Matthew C. Davis Curriculum Vitae, May 2024

CONTACT: TCS Hall mcd2 [at] cmu [] edu
Carnegie Mellon University
4665 Forbes Avenue
Pittsburgh, PA 15213

RESEARCH INTERESTS

Software engineers can get more done -- and enjoy their work more -- when they use tools that consider the unique strengths and weaknesses of human cognition.

My empirical and theoretical **Accelerated Testing** research program at Carnegie Mellon University's School of Computer Science investigates novel interventions that improve the human ability to build and test useful software. This program builds upon a wide base of software engineering, human computer interaction, programming language, cognitive science, and artificial intelligence research.

Presently, I publish and speak at top venues/journals such as TOSEM, ICSE, and FSE as a PhD candidate under the advisement or Dr. Brad A. Myers and Dr. Joshua Sunshine. My research program is funded by the US government via multiple NSF grants and by industry partners such as Amazon, Microsoft, Meta, SAP, and Cisco via CyLab grants.

My prior industry experience as a software engineer and global technology director motivates my research program and encompasses more than twenty years of building and managing the full life cycle and full stack of complex critical systems across a variety of domains and contexts.

EDUCATION

- **Ph.D., Software Engineering** (expected graduation: 2026)
  Carnegie Mellon University School of Computer Science, 4.0 GPA
  Advisors: Dr. Brad A. Myers, Dr. Joshua Sunshine
- **Non-degree-seeking Mathematics Student**
  North Carolina State University, 4.0 GPA
- **M.Sc., Software Engineering** (research track)
  East Carolina University, 4.0 GPA, Advisor: Dr. Mark Hills
- **BA, Computer Information Systems**
  Lenoir-Rhyne University

PAPERS

- **Matthew C. Davis**, Sangheon Choi, Sam Estep, Brad A. Myers, and Joshua Sunshine. “NaNofuzz: A Usable Tool for Automatic Test Generation.” In Proceedings of the 31st ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering, 2023. https://dl.acm.org/doi/abs/10.1145/3611643.3616327
- **Matthew C. Davis**, Emad Aghayi, Thomas D. LaToza, Xiaoyin Wang, Brad A. Myers, Joshua Sunshine. “What’s (not) Working in Programmer User Studies?” Transactions on Software Engineering and Methodology. 2023. https://dl.acm.org/doi/10.1145/3587157
- **Matthew C. Davis** and Mark Hills. "Escaping the Clone Zone: Java Runtime-Managed Snapshots Current and Future Work." Southeastern Regional Programming Language Seminar. Paper & Talk. 2019. http://www.cs.ecu.edu/hillsma/publications/davis-hills-2019-serpl.pdf

- **Matthew C. Davis**. "Applying Mutable Object Snapshots to a High-level Object-Oriented Language." M.Sc. Thesis. 2018. http://thescholarship.ecu.edu/handle/10342/7032
- **Matthew C. Davis**. "A Student's Perspective of a Capstone Course**"** (Software Engineering Team Dynamics). 14th Annual CCSC Regional Conference. https://dl.acm.org/doi/10.5555/369274.369349

HONORS

Unit of the Year award, Boy Scouts of America (Council-level)
Various Division Cash Awards, Corning, Inc.
Corning Software Process Excellence Award
Lenoir-Rhyne University Junior Award
Lenoir-Rhyne University Man of the Year Award
Phi Beta Lambda State Leadership Conference
- State Award – 1st Place Website
- State Award – 1st Place Telecommunications

Phi Beta Lambda National Leadership Conference
- National Award – 2nd Place Website
- National Award – 2nd Place Computer Concepts
- National Award – 3rd Place Emerging Business Issues

MENTORING

Undergraduate Mentees
- Amy Wei (University of Michigan) (2023-2024)
- Sangheon Choi (Rose Hulman Institute of Technology) (2022-2023)

TEACHING

17-950: Crafting Software (CMU) (2024)
Head TA. Doctoral-level course intended for non-CS PhD students such as mechanical and chemical engineers. Primarily led by discussion and whiteboard. Formalized course content by building outlines and content for each lecture. Designed and delivered new lectures on complex topics such as testing. Designed new homework assignments and a new property-based testing unit. **https://cmu-crafting-software.github.io/**

