# LUCY LAI

lucylai@g.harvard.edu
github.com/lucylai96
lucy-lai.com

## EDUCATION

**HARVARD UNIVERSITY**, CAMBRIDGE, MA 2018 –
Ph.D. in Neuroscience
Teaching Certificate, Derek Bok Center for Teaching and Learning

**RICE UNIVERSITY**, HOUSTON, TX 2014 – 2018
B.A. in Cognitive Sciences with Honors
Minors in Neuroscience, Computational and Applied Mathematics
Distinction in Research and Creative Work, Thesis: *Multisensory context warps time perception*

**Center for Brains, Minds, and Machines (CBMM) Summer School**, MBL, Woods Hole, MA AUG 2019
**NSAS Computational Psychiatry Summer School**, Venice, Italy JUN 2022

## RESEARCH

**HARVARD UNIVERSITY**, CAMBRIDGE, MA JUN 2019 –
*Department of Psychology and Center for Brain Science*
Advisor: Samuel Gershman

- Developing and empirically testing the theory of **policy compression**: a resource-rational model of action selection with applications to decision-making behavior and computational psychiatry.

**UNIVERSITY COLLEGE LONDON**, LONDON, UK JUN 2022 –
*Max Planck UCL Centre for Computational Psychiatry and Ageing Research*
Advisors: Quentin Huys and Tobias Hauser

- Developing a computational account of egodystonia in action compulsivity.

**MARINE BIOLOGICAL LABORATORY**, WOODS HOLE, MA AUG 2019
*Center for Brains, Minds, and Machines (CBMM) Summer School*

- Investigated the emergence of representational specificity during continual learning in CNNs.

**BAYLOR COLLEGE OF MEDICINE**, HOUSTON, TX JAN 2015 – JUN 2018
*Department of Neuroscience*
Advisor: Jeffrey Yau

- Developed Bayesian inference models and designed behavioral experiments to understand how context influences time perception across the senses.

## PUBLICATIONS

**Lai, L.***, Huang, ZX*, Gershman, SJ. (in prep). Action chunking as policy compression.

Gershman, SJ., **Lai, L**. (2021). The reward-complexity trade-off in schizophrenia. *Computational Psychiatry.*

**Lai, L.**, Gershman, SJ. (2021). Policy compression: an information bottleneck in action selection. *Psychology of Learning and Motivation, Volume 74.*

Bhui, R., **Lai, L**., Gershman, SJ. (2021). Resource-rational decision making. *Current Opinion in Behavioral Sciences.*

Mikhael, JG, **Lai, L.,** Gershman, SJ. (2021). Rational inattention and tonic dopamine. *PLOS Computational Biology.*

**Lai, L.**, Magnotti, JF., Yau, JM. (in prep). Conditioned inference explains multisensory time distortions.

**Lai, L.,** Magnotti, JF., Yau, JM. (2017). Multisensory context warps time perception. *Conference on Cognitive Computational Neuroscience.*

## AWARDS &HONORS

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|---|---|
| HMS Department of Neurobiology Service Award (awarded for DEIJ efforts) | 2022 |
| Harvey Fellowship ($16k/year) | 2022 – 2025 |
| MAHPING Pedagogy Fellowship | 2022 |
| Harvard University Certificate of Distinction in Teaching | 2021, 2022 |
| Harvard Mind, Brain, Behavior (MBB) Graduate Student Award ($8560) | 2021 |
| National Science Foundation Graduate Research Fellowship | 2018 – 2021 |
| Phi Beta Kappa National Honor Society | 2018 |
| Rice University Student-Taught Course (STC) Teaching Award | 2017 |
| Cognitive Computational Neuroscience student travel award | 2017 |
| Janelia Undergraduate Scholars Program Fellowship | 2017 |
| Barry M. Goldwater Scholarship honorable mention | 2017 |
| Center for Sensorimotor Neural Engineering (CSNE) NSF-REU Fellowship | 2016 |
| Computational and Systems Neuroscience (Cosyne) undergraduate travel award | 2016 |
| Rice Undergraduate Scholars Program thesis grant | 2016 – 2018 |

