Christopher Steven Timperley

Systems Scientist at Software and Societal Systems Department
School of Computer Science, Carnegie Mellon University

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Research Experience

Carnegie Mellon University — Pittsburgh, PA, USA
Senior Systems Scientist — *effective July, 2023*

Carnegie Mellon University — Pittsburgh, PA, USA
Systems Scientist — *August, 2018 – July, 2023*

Carnegie Mellon University — Pittsburgh, PA, USA
Postdoctoral Researcher — *October, 2016 – August, 2018*

Carnegie Mellon University — Pittsburgh, PA, USA
Visiting Research Student — *July, 2015 – October, 2015*

Education

University of York, UK — 2013–2017
Ph.D. Computer Science
Advisor: Susan Stepney
Thesis: Advanced methods for search-based program repair

University of York, UK — 2009–2013
M.Eng. Computer Science with Artificial Intelligence — *First Class Honours*
Advisor: Susan Stepney
Thesis: Reflective method matching for object-oriented programs

Industry Experience

Analytica Informatics — London, UK
Co-Founder, Technical Director — *February, 2012 – August, 2013*

Awards, Grants & Honors

EPSRC Doctoral Training Grant 2013–2016
William Gibbs Award (£3,000) 2015
K.M. Stott Prize for Best Qualifying Disseration 2015

Press Coverage

"Broad Agency Announcement: Robotic Autonomy in Complex Environments with Resiliency — Simulation (Racer-Sim)". In: *DARPA Tactical Technology Office* (Nov. 30, 2020). URL: https://www.grants.gov/web/grants/view-opportunity.html?oppId=330584.

Steve Crowe. "10 challenges of using simulators for testing robots". In: *The Robot Report* (May 25, 2020). URL: https://www.therobotreport.com/10-challenges-simulators-robotics-testing/.

Kyle Wiggers. "The challenges of developing autonomous vehicles during a pandemic". In: *Venture Beat* (Apr. 28, 2020). URL: https://venturebeat.com/2020/04/28/challenges-of-developing-autonomous-vehicles-during-coronavirus-covid-19-pandemic.

Open Robotics. "ROSCon Macau 2019". In: (Nov. 5, 2019). URL: https://www.openrobotics.org/blog/2019/11/4/roscon-macau-2019.

Publications

Refereed Journal Publications

[Mithra] Afsoon Afzal, Claire Le Goues, and Christopher S Timperley. "Mithra: Blackbox Oracle Learning for Cyberphysical Systems". In: *Transactions on Software Engineering* 48.11 (2022), pp. 4535–4552.

[EMSE'21] Christopher S. Timperley, Lauren Herckis, Claire Le Goues, and Michael Hilton. "Understanding and Improving Artifact Sharing in Software Engineering Research". In: *Empirical Software Engineering* 26 (4 2021), pp. 1–41.

[Soft'19] J. Aldrich, D. Garlan, C. Kaestner, C. Le Goues, A. Mohseni-Kabir, I. Ruchkin, S. Samuel, B. Schmerl, C. S. Timperley, M. Veloso, I. Voysey, J. Biswas, A. Guha, J. Holtz, J. Camara, and P. Jamshidi. "Model-Based Adaptation for Robotics Software". In: *IEEE Software* 36.2 (2019), pp. 83–90.

[ALIFE'16] Tim Taylor et al. "Open-Ended Evolution: Perspectives from the OEE Workshop in York". In: *Artificial Life* 22.3 (2016), pp. 408–423.

Refereed Conference and Workshop Publications

[ICSE-NEIR'23] Earl Barr, Jonathan Bell, Michael Hilton, Sergey Mechtaev, and Christopher Timperley. "Continuously Accelerating Research". In: *International Conference on Software Engineering: New Ideas and Emerging Results*. ICSE NEIR '23. **(Accepted.)** 2023.

[RSA'23] Tobias Dürschmid, Christopher S. Timperley, David Garlan, and Claire Le Goues. "Architectural Model Inference from Code for ROS-based Robotics Systems". In: *Workshop on Robot Software Architectures at International Conference on Robotics and Automation*. RSA '23. **(Accepted.)** 2023.

[ICSE'23] Catarina Gamboa, Paulo Alexandre Santos, Christopher S Timperley, and Alcides Fonseca. "User-driven Design and Evaluation of Liquid Types in Java". In: *International Conference on Software Engineering*. ICSE '23. **(Accepted.)** 2023.

[RoSE'22] Paulo Canelas, Miguel Tavares, Ricardo Cordeiro, Alcides Fonseca, and Christopher S. Timperley. "The Developer Experience of Newcomers in Learning the Robot Operating System". In: *International Workshop on Robotics Software Engineering*. RoSE '22. **(Accepted.)** 2022.