17-214/514: Principles of Software Construction (CMU) (2023)
Head TA. Graduate/Undergraduate-level course. Seven sections, >100 students, two instructors (Dr. Jonathan Aldrich and Dr. Bogdan Vasilescu). Designed and gave lectures, lead grading, managed 13 TAs. https://cmu-17-214.github.io/s2023/

INVITED TALKS AND PANELS
- "What's (Not) Working in Programmer User Studies?" ICSE (2024)
- "NaNofuzz to TestLoop: Empirical to Theoretical Research" UCSC (2024)
- "TestLoop: A Process Model of Test Suite Generation" PLATEAU (2024)
- "NaNofuzz: A Usable Tool for Automatic Test Generation" FSE (2023)
- "Academia vs. Industry" Seminar Talk (2023)
- Invited Panel: NSF CSGrad4US (2023)

SUPPORTING GRANTS AND AWARDS
- NSF Grants 191026, 2150217, and 2339775 (2021-2024)
- CyLab Seed Funding: Usable Test Generation for Security (2023-2024)

SERVICE

- Student Organizer, PLATEAU (2023-2024)
- Elected Student Representative to Department Faculty Meeting (2023-2025)
- Appointed Student Representative to Department Marketing Mtg (2022-2023)

EXPERIENCE

Carnegie Mellon University School of Computer Science

PhD Student, Accelerated Testing Research Program, Program Lead (2021-2026)

Under the advisement of Dr. Brad A. Myers and Dr. Joshua Sunshine, my research program creates novel interventions that improve the human ability to test complex software. The NaNofuzz project provides a platform for the program's empirical testing research. The TestLoop project provides theoretical frameworks informed by empirical data that help tool designers identify ways to increase the productivity and satisfaction of software engineers using testing tools. The PURSE project identifies ways to human experiments of software engineers. This program is featured at top venues such as TOSEM, ICSE, and FSE. https://github.com/nanofuzz/

DEFCON Generative AI Red Team / AI Village, Student Volunteer (2023-2024)

Assisted with the operations of the AI Village's Generative AI Red Teaming competition. This competition was featured in major news outlets and was an extremely popular event at DEFCON 31. https://aivillage.org/

IRIS Lunar Rover, Mission Control Operator (2022-2024)

Iris Lunar Rover was successfully launched into space aboard a Vulcan Centaur rocket on January 8, 2024. During this student-led project, I served in various roles as, e.g., Telemetry Operator, Communications Officer, Lunar Cartographer, and Science Officer. https://irislunarrover.space/

Penrose, Software Engineering Researcher (2021-2023)

Contributed improvements and fixes to the Penrose diagram tool. Led redesign of the Penrose web renderer and implemented a research-focused semantic debugger. https://penrose.cs.cmu.edu/

Shurtape Technologies, LLC

Director, Global Technology Infrastructure and Operations (2014-2021)

Deliver "always on" global business-critical software systems including app stack, databases, network, datacenter, compute, storage, security, endpoints, and helpdesk.

- Operate two datacenters: compute, storage, network, power, cooling, DR, IAM, security.
- Operate global business critical software systems in a 24x7 high-availability landscape
- Manage full life-cycle end-user services: helpdesk, field services, reverse logistics, app and desktop virtualization, PCs, Macs, printers, phones, mobile devices, policies, etc.
- Manage global network encompassing facilities on three continents including wireless, LAN, WAN, SD-WAN, NAC, security, and a private SMF metro fiber ring.
- Responsible for roadmaps, strategy, budget, and leading change across the environment. A cost-conscious leader, I seek smart long-term opportunities to streamline operations, improve reliability and performance, and direct investment to high-value priorities.
- Manage strategic vendor relationships including contracts and negotiations, ensuring accountability and remediation, setting and managing budget and timelines.
- Deliver executive communications informally and in formal settings with meaningful messages in everyday language. Frequently regarded as a "top speaker" by executives.

Exhibited key traits necessary in this role: flexibility, persistence, persuasion, partnership, professionalism, long-range planning, candor, and a persistent positive attitude

Director, Network and Data Center (2012-2014)

Same as above minus end user services and SAP basis operations.

Manager, E-Commerce (2009-2012)

Hired to solve a difficult problem for the CEO and CIO: the company planned to purchase a large carve-out divestiture of a global CPG company. This would require integrating numerous challenging retailers, vendors, and 3PLs -- in short order and in concert with an ERP migration. Both knew the existing in-house technoloy and team were not up to the challenge.

