Talia Lily Ringer

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

ACADEMIA

University of Illinois Urbana-Champaign *2021 – Present*
Assistant Professor

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

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

INDUSTRY

Visiting Researcher at Google Research (N2Formal) *Summer 2022*
Working on machine learning tools for proof assistants.

Research Scientist Intern at Amazon (Automated Reasoning Group) *Summer 2016*
Developed a solver-aided domain-specific language to generate test inputs.

Software Development Engineer II at Amazon (Amazon Business) *2012 – 2015*
Helped launch Amazon Business. Wrote customer-facing code used company-wide.

INTERNATIONAL PROGRAMS FOUNDED

I am the **founder and president** of the **Computing Connections Fellowship**, a fellowship that provides institution-independent transitional funding for computer science Ph.D. students who need help escaping unhealthy environments. We are in the process of a two year pilot in the programming languages research community.

I am also the **founder and chair** of the **SIGPLAN Long-Term Mentoring Committee (SIGPLAN-M)**. SIGPLAN-M pairs mentors and mentees in the programming languages research community for cross-institutional mentoring relationships lasting a year by default. It currently reaches more than **200 mentors** and more than **300 mentees** across more than **41 countries**, and has been described by mentees as **“life changing”** and **“a career saver**.**”**

RESEARCH IMPACT

Proof repair, the subject of my PhD thesis, has since been reimplemented by researchers and engineers at **Amazon** and **NASA**, and adapted to the languages they use. It is also the subject of a **DARPA** AI Exploration called PEARLS, 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

Cosmo Viola (Ph.D., 2021 – Present)
Extending proof repair to handle relations more general than type equivalences.

Chris Lam (Ph.D., 2021 – Present)
Compiling proofs alongside programs.

Hannah Leung (Ph.D., coadvised with Christopher Fletcher, 2022 – Present)
Formally verifying security properties of Path ORAM.

Shizhuo Zhang (Ph.D., coadvised with Maxim Raginsky, 2022 – Present)
Developing neurosymbolic proof models to infer deep semantic relations between types.

Thomas Reichel (masters student, 2022 – Present)
Developing a neural proof repair model.

Timothy Zhou (undergraduate, 2021 – Present)
Improving neural tactic prediction models for proof synthesis and repair.

Max Fan (undergraduate, 2022 – Present)
Building practical proof repair tools for relations more general than type equivalences.

Arpan Agrawal (visiting research programmer, 2022 – Present)
Building machine learning models for proofs into practical user-facing tools.

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. PI: **Talia Ringer** (UIUC). Budget: $40,000.

INVITED TALKS

Concrete Problems in Proof Automation *2022*
AI for Theorem Proving (AITP)

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

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

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.

OTHER PUBLICATIONS

Emily Ruppel*, Sihang Liu*, Elba Garza, Sukyoung Ryu, Alexandra Silva, Talia Ringer.
Long-Term Mentoring for Computer Science Researchers.
Under Submission.

Alex Sanchez-Stern*, Emily First*, Timothy Zhou, Zhanna Kaufman, Yuriy Brun, Talia Ringer.
Passport: Improving Automated Formal Verification Using Identifiers.
Under Submission.

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

LEADERSHIP & SERVICE

Computing Connections Fellowship Founder & President *2022*
Beyond Bayes Workshop Co-Chair *2022*
Coq Workshop Co-Chair *2022*
Illinois Mental Health Ambassador *2021 – Present*
Illinois CS CARES Committee *2021 – Present*
SIGPLAN-M Founder & Chair *2021 – Present*
SPLASH Hybridization Committee *2021*

ICFP Mentoring Chair *2020*
ICFP Programming Languages Mentoring Workshop (PLMW) Co-Chair *2020*
POPLmark 15 Year Retrospective Panel Lead Organizer *2020*
University of Washington Graduate Admissions Committee *2018*
DeepSpec Summer School Student Talks Organizer *2017*

PROGRAM COMMITTEES

TYPES (2022), ITP (2022), PLDI (2022), AIPLANS (2021), CAV (2021), HATRA (2020), MSCS (2020), CoqPL (2019), CAV AEC (2019), POPL AEC (2018, 2019)

TEACHING

CS 598 TLR: Proof Automation *Spring 2022, Fall 2022*
A new graduate seminar on proof automation.
A lot of thought went into its design. Check it out!

MENTORSHIP, DIVERSITY, & OUTREACH

SIGPLAN-M *2021 – Present*
Mentor for the mentorship program listed under leadership & service above.

Shut Down PL *2020*
Coorganizer of an anti-racist workshop for programming languages researchers.

Neighbors Feeding Neighbors Seattle & Ballard Food Bank *2020 – 2021*
Packer & delivery driver of food & masks for the hungry during the pandemic.

UW CSE Care Committee *2019 – 2021*
Founder & organizer of a support network for graduate students in times of need.

Jewish Family Services *2017 – 2021*
ESL tutor and friendly visitor for an elderly refugee.

UW CSE & TUNE House *2015 – 2020*
Mentor for undergraduate women and graduate students in computer science.

UW Queer Mentoring Program *2016 – 2019*
Mentor for LGBT students from any major.

The Identity Function *2016 – 2018*
Author of a blog interview series about LGBT computer science researchers.

Amazon *2012 – 2015*
Technical and career mentor for software engineers.

HONORS & AWARDS

Amazon Research Awards Recipient, PEO Scholar, NSF GRFP Fellow

MEDIA

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 enjoy **distance running**. 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.

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