Emma Lucia Byrnes Finn

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Education

Harvard University Cambridge, MA
A.B, Mathematics and Classics, GPA 3.96/4.00. May 2026
Concurrent A.M, Statistics, GPA 4.00/4.00. Graduate coursework includes: Probability I & II (STAT 210, 212)
Honors Thesis in Mathematics: *Mathematical Foundations of Interpretable Diffusion*, in preparation
Advisors: Mark Selke and Kevin Yang
Honors Thesis in Classics: *Quantifying the Past: Empirical Tropes in Greek Historiography,* in preparation
Advisors: Emily Greenwood

Phillips Exeter Academy Exeter, NH
Classical Diploma with highest honors. Graduated 2nd in class of 330 students. GPA 10.96/11.00 May 2022

Honors and Awards

Best Poster Award, Kranium Summer Research Program August 2024
Kempner Institute at Harvard University

Kempner Institute Research Fellowship May 2024 – May 2025
Kempner Institute at Harvard University, selected for Summer 2024, Fall 2024, and Spring 2025 Kempner Institute research cohort on the basis of original research proposals

John Harvard Scholar September 2023 – September 2024
Harvard University, awarded to the top 5% of the class by GPA

Coolidge Scholar June 2021 – May 2026
Calvin Coolidge Presidential Foundation, awarded a four-year, full-ride merit-based scholarship to any US college

Publications and Manuscripts

Finn, E., Keller T. A., Theodosis, M., Ba, D.E. *Origins of Creativity in Attention-Based Diffusion Models.* 3rd ICML Workshop on High-dimensional Learning Dynamics (HiLD 2025), accepted.

Finn, E., Keller T. A., Theodosis, M., Ba, D.E. *Learning Artistic Signatures: Symmetry Discovery and Style Transfer*. arXiv:2412.04441, 2024.

Finn, E. Group-Theoretic Foundations of Rader's Fast Fourier Transform. Undergraduate junior paper, Harvard University, 2023. Unpublished manuscript.

M. Hartnett. *AGON: Introduction to Ancient Greek*. Edited by **E. Finn** and C. Preston. Phillips Exeter Academy, 2021.

Research and Work Experience

CRISP Lab Cambridge, MA
Undergraduate Researcher December 2023 – Present

- Developed a theoretical framework describing how self-attention mechanisms in diffusion models induce global image consistency, extending prior work on CNN-based inductive biases
- Designed a method to quantify stylistic similarity and investigate the origins of creativity in diffusion models via associate memory networks
- Engineered and trained equivariant and steerable neural networks for computer vision tasks including style transfer, classification, and continuous symmetry discovery

Federal Reserve Bank of St. Louis St. Louis, MO
Government Relations Intern May – August 2023

- Directed a project to analyze data from 300+ meetings with federal and state officials over four years using

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Microsoft Dynamics to identify underrepresented constituencies in the 8th district of the Federal Reserve

Teaching Experience

Harvard Statistics Department Cambridge, MA
Course Assistant September 2024 – Present

- Courses: STAT 110 (Intro to Probability, Fall 2024), STAT 111 (Intro to Statistical Inference, Spring 2025) and STAT 210 (Graduate Probability I, Fall 2025)
- Achieved score of 4.95/5 across student evaluation metrics, including effectiveness and engagement
- Wrote original review materials for weekly sections to reinforce core concepts in probability and statistical inference, including limit theorems and MCMC methods as well as hypothesis testing and linear regression

Harvard Math Department Cambridge, MA
Course Assistant August 2023 – May 2024

- Facilitated teaching of multivariable calculus (Fall 2023) and linear algebra (Spring 2024) to undergraduate students
- Led student workshops to illustrate applications of course material, hosted office hours, and graded homework

Presentations and Leadership

Kemner Institute Lunch and Learn Series Cambridge, MA
Organizer and Presenter September 2024 – Present

- Coordinated weekly forum for undergraduate and graduate researchers to share and discuss current work in theoretical neuroscience and machine learning. Led undergraduate outreach and helped to prepare speakers
- Delivered three invited talks: *Intro to Equivariant Neural Networks, A Primer on Diffusion Models,* and *Attention and Creativity in Generative Diffusion*

Boston Symmetry Day Cambridge, MA
Poster Session Participant March 2025

- Presented Learning Artistic Signatures: Symmetry Discovery and Style Transfer, in which I proposed and validated a quantitative definition of artistic style

Programs and Workshops

Mathematics and Machine Learning Program Cambridge, MA
Workshop Participant September – November 2024

- Selected to attend a program at the Center of Mathematical Sciences and Applications at Harvard focused on applications of ML to open mathematical problems in knot theory, number theory, graph theory, and PDEs

Harvard Math Department Cambridge, MA
Directed Reading Program Participant January – December 2024

- [Fall 2024] Performed an independent study of stochastic branching processes with a graduate student mentor and presented my findings, focusing on immigration and age-dependence in branching processes
- [Spring 2024] Worked through a graduate-level algebraic graph theory textbook with a grad student mentor and presented on combinatorial optimization algorithms to the Harvard math community

Skills & Interests

Technical: Python (Pytorch), R, HTML, SQL
Interests: Ancient Greek, Art History, Distance Running, Bread Baking