

# LUCY LAI

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**EDUCATION** | HARVARD UNIVERSITY, CAMBRIDGE, MA 2018 – 2024  
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

**RESEARCH** | HARVARD UNIVERSITY, CAMBRIDGE, MA JUN 2019 – MAY 2024  
*Department of Psychology and Center for Brain Science*

Advisor: Samuel Gershman

- Developed a theory of **policy compression**: a resource-rational model of decision making under cognitive constraints.
- Designed and implemented behavioral experiments using js.Psych and Amazon MTurk to test novel predictions resulting from our models.
- Collected and analyzed data from over 2,000 human subjects over 5 projects. Performed quantitative model comparison to adjudicate between cognitive models.

OKINAWA INSTITUTE OF SCIENCE AND TECHNOLOGY, OKINAWA, JP SEP 2023 –  
Advisors: Gail Tripp and Kenji Doya

- TSVP Visiting Scholar in the Human Neurobiology Unit and the Neural Computation Unit
- Building models of reward learning to engineer behavioral shaping interventions for children with attention-deficit/hyperactivity disorder (ADHD)

UNIVERSITY COLLEGE LONDON, LONDON, UK JUN 2022 – AUG 2022  
*Max Planck UCL Centre for Computational Psychiatry and Ageing Research*

Advisors: Quentin Huys and Tobias Hauser

- Developed a computational theory of egodystonia and designed behavioral experiments to test model predictions in a sample population with a range of obsessive-compulsive traits.

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.

## SUMMER SCHOOLS & INTERNSHIPS

NSAS Computational Psychiatry Summer School, Venice, Italy JUN 2022

Center for Brains, Minds, and Machines (CBMM) Summer School, Woods Hole, MA AUG 2019

HHMI Janelia Undergraduate Scholars Program, Ashburn, VA JUN – AUG 2017

Center for Sensorimotor Neural Engineering NSF-REU @ MIT, Cambridge, MA JUN – AUG 2016

**PUBLICATIONS** | Liu, S. Lai, L., Gershman, S.J. Bari, BA. (submitted). Time and memory costs jointly determine a speed-accuracy trade-off and set-size effects.

Lai, L., Gershman, S.J. (2024). [Human decision making balances reward maximization and policy compression](#). *PLOS Computational Biology*.

Lai, L.\*, Huang, AZX.\*, Gershman, S.J. (under review). [Action chunking as policy compression](#).

Gershman, S.J., Lai, L. (2021). [The reward-complexity trade-off in schizophrenia](#). *Computational Psychiatry*.

- Lai, L., Gershman, S.J. (2021). [Policy compression: an information bottleneck in action selection](#). *Psychology of Learning and Motivation, Volume 74*.
- Bhui, R., Lai, L., Gershman, S.J. (2021). [Resource-rational decision making](#). *Current Opinion in Behavioral Sciences*.
- Mikhael, JG., Lai, L., Gershman, S.J. (2021). [Rational inattention and tonic dopamine](#). *PLOS Computational Biology*.
- Lai, L., Magnotti, JF., Yau, JM. (2017). [Multisensory context warps time perception](#). *Conference on Cognitive Computational Neuroscience*.

## AWARDS & HONORS

HMS Department of Neurobiology Service Award (awarded for DEIJ efforts)	2022
Harvey Fellowship (\$16k/year)	2022 – 2024
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
Barry M. Goldwater Scholarship honorable mention	2017
Computational and Systems Neuroscience (Cosyne) undergraduate travel award	2016
Rice Undergraduate Scholars Program thesis grant	2016 – 2018

## INVITED TALKS

Mathematics of Neuroscience and AI, Rome, Italy	MAY 2024
Theoretical Sciences Visiting Program Seminar, OIST, Okinawa, Japan	JAN 2024
Neural Computation Unit, OIST, Okinawa, Japan	SEP 2023
Harvey Fellows 30 <sup>th</sup> Reunion, American University, Washington, DC	JUN 2023
Shahar Computational Seminar, Tel Aviv University, Tel Aviv, Israel	NOV 2022
RLDM Workshop: Maps in reinforcement learning, Brown University, Providence, RI	JUN 2022
FriSem, Dept. of Psychology, Stanford University, Stanford, CA	MAY 2022
Otto Lab, McGill University, Providence, RI	NOV 2021
Gold Lab, University of Maryland School of Medicine, Baltimore, MD	OCT 2021
RL Super Lab (Akrami, Botvinick, Gershman, Hermundstad, Paton, Pehlevan, Pouget)	OCT 2021
Shenhav Lab, Brown University, Providence, RI	OCT 2021
From Neuroscience to Artificially Intelligent Systems (NAISys), CSHL, NY	NOV 2020
Computational Principles of Intelligence Lab, MPI Tübingen, Germany	SEP 2020

## CONFERENCE ABSTRACTS

- Lai, L., Bhatia, C., Hardcastle, K., Mizes, K., Ölveczky, BP., Gershman, S.J. Policy regularization enables robustness and flexibility in motor sequence learning. *Mathematics of Neuroscience and AI 2024, Rome, Italy*
- Lai, L., Gershman, S.J. 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.

### COGS180: DECISION MAKING IN THE BRAIN

Su 2024

*Department of Cognitive Science, University of California, San Diego*

- o Designed an interdisciplinary course that aims to unravel the complexities behind human decision making by integrating insights from psychology, economics, neuroscience, design, and machine learning. This upper-division course explores a range of topics from the cognitive biases and heuristics that shape everyday decisions, to how decision making is impaired in various psychiatric disorders.

### FROM BENCH TO BEDTIME: ENTRAINING POLICY TO SCIENCE

F 2022

*Morehouse School of Medicine & Harvard Medical School*

- o 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](#).
- o 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*

- o 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.
- o 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*

- o 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 Teaching Award!

### Teaching Support

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

### TEACHING FELLOW, *Harvard University*

- o Teaching 100: The Theory and Science of Teaching F 2022
- o 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 discussion 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 section of 15-20 students.
- o NB212: Math Tools for Neuroscience F 2020
- o NB306QC: Quantitative Methods for Biologists AUG 2020
- o NB316QC: Probabilistic Modeling of Neural Data S 2020

### TEACHING ASSISTANT, *Rice University*

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

### MISC.

- o Okinawa/OIST Computational Neuroscience Course (OCNC) Summer School JUN 2024
- o COSYNE Conference Workshop on Bayesian Modeling MAR 2019

## OUTREACH &SERVICE

### 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 – 2023

- The resident tutor role is akin to a traditional resident assistant (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 – 2023

**Alumni Externship Advisor, Rice University** 2018 – 2020

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

### Research Mentoring

Advised the following students on independent research projects.

**Sidd Tiwari, Harvard Undergraduate Student** 2022

**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

### 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

**Growing Up in Science Global Series Organizer** 2023 –

**Founder and Co-Organizer, "Listening Lab" Forum, Harvard Dept. of Neurobiology** 2020 – 2022

**Committee on Diversity and Inclusion, Harvard Dept. of Neurobiology** 2020 – 2022

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

### Peer Reviewing

NeurIPS Biological and Artificial Reinforcement Learning Workshop

Cognitive Science Society

PLOS Computational Biology

### Other

**Student Interviewer, Harvard PhD Program in Neuroscience Admissions** 2022, 2023

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

## SKILLS &OTHER

**Languages:** English (native), Mandarin Chinese (native), Japanese (beginner)

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

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