[FSE-Industry'22] James Ivers, Robert L Nord, Ipek Ozkaya, Chris Seifried, Christopher S Timperley, and Marouane Kessentini. "Industry Experiences with Large-Scale Refactoring". In: *Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering: Industry Track*. ESEC/FSE '22. 2022, pp. 1544–1554.

[SEIP'22] James Ivers, Robert L Nord, Ipek Ozkaya, Chris Seifried, Christopher S Timperley, and Marouane Kessentini. "Industry's Cry for Tools that Support Large-Scale Refactoring". In: *International Conference on Software Engineering – Software Engineering in Practice: Poster Track*. ICSE SEIP '22. 2022, pp. 163–164.

[START] Kevin Leach, Christopher S. Timperley, Kevin Angstadt, Anh Nguyen-Tuong, Jason Hiser, Aaron Paulos, Partha Pal, Patrick Hurley, Carl Thomas, Jack W. Davidson, Stephanie Forrest, Claire Le Goues, and Westley Weimer. "START: A Framework for Trusted and Resilient Autonomous Vehicles (Practical Experience Report". In: *International Symposium on Software Reliability Engineering*. ISSRE '22. 2022, pp. 73–84.

[ISSRE'22] Kevin Leach*, Christopher S Timperley*, Kevin Angstadt, Anh Nguyen-Tuong, Jason Hiser, Aaron Paulos, Partha Pal, Patrick Hurley, Carl Thomas, Jack W. Davidson, Stephanie Forrest, Claire Le Goues, and Westley Weimer. "START: A Framework for Trusted and Resilient Autonomous Vehicles (Practical Experience Report)". In: *International Symposium on Software Reliability Engineering*. ISSRE '22. 2022, pp. 73–84.

[ICSA'22] Christopher S. Timperley, Tobias Dürschmid, Bradley Schmerl, David Garlan, and Claire Le Goues. "ROSDiscover: Statically Detecting Architecture Misconfigurations in Robotics Systems". In: *International Conference on Software Architecture*. ICSA '22. 2022, pp. 112–123.

[FSE'22] Stefan Winter, Christopher S. Timperley, Ben Hermann, Jürgen Cito, Jonathan Bell, Michael Hilton, and Dirk Beyer. "A Retrospective Study of one Decade of Artifact Evaluations". In: *Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering*. ESEC/FSE '22. 2022, pp. 145–156.

[ICST'21] Afsoon Afzal, Deborah S. Katz, Claire Le Goues, and Christopher S. Timperley. "Simulation for Robotics Test Automation: Developer Perspectives". In: *International Conference on Software Testing*. ICST '21. 2021, pp. 263–274.

[SBST'21] Paulo Santos, José Campos, Christopher S. Timperley, and Alcides Fonseca. "Augmenting Search-based Techniques with Static Synthesis-based Input Generation". In: *International Workshop on Search-Based Software Testing*. SBST '21. 2021, pp. 12–15.

[ICST'20] Afsoon Afzal, Claire Le Goues, Michael Hilton, and Christopher S. Timperley. "A Study on Challenges of Testing Robotic Systems". In: *International Conference on Software Testing*. ICST '20. 2020, pp. 96–107.

[ICSME'20] Sophia Kolak, Afsoon Afzal, Michael Hilton, Claire Le Goues, and Christopher S Timperley. "It Takes a Village To Build a Robot: An Empirical Study of the ROS Ecosystem". In: *International Conference on Software Maintenance and Evolution*. ICSME '20. 2020, pp. 430–440.

[GI'19] Zhen Yu Ding, Yiwei Lyu, Christopher S. Timperley, and Claire Le Goues. "Leveraging Program Invariants to Promote Population Diversity in Search-Based Automatic Program Repair". In: *Genetic Improvement Workshop*. GI '19. 2019, pp. 2–9.

[ROSConK'19] Sophia Kolak and Christopher S. Timperley. "It Takes a Village: Collaboration in ROS". In: *ROSCon Macau 2019*. Open Robotics, 2019. URL: https://doi.org/10.36288/ROSCon2019-900875.

[ROSCon'19] Christopher Timperley and Andrzej Wąsowski. "188 ROS bugs later: Where do we go from here?" In: *ROSCon Macau 2019*. Open Robotics, 2019. URL: https://doi.org/10.36288/ROSCon2019-900898.

[GI'18b] Afsoon Afzal and Jeremy Lacomis and Claire Le Goues and Christopher S. Timperley. "A Turing Test for Genetic Improvement". In: *International Workshop on Genetic Improvement*. GI '18. 2018, pp. 17–18.

