Jessica Mollick, PhD

Department of Psychiatry
Clinical and Affective Neuroscience Lab
Yale University School of Medicine
1 Church St, Suite 701

New Haven, CT 06510
Phone: 425 442 7546
Email: Jessica.Mollick@yale.edu
Website: https://jmol048.github.io/

Current Position
Postdoctoral Associate, Department of Psychiatry, Yale University, School of Medicine (2018-present)
Mentor: Hedy Kober, Ph. D

Research Interests:
I am looking for a career applying my understanding the neuroscience of decision-making and reinforcement learning to understand how complex systems in the brain contribute to these behaviors. In my research, I have examined how brain systems contribute to the encoding of prediction error, by conducting research examining the brain areas involving in negative prediction error signals, meta-analytic research examining how different brain areas respond to different aspects of prediction error, and computational modeling research with biologically based neural networks, and decision-making research in substance use disorders.

Education:
2011-2017: University of Colorado, Boulder
  (2017): Ph. D. Psychology, Ph. D. Neuroscience
  Thesis: *Neural and Computational Mechanisms of Reward and Aversion*
  (Advisors: Randall C. O'Reilly & Tor D. Wager)
2011: University of California, Berkeley
  B.A. (2011): Cognitive Science (3.9 GPA)

Publications:

Peer-reviewed publications**:**
Corlett, P.R.*, Mollick, J.A,*, Kober, H. *Meta-Analysis of Human Prediction Error for Incentives, Perception, Cognition, and Action*, Neuropsychopharmacology (2022) [link]
Herd, S.A., Krueger, K.A., Nair, A., **Mollick, J.A.** & O'Reilly, R.C. *Neural Mechanisms of Human Decision-Making*. Cognitive, Affective and Behavioral Neuroscience (2021) [link]
Mollick, J.A., Chang L., Krishnan, A., Hazy, T.E, Krueger, K, Frank, G, Wager, T.D, O'Reilly, R.C. *The neural correlates of cued reward omission*, Frontiers in Human Neuroscience (2021) [link]
Mollick, J.A., Kober, H. *Computational Models of Drug Use and Addiction: A Review*. Journal of Abnormal Psychology 129 (6), 544, (2020) [link]
Mollick, J.A., Hazy, T.E., Nair, A, Krueger, K., O'Reilly, R.C., *A systems-neuroscience model of phasic dopamine*. Psychological Review 127 (6), 972 (2020) [link]

In Revision:
Gadassi Polack, Reuma, **Mollick, J.A.**, Joorman, J., Watts, Richard. *Neural responses to reward valence and magnitude from pre- to early adolescence* (in revision)

In Preparation:
Mollick, J.A., Kober, H. *A Hierarchical Value-Based Decision-Making Model of Addiction*. (in prep)
Mollick, J.A.*, Brant, A.*, Friedman, N., O'Reilly, R.C., *Working memory: Looking at gating and maintenance with the keep-track task* (in prep)
Mollick, J.A., Malta. S., Corlett, Philip, Kober, H. *Meta-Analysis of Reward Prediction Error Signals in Substance Users* (in prep)

Preprints:

O'Reilly, R.C., Hazy, T.E., **Mollick, J.A.**, Mackie, P., Herd, S. *Goal-Driven Cognition in the Brain: A Computational Framework*. (2014) [link]

Corlett, P.R.*, Mollick, J.A,*, Kober, H. *Substrates of Human Prediction Error for Incentives, Perception, Cognition, and Action* (2021) [link]

Yousefzadeh, R*., **Mollick, J.A**.* *Extrapolation Frameworks in Cognitive Psychology Suitable for Study of Image Classification Models* (2021) [link]

Awards and Honors:
Travel Award, Oregon Decision Neuroscience Symposium (2019) $800
Summer Dissertation Fellowship, Graduate School, CU Boulder (2017) $6000

Abstracts and Presentations:

Conference Talks:
Mollick, J.A. & Kober, H (2019) A hierarchical value-based decision-making model of addiction. Oregon Decision Neuroscience Symposium (2019), Eugene, OR.
Mollick, J.A., Krishnan, A., Chang, L.J., Reynolds, J., Frank, G., Wager, T. D., O'Reilly, R.C., (2015) Brain mechanisms of worse than expected rewards. Nanosymposium Presentation, Annual Meeting of Society for Neuroscience (SfN'15), Chicago, IL. October 2015.