## INVITED TALKS

**Shahar Lab Computational Seminar**, Tel Aviv University, Tel Aviv, Israel — NOV 2022
Policy compression and psychiatric disease

**RLDM Workshop: Maps in reinforcement learning**, Brown University, Providence, RI — JUN 2022
Policy compression: an information bottleneck in action selection

**FriSem**, **Dept. of Psychology**, Stanford University, Stanford, CA — MAY 2022
Policy compression: an information bottleneck in action selection

**Otto Lab Meeting**, McGill University, Providence, RI — NOV 2021
Action chunking as policy compression

**Gold Lab Meeting**, University of Maryland School of Medicine, Baltimore, MD — OCT 2021
Action chunking as policy compression

**RL Super Lab (Akrami, Botvinick, Gershman, Hermundstad, Paton, Pehlevan, Pouget)** OCT 2021
Action chunking as policy compression

**Shenhav Lab Meeting**, Brown University, Providence, RI — OCT 2021
Action chunking as policy compression

**From Neuroscience to Artificially Intelligent Systems (NAISys)**, CSHL, NY — NOV 2020
A computational division of labor for motor skill learning

**Computational Principles of Intelligence Lab**, MPI Tübingen, Germany — SEP 2020
The reward-complexity tradeoff explains habit formation in free-operant conditioning

## CONFERENCE ABSTRACTS

**Lai, L.**, Gershman, SJ. Policy compression: an information bottleneck in action selection.
*Reward and Decision Making 2022, Lake Arrowhead, CA.*

**Lai, L.**, Dudman, JT. Neural correlates of action kinematics in the dorsal striatum.
*Janelia Undergraduate Scholars Symposium 2017, Ashburn, VA.*

**Lai, L.**, Magnotti, JF., Yau, JM. Contextual determinants of cue binding or separation in multisensory time perception*. International Multisensory Research Forum (IMRF) 2017, Nashville, TN.*

**Lai, L.**, Yau, JM. Attractive and repulsive multisensory interactions in time perception.
*Society for Neuroscience (SfN) 2016, San Diego, CA.*

**Lai, L.**, Jazayeri, M. Characterizing variability in memory recall of time intervals.
*Center for Sensorimotor Neural Engineering (CSNE) REU Symposium 2016, Seattle, WA.*

## TEACHING

### Course Development & Instructor of Record

Courses that I have designed (curriculum, problem sets, etc.) and taught.

**FROM BENCH TO BEDTIME: ENTRAINING POLICY TO SCIENCE** F2022

*Morehouse School of Medicine & Harvard Medical School*

- Co-designing a 3-day nanocourse with 6 other graduate students as a part of the MAHPING (Morehouse and Harvard Partnering in Neuroscience Growth) Pedagogy Fellows program.
- Course taught at both Morehouse and Harvard in Fall 2022.

**NB314QC / NB212: MATH TOOLS FOR NEUROSCIENCE** JAN 2020, F 2020

*Department of Neurobiology, Harvard Medical School*

- Designed and taught a new J-term course for the Neuroscience Ph.D. program curriculum. Topics include fundamentals of linear algebra, probability theory, statistical estimation and inference in neural circuits, and analysis of neural population data.
- Converted to a full-semester curriculum and added as the foundational course for the Certificate in Computational Neuroscience (F2020).

**COLL158: HOW MUSIC PLAYS THE BRAIN** S 2017, F 2017, S 2018

*Rice University*

- Designed and taught a seminar course on the intersection of music and neuroscience. Topics include the neurobiology of music perception and cognition, music therapy, AI and music, etc. Recipient of the 2017 Rice Student-Taught Course Award!

### Teaching Support

Designed / graded problem sets, taught discussion sections, proctored exams, and managed a teaching team.

