

Talia Lily Ringer

4218 Siebel Center for CS
tringer@illinois.edu

<https://dependtyp.es>
<https://github.com/tlringer>

ACADEMIA

University of Illinois Urbana-Champaign 2021 – Present
Assistant Professor (1.5 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 – Present
Research Scientist Intern, Amazon (Automated Reasoning Group) Summer 2016

- Working 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

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.

Dylan 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 \$\delta\$ -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-SPILLS](#). 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

- | | |
|---|-------------|
| <u>Concrete Problems in Proof Automation</u> | 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 | |
| <u>Proof Transformation</u> | 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 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

Emily Ruppel*, Sihang Liu*, Elba Garza, Sukyoung Ryu, Alexandra Silva, Talia Ringer.
[Long-Term Mentoring for Computer Science Researchers.](#)
To appear in Communications of the ACM (CACM).

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

Arpan Agrawal, Emily First, Zhanna Kaufman, Tom Reichel, Shizhuo Zhang, Timothy Zhou, Alex Sanchez-Stern, Talia Ringer, and Yuriy Brun.
[Proofster: Automated Formal Verification.](#)
Under Submission to ICSE (Demo Track).

Alex Sanchez-Stern*, Emily First*, Timothy Zhou, Zhanna Kaufman, Yuriy Brun, Talia Ringer.
[Passport: Improving Automated Formal Verification Using Identifiers.](#)
Under Submission to TOPLAS.

Hannah Leung, Talia Ringer, and Christopher Fletcher.
[Towards Formally Verified Path ORAM in Coq.](#)
CoqPL 2022.

Seth Poulsen, Matthew West, Talia Ringer.
[Autogenerating Natural Language Proofs for Proof Education.](#)
The Coq Workshop 2022.

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

Reviewing & Program Committees (PCs):

- **Conference PCs:** 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 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!

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. These days, though, I'm getting more into **judo**.

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