Dr Azalea Raad
Director of the UK Research Institute on Verified Trustworthy Software Systems (VeTSS)
(last updated: September 2023)

Senior Lecturer and UKRI Future Leader Fellow
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Nationality: British
Languages (native fluency): English, Farsi, Turkish
Languages (intermediate): German
Languages (basic): French

EMPLOYMENT

Senior Lecturer at Imperial College London
Department of Computing
July 2022 – Present

Lecturer at Imperial College London
Department of Computing
October 2019 – July 2022

Consultant at Bloomberg, London
Chief Technical Office
September 2022 – Present

Consultant at Meta (formerly Facebook), London
Infer Verification Team and Incorrectness Logic Lab
September 2020 – July 2022

Postdoctoral Researcher at MPI-SWS
Group: Programming Languages and Verification (PLV)
Managers: Derek Dreyer and Viktor Vafeiadis
July 2017 – March 2020

Research Associate at Imperial College London
Group: Verified Trustworthy Software Specification
Manager: Philippa Gardner
January 2017 – June 2017

FUNDING

Principal Investigator
EPSRC Standard Grant
Project Title: “SACRED-MA: Safe and Secure Remote Direct Memory Access”
Amount: £750,000

Co-Director
Directorship of the UK Research Institute Verified Trustworthy Software Systems (VeTSS)
Amount: £750,000

Principal Investigator
Research Gift by Meta
Project Title: “Automated Generation and Detection of Exploits via Incorrectness Logic”
Amount: $50,000

Sole Investigator
UKRI Future Leader Fellowship
Project Title: “PERSEVERE: A Rigorous Foundation for Persistent Verification”
Amount: £1,500,000
Principal Investigator  
UKRI VeTSS (UK Research Institute in Verified Trustworthy Software Systems)  
Project Title: “Validating the Foundations of Verified Persistent Programming”  
Amount: £100,000

EDUCATION

PhD in Theoretical Computer Science  
October 2010 – December 2016  
Imperial College London  
Thesis: Abstraction, Refinement and Concurrent Reasoning  
Supervisors: Philippa Gardner and Sophia Drossopoulou  
Examiners: Derek Dreyer (MPI-SWS) and Matthew Parkinson (Microsoft Research)

Master of Engineering in Computer Science  
October 2006 – June 2010  
Imperial College London, graduated third in class with a First Class Honours Degree  
Thesis title: Smelling of Roses (ROles - Specification, Exploration, Scrutiny)  
Supervisors: Sophia Drossopoulou and Susan Eisenbach  
The thesis was awarded the Corporate Partnership Prize

PUBLICATIONS

Specifying and Verifying Persistent Libraries  
Léo Stefanesco, Azalea Raad, Viktor Vafeiadis  
European Symposium on Programming (ESOP), 2024 (under submission)

Intel PMDK Transactions: Specification and Concurrency  
Azalea Raad, Ori Lahav, John Wickerson, Brijesh Dongol  
European Symposium on Programming (ESOP), 2024 (under submission)

Challenges in Empirically Testing Memory Persistency Models  
Vasileios Klimis, Alastair F. Donaldson, Viktor Vafeiadis, John Wickerson, Azalea Raad  
International Conference on Software Engineering (ICSE), 2024 (under submission)

A General Approach to Under-approximate Reasoning about Concurrent Programs  
Azalea Raad, Julien Vanegue, Josh Berdine, Peter O’Hearn  
Conference on Concurrency Theory (CONCUR), 2023

Memento: A Framework for Detectable Recoverability in Persistent Memory  
Kyeongmin Cho, Seungmin Jeon, Azalea Raad, Jeehoon Kang  
Programming Language Design and Implementation (PLDI), 2023

The Path to Durable Linearizability  
Emanuele D’Osualdo, Azalea Raad, Viktor Vafeiadis  
Principles of Programming Languages (POPL), 2023

Finding Real Bugs in Big Programs with Incorrectness Logic  
Quang Loc Le, Azalea Raad, Jules Villard, Josh Berdine, Derek Dreyer, Peter O’Hearn  
Object-Oriented Programming, Systems, Languages, and Applications (OOPSLA), 2022

Winner of the distinguished paper award

View-Based Owcki-Gries Reasoning for Persistent x86- TSO  
Eleni Vafeiadi Bila, Brijesh Dongol, Ori Lahav, Azalea Raad, John Wickerson  
European Symposium on Programming (ESOP), 2022