Invited Talks:
Mollick, J.A. (2022) Decision-making and value computations: applications to substance use disorders, Brown University
Mollick, J.A. (2021) The Neural Substrates of Human Prediction Error for Incentives, Perception, Cognition and Action. Appetitive Neuroimaging Seminar Series, Yale University
Mollick, J.A. (2017). Using a biologically-based computational model (PVLV) to interpret BOLD signals in the dopamine system. Yale University
Mollick J.A. (2016) Bivalent PVLV Model – controlling dopamine for reward and punishments, INRIA, University of Bordeaux, France.

Conference and workshop papers:
Yousefzadeh, R*., **Mollick, J.A**.* (2021) Extrapolation Frameworks in Cognitive Psychology Suitable for Study of Image Classification Models, Workshop on Human and Machine Decisions, NeurIPS, 2021 [link]
Mollick, J.A., Pauli, W.M., Chang, L.J, O'Reilly, R.C., Wager, T. D. (2017) The Neural Mechanisms of Worse than Expected Prediction Errors. The 3rd Multidisciplinary Conference on Reinforcement Learning and Decision Making. University of Michigan, Ann Arbor, MI [link]
Mollick, J.A, Malta, Stephanie, Phil Corlett, Kober, Hedy (2022) A Meta-Analysis of Reward Prediction Error Signals in Substance Users. The 5th Multidisciplinary Conference on Reinforcement Learning and Decision Making. Brown University, Providence, RI [link]

Poster presentations:

Presenting Author:
Mollick, J.A., Malta, Stephanie, Corlett, Philip, Kober H. (2022). Meta-Analysis of Reward Prediction Error Signals in Substance Users. Reinforcement Learning & Decision Making Conference, 2022
Mollick, J.A., Corlett, P.R, Kober H (2021) Neural Circuits of Human Prediction Error Computation Across Valences and Tasks, 2021. Organization for Computational Neuroscience, 2021
Mollick, J.A., Corlett, P.R, Kober J (2020) Meta-Analysis is Consistent with Dopaminergic Perceptual and Cognitive Prediction Errors. Biological Psychiatry, 2020
Mollick, J.A., Kober, H. (2019) A Hierarchical Value-Based Decision-Making Model of Addiction. The 4th Multidisciplinary Conference on Reinforcement Learning and Decision Making.
Mollick, J.A., Kober, H. (2019) A Hierarchical Value-Based Decision-Making Model of Addiction. Society for Affective Science (2019), Boston, MA.

Mollick, J.A., Hazy, T.E., Krueger, K., O'Reilly, R.C. (2018) Using a biologically based computational model (PVLV) to interpret BOLD signals in the dopamine system. Brooklyn, NY. The Social and Affective Neuroscience Society (SANS) 2018.

Mollick, J.A., O'Reilly, R.C., Wager, T. D. and Frank, G. (2012). Conditioned inhibition and the learning of negative values. Annual Meeting of Society for Neuroscience (SfN'12).

Mollick, J.A., Krishnan, A., Chang, L.J., Reynolds, J., Wager, T. D. and Frank, G., O'Reilly, R.C., (2013). Conditioned inhibition and the learning of negative values. Social and Affective Neuroscience 2013

Mollick, J.A., Brant, A., Friedman, N., O'Reilly, R.C. (2013) Working memory: Looking at gating and maintenance with the keep-track task Annual Meeting of Society for Neuroscience (SfN'13).