The team I built engineered a new software stack using a combination of off-the-shelf and custom software to integrated Wal-Mart, Target, Lowe's, carriers, vendors, 3PLs, and many other leading retailers. This coincided with a back-end ERP change and a net decrease in headcount without issues.

The company has successfully expanded its business using this platform and team for the last ten years.

Corning, Inc.

Supply Chain Applications Technical Lead (2004-2009)

Full-cycle SAP implementation core team experience at a global Fortune 500 company

- Led dev team implementing SAP Product Configuration, including full EDI integration
- Led dev team implementing re-designed integration solution for new SAP back-end
- Recruited, selected, evaluated, and managed contingent labor to augment internal staff
- Managed timelines, budgets, scope, and deliverables. Provided hands-on leadership
- Mentored team, advocated design, adapted, and maintained solution integrity
- Designed business processes, reports, interfaces, conversions, and subsystems
- Configured pricing, output, copy control, texts, credit, batch jobs, ports, and partners
- Provided support, training, troubleshooting, and maintenance for SAP and integrations
- By the post-go live stages, my role's scope expanded to include cross-module initiatives across North America encompassing any combination of SD, LE, MM, PP, WM, FI, and CO
- Worked closely to lead a team of on- and off-shore developers during this timeframe
- During this period, I was frequently writing and deploying code in Java, ABAP, COBOL, and CL with back-end databases including Oracle, MySQL, and DB2

Senior Applications Analyst (2002-2004)

- Led implementation of web-based product configurator
- Led software development team to build and successfully deploy configurable pricing engine using Java, Oracle, XML, JEP, Tomcat. This flexible and custom system had a long life and remained in active use long after I left Corning.
- Pricing engine included a novel, intuitive interface for product management to easily define pricing rules for complex, configurable products using a formula engine.
- Site lead for IT ISO 9001 implementation. Externally audited w/no site non-conformities.
- Provided support for Configurator, Pricing, EDI, ERP, and Cable Data Sheets systems.

Applications Analyst (2001-2002)

- Implemented consignment and vendor managed inventory software system projects with complex and demanding customers such as AT&T, Bell Canada, and Verizon.
- Configured and coded new functionality across multiple modules of ERP system
- Created XML schemas and XSLT transformations to present Cable Data Sheets to end-users in a familiar PDF format on the web using a Java-based Formatting Objects Processor. (emerging technology at the time)
- Implemented numerous new or enhanced integrations with Fortune 50 companies allowing automation of manual business processes such as consignment processing and order entry.
- Maintained, enhanced, and supported ERP software interfaces as part of a team.

Programmer (2000-2001)

I had not yet graduated from university and balanced full-time work with finishing my degree.

- Through hard work and methodical knowledge acquisition, successfully supported the business software system, implementing new functionality, and solving problems.
- Developed and maintained high-profile integrations into and out of the ERP system. (i.e., those with customers, suppliers, and financial institutions)

- Documented and improved existing processes. Created new processes as needed and drove process standardization and improvement within the team.

Information Technology Intern (1999-2000)

Worked as an IT intern while at university. This involved solving technology problems for several hundred people, including the CEO. During this time, I started an internal monthly technology news magazine that received positive feedback within the company, documented and improved our team processes, and trained new interns and co-ops. During this time, I received frequent recognition from users via the company's recognition program.

Lenoir-Rhyne University

Information Technology Intern (1998-1999)

While at University, I worked in the IT department. My duties were helping people who called the help desk, maintaining PC inventory, and updating the University website. One of my early tasks was putting the academic catalog online for the first time since I had web experience.

SBC Development

Independent Software Developer (1994-1999)

During High School and University, I developed software systems and utilities. Some were freeware, some were shareware, and others were published via BMT Micro in Wilmington, NC. Software included:

- McList (a mailing list processor reviewed favorably by c't magazine in 1997)
- stree (ranked #8 best online utility by a Japanese-language IDG publication in 1999)
- McD-CBV (popular call-back verifier for AdeptXBBS)
- Mail Center Professional (SMTP and POP3 mail server), etc.

People and organizations around the world used this software, and I enjoyed working with and supporting them. My largest customer was a Canadian government agency, the Ontario Ministry of Housing, which used the McList system to distribute building code proposals and changes to a large base of stakeholders and constituents.