2020*
- POPLmark 15 Year Retrospective Panel Lead Organizer *2020*
- Shut Down PL Co-Organizer (anti-racist workshop) *2020*
- DeepSpec Summer School Student Talks Organizer *2017*

Departmental & University Service:

- Grainger IDEA Institute Core Faculty Member *2022 – Present*
- UW CSE Academic Jobs Panel *2022*
- Illinois CS BPC Committee *2022 – Present*
- Illinois Mental Health Ambassador *2021 – Present*

- Illinois CS CARES Committee *2021 – Present*
- UW CSE Care Committee Founder & Organizer (support network) *2019 – 2021*
- UW CSE Graduate Admissions Committee *2018*

National Service & Policy:
- NASEM AI to Assist Mathematical Reasoning Workshop Planning Committee *2023*
- C3E Workshop Planning Committee *2023*

Reviewing & Program Committees (PCs):
- **Panels:** NSF (2023).
- **Conference PCs:** POPL (2024), ICFP (2023), ITP (2022), PLDI (2022), CAV (2021).
- **Journal Reviewing:** JAR (2022), Mathematical Structures in Computer Science (2020).
- **Workshop PCs:** TYPES (2022), AIPLANS (2021), HATRA (2020), CoqPL (2019).
- **Artifact Evaluation Committees:** CAV (2019), POPL (2018, 2019).

Mentoring:
- Mentor for SIGPLAN-M, the program that I founded and chair. *2021 – Present*
- Mentor for undergraduate and graduate women in CS at UW. *2015 – 2020*
- Mentor for LGBT students through the UW Queer Mentoring Program. *2016 – 2019*
- Technical and career mentor for software engineers at Amazon. *2012 – 2015*

Community:
- Creator and administrator of the Neurodivergent at UIUC Slack (2022 – Present).
- Creator and administrator of the Neurodivergent in CS Slack (2021 – Present).
- Creator and administrator of the Midwest PL Slack (2021 – Present).
- Packer and food delivery driver for food banks in Seattle (2020 – 2021).
- ESL tutor & friendly visitor for an elderly refugee with JFS (2017 – 2021).
- Author of a blog interview series about LGBT CS researchers (2016 – 2018).

HONORS & AWARDS

Amazon Research Awards Recipient, PEO Scholar, NSF GRFP Fellow

TEACHING

CS 421: Programming Languages and Compilers *Fall 2023*
CS 598 TLR: Proof Automation *Spring 2022, Fall 2022*

MEDIA

Formal Verification and Deep Learning
Podcast interview for The Gradient about my work as it intersects with machine learning.

Ringer Seeks to Expand Upon the Impact of Being a Mentor
Article about my international service work.

Proof Repair
Thesis Review podcast about my thesis work and how it has informed my work since.

Tenure, Sexism, and ADHD
Type Theory Forall podcast about my work and my experiences.

How Will Proof Engineering Affect the Future of Software Development?
A podcast interview about my work and future vision. From DevDiscuss Season 6, Episode 4.

Proof Repair & Code Generation
A Galois blog post by Valentin Robert about using my tools for industrial applications.

Proof Engineering for the People
A podcast interview about my work and future vision. From Building Better Systems.

AMA on Mentoring
Invited Ask Me Anything (AMA) session at ICFP 2021 about SIGPLAN-M.

GAP Interview
Interview about the academic job search.

JUST FOR FUN

I love **judo**. I am just a yellow belt, but I am hooked. My favorite throw is **ippon seoi nage**. My home dojo (**Kokushi Midwest Judo)** is fantastic. I find judo really amazing for clearing my mind, staying fit, and making friends. I like to visit other dojos all over the world when I travel for work. You should try judo, too!

Before that, I used to compete for **Club Northwest**, a top **distance running** club in Seattle. I served on the board of Club Northwest from 2015 to 2016. I ran **NCAA Division I Cross-Country** in 2009. And before even that, I was a **competitive swimmer** for ten years,

I also enjoy **solving logic and number puzzles**, **writing poetry**, **singing**, **studying languages, making bagels**, **making chocolate truffles, windsurfing, playing Dance Dance Revolution, foraging edible mushrooms**, and **composing music for the piano.**