Winner of the distinguished artifact award
Concurrent Incorrectness Separation Logic
Azalea Raad, Josh Berdine, Derek Dreyer, Peter O’Hearn
Principles of Programming Languages (POPL), 2022

Extending Intel-x86 Consistency and Persistency: Formalising the Semantics of Intel-x86 Memory Types and Non-Temporal Stores
Azalea Raad, Luc Maranget, Viktor Vafeiadis
Principles of Programming Languages (POPL), 2022

Revamping Hardware Persistency Models
Kyeongmin Cho, Sung-Hwan Lee, Azalea Raad, Jeehoon Kang
Programming Language Design and Implementation (PLDI), 2021

PerSeVerE: Persistency Semantics for Verification under Ext4
Michalis Kokologiannakis, Ilya Kaysin, Azalea Raad, Viktor Vafeiadis
Principles of Programming Languages (POPL), 2021

Persistent Owick-Gries Reasoning
Azalea Raad, Ori Lahav, Viktor Vafeiadis
Object-Oriented Programming, Systems, Languages, and Applications (OOPSLA), 2020

Local Reasoning about the Presence of Bugs: Incorrectness Separation Logic
Azalea Raad, Josh Berdine, Hoang-Hai Dang, Derek Dreyer, Peter O’Hearn, Jules Villard
Computer-Aided Verification (CAV), 2020

Data Consistency in Transactional Storage Systems: A Centralised Approach
Shale Xiong, Andrea Cerone, Azalea Raad, Philippa Gardner
European Conference on Object-Oriented Programming (ECOOP), 2020

Persistency Semantics of the Intel-x86 Architecture
Azalea Raad, Gil Neiger, John Wickerson, Viktor Vafeiadis
Principles of Programming Languages (POPL), 2020

Weak Persistency Semantics from the Ground Up
Azalea Raad, John Wickerson, Viktor Vafeiadis
Object-Oriented Programming, Systems, Languages, and Applications (OOPSLA), 2019

Effective Lock Handling in Stateless Model Checking
Michalis Kokologiannakis, Azalea Raad, Viktor Vafeiadis
Object-Oriented Programming, Systems, Languages, and Applications (OOPSLA), 2019

Hyperstate Space Graphs for Automated Game Analysis
Michael Cook, Azalea Raad
Conference on Games (Cog), 2019, Winner of the best paper award

Model Checking for Weakly Consistent Libraries
Michalis Kokologiannakis, Azalea Raad, Viktor Vafeiadis
Programming Language Design and Implementation (PLDI), 2019

On Library Correctness under Weak Memory Consistency
Azalea Raad, Marko Doko, Lovro Rožić, Ori Lahav, Viktor Vafeiadis
Principles of Programming Languages (POPL), 2019
On the Semantics of Snapshot Isolation

**Azalea Raad**, Ori Lahav, Viktor Vafeiadis
Verification, Model Checking and Abstract Interpretation (VMCAI), 2019

Persistence Semantics for Weak Memory

**Azalea Raad**, Viktor Vafeiadis
Object-Oriented Programming, Systems, Languages, and Applications (OOPSLA), 2018

On Parallel Snapshot Isolation and Release/Acquire Consistency

**Azalea Raad**, Ori Lahav, Viktor Vafeiadis
European Symposium on Programming (ESOP), 2018

Inferring Design Constraints from Game Ruleset Analysis

Michael Cook, Simon Colton, **Azalea Raad**
IEEE Conference on Computational Intelligence and Games (CIG), 2018

Abstraction, Refinement and Concurrent Reasoning

Doctoral Thesis, 2017

Verifying Concurrent Graph Algorithms

**Azalea Raad**, Aquinas Hobor, Jules Villard, Philippa Gardner
Asian Symposium on Programming Languages and Systems (APLAS), 2016

DOM: Specification and Client Reasoning

**Azalea Raad**, José Fragoso Santos, Philippa Gardner
Asian Symposium on Programming Languages and Systems (APLAS), 2016

