

Sam Adam-Day *(he/him)*

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AI safety and mathematics researcher with over 20 years of programming experience

RESEARCH EXPERIENCE

- Neural Interactive Proofs**, collaborative research project 2023–
- Devised games played by neural networks of different strengths, motivated by AI safety.
 - Built large, well-documented and tested codebase for multi-agent reinforcement learning.
 - Applied game-theoretic techniques to provide guarantees on agent behaviour.
 - Produced joint first-author paper, and presented at ICML and NeurIPS 2024 workshops.
 - Funded by Long Term Future Fund and OpenAI Superalignment grants.
- Postdoctoral Research Assistant**, Department of Computer Science, University of Oxford 2023–2024
- Theoretical investigation of the expressive power of graph neural networks.
 - Advised PhD student on mathematical aspects of their research project.
 - Helped supervise Ukrainian undergrad students with project on learning with constraints.
 - Demonstrated asymptotic convergence laws for a wide class of architectures.
 - First-author conference papers in published in NeurIPS 2023 and 2024.
- Causal alignment in transformer models**, ML Alignment & Theory Scholars programme 2023
- Investigated procedure for testing hypotheses in mechanistic interpretability.
 - Produced codebase for automated experimentation using TransformerLens.
- Team lead**, OxAI Safety Hub Labs internship 2022
- Research internship performing active learning using large language models.
 - Lead team of investigators, managing upskilling and development process.
 - Contributed over 10,000 lines of Python code, and ran over 500 GPU experiments.
- PhD Research**, Institute of Mathematics, University of Oxford 2019–2023
- Resolved 2004 open problem in geometric group theory using set-theoretic techniques.
 - Spearheaded project investigating asymptotic behaviour of graph neural networks.
- MSc Research**, University of Amsterdam 2017–2019
- Devised novel techniques combining logic, geometry and combinatorics.

EDUCATION

- DPhil in Mathematics, University of Oxford** 2019–2023
Branchwise-real trees and bisimulations of potentialist systems
- MSc Master of Logic, University of Amsterdam** 2017–2019
Cum Laude; GPA: 9.1/10
- MMath Master of Mathematics, University of Oxford** 2012–2016
Master's part: First Class 92%; top in year.
Bachelor's part: First Class 83%.

PUBLICATIONS

Neural Interactive Proofs , Hammond and Adam-Day (<i>equal contribution</i>), <i>Preprint</i> , <i>Presented as a workshop paper in ICML 2024 and NeurIPS 2024</i>	2024
Almost Surely Asymptotically Constant Graph Neural Networks , Adam-Day, Benedikt, Ceylan and Finkelshtein, <i>NeurIPS 2024</i> , arXiv:2403.03880	2024
Zero-One Laws of Graph Neural Networks , Adam-Day, Iliant and Ceylan, <i>NeurIPS 2023</i> , arXiv:2301.13060	2023
The Intermediate Logic of Convex Polyhedra , Adam-Day, Bezhanishvili, Gabelaia, and Marra, <i>Preprint submitted to the Annals of Pure and Applied Logic</i> , arXiv:2307.16600	2023
On the continuous gradability of the cut-point orders of R-trees , Adam-Day, <i>Topology and its Applications</i> , doi:10.1016/j.topol.2021.107937	2022
Uniform, rigid branchwise-real trees , Adam-Day, <i>to appear in the Israel Journal of Mathe- matics</i> , arXiv:2206.15344	2022
Polyhedral completeness of intermediate logics: the Nerve Criterion , Adam-Day, Bezhan- ishvili, Gabelaia and Marra, <i>The Journal of Symbolic Logic</i> , doi:10.1017/jsl.2022.76	2022
Bisimulations of potentialist systems , Adam-Day, <i>preprint submitted to The Journal of Sym- bolic Logic</i> , arXiv:2206.10359	2022

OTHER EXPERIENCE

Academic talks presented

- “Almost Surely Asymptotically Constant Graph Neural Networks”, *Oxford Logic Advanced Class*, November 2024.
- “Asymptotically useless? The outputs of these GNNs converge to a constant function”, *Oxford Learning on Graphs seminar*, October 2024.
- “Zero-One Laws of Graph Neural Networks”, *NeurIPS poster session*, December 2023.
- “Prover-Verifier Games”, *Oxford AI Safety WIP Sessions*, June 2023.
- “Polyhedral Completeness of Intermediate and Modal Logics”, *Logic Algebra and Truth Degrees*, September 2022.
- “Uniform, rigid branchwise-real tree orders”, *European Set Theory Conference*, August 2022.

Academic events co-organised

- Oxford AI Safety Work-In-Progress Sessions, a bi-weekly research seminar. 2023.
- British Postgraduate Model Theory Conference, University of Oxford, April 2021.
- Oxford Set Theory Seminar series. 2020–2021.
- Set Theory in the UK 4, University of Oxford, December 2019.

Web developer and server administrator , self-employed	2010–
<ul style="list-style-type: none">• Developed websites in Python and PHP, working directly with clients.• Examples: tunelines.com and alevelnotes.com.• Maintained and secured websites receiving 1,000,000s of monthly visitors.	