Contributed:

Gadassi-Polack, Reuma, Yihan (Sophy) Xiong, **Mollick**, **Jessica A.** & Kober, H. (2022)
Emotion Regulation in Typically-Developing and Non-Typically-Developing Children and adolescents: A Meta-Analysis of fMRI Studies. Society for Biological Psychiatry

Krueger, Kai, Nair, Ananta, **Mollick, Jessica A**, Herd, Seth, O'Reilly, R.C. (2018) A Biologically inspired neural network of integration and arbitration of decision-making. Cosyne, 2018, Denver, CO

Research Experience:

Postdoctoral Associate, Kober Lab, Yale University Dec 2017-present:

- Contributed to multiple publications on the cognitive neuroscience of drug use and addiction, including a novel computational model of addiction, and a review of existing computational models of addiction, and a neuroimaging-meta-analysis on prediction error.
- Experience with clinical interviews and assessments, including the SCID and Timeline Followback interviews about drug use, and addiction-related surveys and assessments.
- Designed and conducted a behavioral and fMRI study designed to examine the effects of craving on decision-making and risk estimation in cocaine users and control subjects.
- Experience fitting value-based decision-making models to behavioral, including hierarchical Bayesian estimation and within subject estimation, in both R and Matlab.
- Worked on all stages of fMRI meta-analysis of the neural correlates of prediction errors, including identifying eligible articles, extracting data, and running analysis.
- Drafted graft applications for our research in decision-making in substance use

Graduate Student, **O'Reilly Lab, University of Colorado Boulder** 2011-2017

- Completed design and data collection for two fMRI studies on the neural correlates of reward omission, and wrote up results for publication.
- Built and implemented a novel computational model of the phasic dopamine system, which included literature review identifying relevant brain areas, proposing the computations occurring in each brain area, implementing them in a model, and simulating existing data with the model.
- Designed, ran and analyzed data for an fMRI experiment testing the predictions of a computational model.
- Experience with model-based analysis of fMRI data, including experience with reinforcement learning (TD) algorithms and programing a computational model to generate regressors for fMRI experiment.
- Detailed knowledge of Emergent modeling framework and neural network models.
- Assisted with multiple grant applications, included a funded NIH grant on risky decision making
- Experience working with patient populations (Parkinson's) and collecting data for fMRI experiments
- Data analysis with many statistical packages (R, Matlab, Numpy/Scipy), including general linear models for fMRI analysis, classification, and linear mixed effects models.
- Experience with multiple fMRI pipelines, including SPM, fsl, ICA and robust regression, classification and other matlab based tools from Tor Wager's lab
- Worked on a computational model of decision making, focusing on the role of prefrontal cortical areas such as OFC and ACC, funded by an NIH grant on risky decision making.
- Integrated animal & human data on the roles of the prefrontal cortex and basal ganglia in decision-making

- Experience with understanding and analyzing representations in neural network layers, experience with multi-layer (deep) neural networks incorporating both reinforcement learning and supervised learning.

Research Assistant, **Bishop Lab, UC Berkeley** 2010 – Jul 2011
- Designed new, informative and aesthetically pleasing lab website by hand according to the specifications of lab members and Professor Bishop.
- Programmed a php application for putting experimental tasks on Amazon's Mechanical Turk.
- Helped program a desktop application for labeling movie stimuli.
- Completed multiple CPHS certifications and scanner safety quiz, received extended training on scanner and peripherals operation, and learned about fMRI analysis and data acquisition.

Research Assistant, Ivry Lab, Griffiths Lab, UC Berkeley 2010 – Jun 2011
- Customized a complicated java applet for an experiment simulating a probabilistic environment
- Worked on data analysis in MATLAB for multiple behavioral experiments and presented research findings and results of analysis at lab meetings.
- Coded a web experiment for mechanical turk, using javascript, php and mySQL databases, according to the exact specifications of a complex experimental paradigm.
- Collected data from a variety of subjects, including patients and older controls.

