Sam Adam-Day *(he/him)*

Email: **me@samdamday.com** Tel: **+447532312659** **samadamday.com** GitHub: **SamAdamDay**

Machine learning and mathematics researcher with over 19 years of programming experience

RESEARCH EXPERIENCE

Postdoctoral Research Assistant, Department of Computer Science, University of Oxford 2023–

- Theoretical investigation of the expressive power of graph neural networks.
- Advising 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 paper in preparation.

Prover-verifier games, 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.
- Joint first-author conference paper in preparation.

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

Zero-One Laws of Graph Neural Networks, Adam-Day, Iliant and Ceylan, *Proceedings of the 37th Annual Conference on Neural Information Processing Systems (NeurIPS) 2023*, arXiv:2301.13060 — 2023

The Intermediate Logic of Convex Polyhedra, Adam-Day, Bezhanishvili, Gabelaia, and Marra, *Prepreint submitted to the Annals of Pure and Applied Logic*, arXiv:2307.16600 — 2023

On the continuous gradability of the cut-point orders of R-trees, Adam-Day, *Topology and its Applications*, doi:10.1016/j.topol.2021.107937 — 2022

Uniform, rigid branchwise-real trees, Adam-Day, *to appear in the Israel Journal of Mathematics*, arXiv:2206.15344 — 2022

Polyhedral completeness of intermediate logics: the Nerve Criterion, Adam-Day, Bezhanishvili, Gabelaia and Marra, *The Journal of Symbolic Logic*, doi:10.1017/jsl.2022.76 — 2022

Bisimulations of potentialist systems, Adam-Day, *preprint submitted to The Journal of Symbolic Logic*, arXiv:2206.10359 — 2022

OTHER EXPERIENCE

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, 30th April 2021.
- Oxford Set Theory Seminar series. 2020–2021.
- Set Theory in the UK 4, University of Oxford, 14th December 2019.

Academic talks presented

- "Zero-One Laws of Graph Neural Networks", *NeurIPS poster session*, 13th December 2023.
- "Prover-Verifier Games", *Oxford AI Safety WIP Sessions*, 16th June 2023.
- "Polyhedral Completeness of Intermediate and Modal Logics", *Logic Algebra and Truth Degrees*, 5th September 2022.
- "Uniform, rigid branchwise-real tree orders", *European Set Theory Conference*, 29th August 2022.
- "Rigid branchwise-real tree orders", *Oxford Logic Advanced Class*, 28th October 2021.
- "Rigid branchwise-real tree orders", *Leeds Models and Sets seminar*, 13th October 2021.
- "The continuous gradability of the cut-point orders of $\mathbb{R}$-trees", *Oxford Set Theory Seminar*, 19th May 2021.
- "From R-trees to well-founded trees (and back)", *Logic Advanced Class, University of Oxford*, 28th January 2021.

Web developer and server administrator, self-employed — 2010–

- 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.