CoLoSL: Concurrent Local Subjective Logic

**Azalea Raad**, Jules Villard, Philippa Gardner
European Symposium on Programming (ESOP), 2015

Abstract Local Reasoning for Concurrent Libraries: Mind the Gap

Philippa Gardner, **Azalea Raad***, Adam Wright, Mark Wheelhouse
Mathematical Foundations of Programming Semantics (MFPS), 2014

(* author list in alphabetical order – Raad and Wright have joint first authorship)

Mechanic Miner: Reflection-Driven Game Mechanic Discovery And Design

Michael Cook, Simon Colton, **Azalea Raad**, Jeremy Gow
EvoGames Workshop at European Conference on Applications of Evolutionary Computation, 2013

A Sip of the Chalice

**Azalea Raad**, Sophia Drossopoulou
Functional Techniques for Java-like Programs (FTfJP), 2011

Ludic Considerations of Tablet-Based Evo-Art

Simon Colton, Michael Cook, **Azalea Raad**
EvoMusArt Workshop at European Conference on Applications of Evolutionary Computation, 2011

**SELECTED KEYNOTE AND INVITED TALKS**

**Invited Talk**
**September 2023**

Principles of Persistent Programming
Trends in Concurrency Theory (TRENDS)
| Event Type         | Date       | Title                                                                 |
|-------------------|------------|----------------------------------------------------------------------|
| Invited Talk      | September 2023 | Under-approximation for Scalable Bug Detection                     |
|                   |            | Young Researchers Workshop on Concurrency Theory (YR-CONCUR)         |
| Keynote Talk      | June 2023  | Principles of Persistent Programming                                |
|                   |            | Federated Conference on Distributed Computing Techniques (DisCoTec)  |
| Keynote Talk      | June 2023  | Incorrectness Logic for Scalable Bug Detection                      |
|                   |            | Mathematical Foundations of Programming Semantics (MFPS)             |
| Invited Talk      | May 2023   | Incorrectness Logic for Scalable Bug Detection                      |
|                   |            | Conference on High Confidence Software and Systems conference (HCSS) |
| Invited Talk      | May 2023   | Incorrectness Logic for Scalable Bug Detection                      |
|                   |            | Iris Workshop                                                       |
| Keynote Tutorial  | January 2023 | Incorrectness Logic and Under-approximation: Foundations of Bug Catching |
|                   |            | Principles of Programming Languages (POPL)                          |
| Invited Talk      | October 2022 | Incorrectness Logic for Scalable Bug Detection                      |
|                   |            | Workshop on Dependable and Secure Software Systems (DSSS)            |
| Invited Talk      | September 2022 | Extending Intel-x86 Consistency and Persistency                   |
|                   |            | Novel Architecture and Novel Design Automation (NANDA) Workshop      |
| Invited Talk      | December 2021 | Scalable, Concurrent Bug Catching: Concurrent Incorrectness Separation Logic |
|                   |            | Testing and Verification Symposium at Facebook, 2021                |
| Keynote Tutorial  | June 2021  | Beyond Weak Memory Consistency: The Challenges of Memory Persistency |
|                   |            | Programming Language Design and Implementation (PLDI), 2021          |
| Invited Talk      | January 2021 | Compositional Bug Catching: Incorrectness Separation Logic          |
|                   |            | World Logic Day                                                     |
| Invited Talk      | June 2019  | Specifying and Verifying Non-Volatile Memory                        |
|                   |            | Verification of Distributed Systems (VDS)                            |
| Keynote Talk      | December 2018 | Correctness in a Weakly Consistent Setting                        |
|                   |            | Asian Symposium on Programming Languages and Systems (APLAS)         |
| Invited Talk      | January 2017 | Verifying Concurrent Graph Algorithms                              |
|                   |            | Northern Concurrency Workshop                                       |
Invited Tutorial Talk  
CoLoSL: Why Not Frame All the Way?  
Mathematical Foundations of Programming Semantics (MFPS)

Invited Talk  
CoLoSL: Concurrent Local Subjective Logic  
Dagstuhl Seminar 15191: Compositional Verification Methods for Next-Generation Concurrency

Invited Talk  
CoLoSL: Concurrent Local Subjective Logic  
Theory Seminar at the University of Birmingham

Invited Talk  
CoLoSL: Compositional Reasoning at Last!  
Research Visit at the Max Planck Institute for Software Systems, Saarbrücken, Germany

Research Group

Post-Doctoral Researchers
- Guillaume Ambal  
  October 2022 – Present
- Paulo de Vilhena  
  April 2023 – Present