[GI'18a] Benoit Baudry and Nicholas Harrand and Eric Schulte and Chris Timperley and Shin Hwei Tan and Marija Selkavoic and Emamurho Ughergughe. "A spoonful of DevOps helps the GI go down". In: *Genetic Improvement Workshop*. GI '18. 2018, pp. 35–36.

[ICST'18] Christopher S. Timperley and Afsoon Afzal and Deborah S. Katz and Jam Marcos Hernandez and Claire Le Goues. "Crashing simulated planes is cheap: Can simulation detect robotics bugs early?" In: *International Conference on Software Testing*. ICST '18. 2018, pp. 331–342.

[ICSE'18] Christopher S. Timperley and Susan Stepney and Claire Le Goues. "Poster: BugZoo – A Platform for Studying Software Bugs". In: *International Conference on Software Engineering*. ICSE '18. 2018, pp. 446–447.

[SSBSE'17] Christopher S. Timperley, Susan Stepney, and Claire Le Goues. "An Investigation into the Use of Mutation Analysis for Automated Program Repair". In: *Search Based Software Engineering*. SSBSE '17. 2017, pp. 99–114.

[ECAL'15] Christopher S. Timperley and Susan Stepney. "Wallace: An efficient generic evolutionary framework". In: *European Conference on Artificial Life*. ECAL '15. 2015, pp. 365–372.

[ALIFE'14] Christopher S. Timperley and Susan Stepney. "Reflective Grammatical Evolution". In: *ALife XIV*. MIT Press. 2014, pp. 71–78.

Unconventional and Non-Refereed Publications

[arXiv:2201.12464] Deborah S Katz, Christopher S. Timperley, and Claire Le Goues. "Using Dynamic Binary Instrumentation to Detect Failures in Robotics Software". In: (2022). arXiv: 2201.12464 [cs-se].

[GzScenic] Afsoon Afzal, Claire Le Goues, and Christopher S Timperley. "GzScenic: Automatic scene generation for gazebo simulator". In: (2021). arXiv: 2104.08625 [cs-ro].

[arXiv:2110.05444] Catarina Gamboa, Paulo Alexandre Santos, Christopher S Timperley, and Alcides Fonseca. "User-driven Design and Evaluation of Liquid Types in Java". In: 2021. arXiv: 2110.05444 [cs-ro].

[arXiv:2004.07368] Afsoon Afzal, Deborah S. Katz, Claire Le Goues, and Christopher S Timperley. "A Study on the Challenges of Using Robotics Simulators for Testing". In: 2020. arXiv: 2004.07368 [cs-ro].

[SEN'19] William B Langdon, Westley Weimer, Christopher Timperley, Oliver Krauss, Zhen Yu Ding, Yiwei Lyu, Nicolas Chausseau, Eric Schulte, Shin Hwei Tan, Kevin Leach, et al. "The State and Future of Genetic Improvement". In: *Software Engineering Notes* 44.3 (2019), pp. 25–29.

[PhD] Christopher S. Timperley. "Advanced Methods for Search-Based Program Repair". PhD thesis. York, England: University of York, 2017.

[MEng] Christopher S. Timperley. "Reflective Method Matching for Object-Oriented Programs". MEng thesis. York, England: University of York, 2013.

Selected Open Source Projects

BugZoo: `https://github.com/squaresLab/BugZoo`
An open platform for studying and reproducing historical software bugs.

Darjeeling: `https://github.com/squaresLab/Darjeeling`
A framework for language-agnostic automated program repair.

ROSWire: `https://github.com/ChrisTimperley/ROSWire`
A library for performing static and dynamic analysis of containerized ROS applications.

ROBUST: `https://github.com/robust-rosin/robust`
A curation of over 200 historical bugs in Robot Operating System packages.

The Robot Cooperative: `https://github.com/TheRobotCooperative/TheRobotCooperative`
A growing set of guides and interactive Docker images for new researchers studying ROS.

Teaching and Demonstrating

Carnegie Mellon University

Spring 2023	17413	Software Engineering Practicum	Instructor of Record
Fall 2022	17313	Foundations of Software Engineering	Instructor of Record
Spring 2022	ExecEd	Testing & Evaluation for Robotics	Instructor of Record
Spring 2022	17413	Software Engineering Practicum	Instructor of Record
Fall 2021	17623	Quality Assurance	Instructor of Record
Spring 2021	17643	Quality Management	Guest Lecturer
Spring 2021	17413	Software Engineering Practicum	Instructor of Record
Fall 2020	17623	Quality Assurance	Instructor of Record
Spring 2020	17413	Software Engineering Practicum	Instructor of Record
Fall 2019	17214	Principles of Software Construction	Instructor of Record
Spring 2019	17355	Program Analysis	Guest Lecturer
Spring 2019	17413	Software Engineering Practicum	Instructor of Record