Research and Professional Skills:
- Experience with clinical interviews and assessments.
- Experience programming psychological experiments using Psychtoolbox, PsychoPy and E-Prime.
- Experience with complex decision-making and learning models, including hierarchical Bayesian estimation and within subject estimation, in both R and Matlab.
- Experience with computational fMRI methods, including machine learning and model-based fMRI.
- Experience with the Emergent neural network modeling framework, including building novel models, understanding deep neural networks, task design and representational analysis, as well as teaching students to build their own models.
- Experience creating figures for publications and presentations, both using python's matplotlib and numpy, and plotting software within Matlab.
- Experience with ICA artifact removal, localizing ROIs using fslview, running fMRI analyses with SPM, NeuroElf and matlab batch scripts and nipy.
- Statistical analyses with R, including lme and ggplot2 packages for data visualization.
- Skills with Linux/Unix systems, programming skills in Java, C#, Python, and MATLAB.
- Graphic design and web design skills. Proficient at Photoshop and Illustrator. Strong web design and development skills (XHTML, CSS, XML, JavaScript, java applets, PHP, mySQL databases).

Languages: French

References:
Hedy Kober, Clinical and Affective Neuroscience Lab, Yale University
Phillip Corlett, Belief, Learning and Memory Lab, Yale University
Randy O'Reilly, Computational Cognitive Neuroscience Lab, CU Boulder
Tor Wager, Director: Cognitive and Affective Neuroscience Lab, CU Boulder
Michael Saddoris, Director: Saddoris Lab, CU Boulder
McKell Carter, Director: Social Neuroscience and Games Lab, CU Boulder

Teaching experience:
Teaching Assistant, Computational Cognitive Neuroscience, Fall 2016, Spring 2014
- Led a laboratory section teaching use of neural network modeling software.
- Developed lesson plans for tutorials on neural network modeling.

Teaching Assistant, General Psychology, Spring 2016, Fall 2018
Teaching Assistant, Advanced Cognitive Psychology, Fall 2014
- Led a laboratory section teaching experimental design and research data analysis.

Graduate Teacher Program, Certificate for College Teaching Preparation (Poorvu Center at Yale)
- Completed advanced teacher training workshops
- Completed classroom observations and teaching evaluations

Service:

Human Subjects Research Committee, Committee Member
- Reviewed the safety of research protocols across campus during the COVID-19 pandemic
- Communicated with Principal Investigators and University Administrators regarding safety concerns related to research reactivation
- Contributed to development of safety guidelines with committee members

Yale Postdoctoral Association: Advocacy Committee and Diversity Committee
- Organized a mental health first aid training in collaboration with university wellness educators
- Co-organized a fundraiser run for local diversity and racial justice groups, raising over $4000

Ad-Hoc Reviewer:

Primary: Social Cognitive and Affective Neuroscience, Addictive Behaviors
Contributed: Neuropsychologia, Neuropsychopharmacology, Journal of Neuroscience, Cognition

Mentorship:

Mentor for Stephanie Malta: Neuroscience Senior Thesis Student, now at Boston University: M.S. Medical Sciences
Mentor for Caroline Lawrence: Graduate Law Student
Mentor for Jennifer Wang: Undergraduate researcher
Mentor for Geraldine Hernandez-Martin: Undergraduate researcher
Mentor for Astra Toyip: Neuroscience Senior Thesis Student, now Scientific Analyst at Aetion
Mentor for Jennifer Okolo: Undergraduate researcher
Mentor for Kaiqi Zhang: Full-time research assistant
Prior:
Hailey Yetman: Undergraduate researcher, now Research Assistant at Harvard Medical School
Ananta Nair: Undergraduate researcher, now AI Technical Engineer at Dell

Advanced Training and Courses:

NEURON Course
Computational Psychiatry Course, Zurich

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