PhD Students
- Shing-Hin Ho  
  January 2023 – Present
- Pedro Carrott  
  October 2023 – Present
- Julien Vanegue (funded by Bloomberg)  
  October 2023 – Present

Master’s Students
- Tiberiu Bucur  
  October 2022 – June 2023  
  Winner of the Corporate Partnership Prize
- Ezra Sitorus  
  October 2022 – June 2023
- Aris Zhu  
  October 2022 – June 2023
- Rini Banerjee  
  October 2021 – June 2022  
  Winner of the ARM project prize for an outstanding project in computer systems

Awards and Prizes

Distinguished Paper Award  
Object-Oriented Programming, Systems, Languages, and Applications (OOPSLA)  
2022

Distinguished Artifact Award, European Symposium on Programming (ESOP)  
2022

Imperial College President’s Award for Excellence in Research  
(Early Career Researcher)  
2021

Best Paper Award, Conference on Games (CoG)  
Hyperstate Space Graphs for Automated Game Analysis  
2019

Corporate Partnership Prize for Excellence and Outstanding Achievement  
2010

Gloucester Research Prize for Academic Excellence  
2009

David Howarth Project Prize for Automated Generation of Compiler Test Cases  
2009

Olav Beckman Project Prize  
2008

Imperial College Research Prize for Cognitive Robotics Project  
2007
Research Prize (Sponsored by Deutsche Bank) 2007
Prize for Excellence in First Year Computing (Sponsored by Morgan Stanley) 2007

Professional Services

Organisation
- Organiser of the Future of Weak Memory workshop at POPL, 2024
- Organiser of the Formal Methods for Incorrectness workshop at POPL, 2024
- Organiser of Dagstuhl seminar on Formal Methods for Correct Persistent Programming, 2023
- Organiser of the Concurrency Meeting at the Isaac Newton Institute, 2022
- Co-chair of the Student Research Competition at POPL, 2022
- Organiser of Dagstuhl seminar 21462 on Foundations of Persistent Programming, 2021
- Co-chair of the Student Research Competition at POPL, 2021
- Organiser of the Programming Languages Mentoring Workshop (PLMW) at POPL, 2021
- Accessibility chair of Programming Language Design and Implementation (PLDI), 2020
- Organiser of Imperial Concurrency Workshop, 2015
- Organiser of the Workshop on Introduction to Verification and Testing (INVEST), 2014

Program Committee Membership
- European Symposium on Programming (ESOP): 2024
- Principles of Programming Languages (POPL): 2023, 2020
- International Conference on Functional Programming (ICFP), 2022
- Computer-Aided Verification (CAV), 2022
- Programming Language Design and Implementation (PLDI): 2021, 2020 (external member)
- Object-Oriented Programming, Systems, Languages, and Applications (OOPSLA): 2020, 2018 (external member)
- Verification, Model Checking, and Abstract Interpretation (VMCAI), 2021
- International Conference on Networked Systems (NETYS), 2020
- European Conference on Object-Oriented Programming (ECOOP), 2019
- Mathematical Foundations of Programming Semantics (MFPS), 2018
- Syntax and Semantics of Low-Level Languages (LOLA), 2018
- European Symposium on Programming (ESOP), 2017 (external reviewer)
- International Workshop on Aliasing, Capabilities and Ownership (IWACO), 2017
- Student Research Competition at POPL, 2020
- Student Research Competition at PLDI, 2019
- Student Research Competition at ICFP, 2019
- Student Research Competition Judge at the Asian Symposium on Programming Languages and Systems (APLAS), 2018

Journal Reviews
- Journal of the American Computer Machinery, 2022
- Foundations and Trends in Programming Languages, 2020
Panel Membership

- Member of the *What I wish I had known before attending graduate school* panel at the Programming Languages Mentoring Workshop (PLMW) co-located with OOPSLA, 2019
- Member of the *Grad School and Beyond* panel at the Programming Languages Mentoring Workshop (PLMW) co-located with POPL, 2019

**Teaching**

**The Theory and Practice of Concurrent Programming** 2021–Present
Third year course (Imperial College London); co-designed the course

**Models of Computation** 2020–2021
Second year course (Imperial College London)

**Logic and Reasoning** 2020
First year course (Imperial College London)