University of York

2016	SMAT	Software Measurement and Testing	Teaching Assistant, Guest Lecturer
2016	TPOP	Theory and Practice of Programmming	Teaching Assistant
2015	EVCO	Evolutionary Computation	Teaching Assistant, Guest Lecturer
2015	CIDCATS	Introduction to Complex Systems	Teaching Assistant
2015	TPOP	Theory and Practice of Programmming	Teaching Assistant
2014	TPOP	Theory and Practice of Programmming	Teaching Assistant

Invited Talks

Lightweight Analysis and Specification for Better Modular Robotics Software
Workshop on Quality and Reliability Assessment of Robotic Software Architectures and Components (QRARSAC) at ICRA 2023, *London, United Kingdom, June 2023.*

A Reflection on Program Repair for Robots
National University of Singapore, *Singapore, Dec 2019.*

188 ROS bugs later: Where do we go from here?
ROS Quality Assurance Group, *Dec 2019.*

188 ROS bugs later: Where do we go from here?
ROSCon 2019, *Macau, China, Nov 2019.*

Crashing simulated planes is cheap: Can simulation detect robotics bugs early?
Swedish Association for Software Testing Quarterly Meeting Q2, *Västerås, Sweden, Apr 2018.*

Automated Program Repair: Opportunities, Challenges, Advances.
58th CREST Open Workshop, Automating Programmers' Programming Experiments for Analytic Result Reporting in Code Review and Continuous Integration, *London, England, Feb 2018.*

BugZoo: A Platform for Studying Historical Bugs. Dagstuhl Seminar 18052, Genetic Improvement of Software, *Wadern, Germany, Jan 2018.*

Professional Activities

Local Service at Carnegie Mellon University

2023 Member, MSE Scalable Systems and Embedded Systems Admissions Committee
2022 Member, MSE Scalable Systems and Embedded Systems Admissions Committee
2021 Member, MSE Scalable Systems and Embedded Systems Admissions Committee
2017 Member, REUSE@CMU Admissions Committee

Organizing Committee Membership

2023 International Workshop on Robotics Software Engineering (RoSE) @ ICSE

Program Committee Membership

2023 International Workshop on the Repair and Optimisation of Software using Computational Search
2022 International Workshop on the Repair and Optimisation of Software using Computational Search
2021 International Workshop on the Repair and Optimisation of Software using Computational Search
2020 International Workshop on the Repair and Optimisation of Software using Computational Search
2019 International Conference on Automated Software Engineering, Tools Track
International Workshop on the Repair and Optimisation of Software using Computational Search
International Conference on Software Engineering, Demo Track
2017 International Symposium on Search-Based Software Engineering, Student and Short Papers Track
Complex Systems Modelling and Simulation Workshop
2014 York Doctoral Symposium

Guest Reviewing and Refereeing

2023	ACM Transactions on Software Engineering and Methodology
2022	Empirical Software Engineering
	Information and Software Technology
	Journal of Systems and Software
	IEEE Transactions on Software Engineering
	IEEE International Conference on Robotics and Automation
2021	ACM Transactions on Software Engineering and Methodology
	IEEE Robotics and Automation Letters
	IEEE Software
	IEEE Transactions on Software Engineering
	Information and Software Technology
	Journal of Field Robotics
	Journal of Systems and Software
2019	Empirical Software Engineering
	Journal of Systems and Software
2015	Artificial Life Journal

Student Service

Ph.D. Student Advising

current	Paulo Santos	Carnegie Mellon University & University of Lisbon

Masters Student Advising

2021–2022	Miguel Tavares	University of Lisbon
2021–2022	Ricardo Cordeiro	University of Lisbon
2020–2021	Catarina Gamboa	University of Lisbon

Ph.D. Student Mentoring

current	Tobias Dürschmid	Institute for Software Research, CMU
2017–2021	Afsoon Afzal	Institute for Software Research, CMU
2018–2020	Deborah Katz	Computer Science Department, CMU

Research Experience for Undergraduates (REU) Mentoring

2023	Eduardo Pareja	Tufts University
2022	Ryan Wong	Northwestern University
2021	Mehal Kayshapp	Carnegie Mellon University
2020	Victoria Jordan	Embry-Riddle Aeronautical University
2019	Sophia Kolak	Columbia University
2017	Jam Marcos Hernandez	State University of New York

CMU Portugal Exchange Program Mentoring

2020–2021	Paulo Santos	University of Lisbon