**TEACHING FELLOW**, *Harvard University*

- Teaching 100: The Theory and Science of Teaching F 2022
- GenEd1125: Artificial and Natural Intelligence (Head TF) S 2021, S 2022

  As Head TF (2022), I developed course materials from scratch (all psets and the section curriculum), gave occasional guest lectures, and managed a teaching team of 5 TFs for a course of ~100 students. Both years I also taught my own discussion section of 15-20 students.
- NB212: Math Tools for Neuroscience F 2020
- NB306QC: Quantitative Methods for Biologists AUG 2020
- NB316QC: Probabilistic Modeling of Neural Data S 2020

**TEACHING ASSISTANT**, *COSYNE Conference Workshop on Bayesian Modeling* MAR 2019

**TEACHING ASSISTANT**, *Rice University*

- NEUR/PSYC 362: Cognitive Neuroscience S 2016, S 2017, S 2018
- NEUR/CAAM 416: Neural Computation S 2018
- NEUR/BIOC 385: Cellular and Molecular Neuroscience F 2016
- STAT 310: Probability and Statistics F 2016
- PSYC 203: Cognitive Psychology F 2015

## OUTREACH &SERVICE

### STEM Outreach

Teaching & mentoring local high school students, often from underserved and underrepresented backgrounds.

**SciTalks,** Manchester Essex Regional High School & Manchester Neuroscience Society 2021

**HPREP Teaching and Mentoring Team**, Harvard Medical School 2018 – 2021

**BrainSTEM**, KIPP Sunnyside High School, Houston, TX 2015 – 2017

**Splash**, Rice University 2017

### Diversity and Inclusion

Active efforts to promote diversity, equity, and inclusion within an academic setting.

**Founder and Co-Organizer, "Listening Lab" Forum**, Harvard Dept. of Neurobiology 2020 –

**Committee on Diversity and Inclusion**, Harvard Dept. of Neurobiology 2020 –

**Growing Up in Science Global Network** 2018 –

**Harvard Graduate Women in Science and Engineering (HGWISE)**, Harvard University 2018 – 2020

### Academic Mentoring

Advising students in academic matters such as curriculum & career planning, graduate school & fellowship applications, and finding research & internship opportunities.

**Resident Tutor**, Quincy House, Harvard University 2021 –

- The resident tutor role is akin to a traditional resident assistent (RA) role with the added responsibilities of formal academic advising and student social and emotional support. Tutors live with Harvard College students and play a vital role in the residential and educational life of undergraduates.
- Examples of yearly events that I host: *"Design Your Life", "So you wanna go to grad school?"*

**Mind, Brain, Behavior (MBB) Graduate Student Mentor**, Harvard University 2019 –

**Alumni Externship Advisor**, Rice University 2018 –

**Head Academic Fellow**, Lovett College, Rice University 2016 – 2018

### Research Mentoring

Advised the following students on independent research projects.

**Jennifer Guo**, Harvard Undergraduate Student 2022 –

**Ann Huang**, McGill University Undergraduate Summer Intern 2021 – 2022

**Lily Zheng**, Harvard Neuroscience Rotation Student 2021

**Varshini Subramanian**, Thomas Jefferson High School Student (Now at CMU) 2020 – 2021

**Danielah Samson**, HPREP, Boston Latin Academy High School Student 2020 – 2021

**Emma Rogge**, Harvard Undergraduate Student 2020

### Peer Reviewing

**NeurIPS Biological and Artificial Reinforcement Learning Workshop**

**Cognitive Science Society**

**PLOS Computational Biology**

### Other

**Organizer, Cambridge Graduate Roundtable on Science and Religion** 2021 –

**Conference Organizer**, Exploring the Mind through Music Conference, Rice University 2016

## SKILLS &OTHER

**Languages:** English (native), Mandarin Chinese (limited working proficiency)

**Programming:** Python, MATLAB, Javascript, HTML/CSS, PyTorch, Tensorflow

**Interests:** classical music, poetry, theology, philosophy of science and religion, running, coffee