Maria Katharina Eckstein

Senior Research Scientist, Google DeepMind

mariaeckstein@deepmind.com | https://mariaeckstein.com/ | 0000-0002-0330-9367 |

Education and Employment

Google DeepMind — *London & San Francisco*
Senior Research Scientist, Foundational Research Unit. Algorithms of the Mind (Colead) & LLM Investigations (Individual Contributor). — 2021 - Today

University College London — *London, UK*
Honorary Lecturer, Department of Experimental Psychology. — 2024 - 2026

University of California, Berkeley — *Berkeley, USA*
PhD, Psychology. Advisors: Profs. Anne Collins and Silvia Bunge. Cognition, Brain & Behavior. Dissertation: Computational Models of Learning and Hierarchy. — 2015 - 2021

Graduate School of Systemic Neurosciences — *Munich, Germany*
PhD, Neuroscience (unfinished). Advisor: Klaus Wunderlich. Focus: Model-Based and Model-Free Reinforcement Learning. — 2013 - 2015

Ludwig-Maximilians-Universität — *Munich, Germany*
BA, Philosophy. Focus: Philosophy of Mind, Neurophilosophy, History of Science. Thesis: Donald Davidson's Theory of Action: Description, Critique, and Alternatives. — 2011 - 2013

Ludwig-Maximilians-Universität — *Munich, Germany*
BSc, Psychology. Focus: Clinical Neuropsychology, Developmental Psychology. Thesis: Empirical Evaluation of the Zurich Model of Motivation. — 2010 - 2013

Albert-Ludwigs-Universität — *Freiburg, Germany*
BA, Ancient Languages, Cognitive Science (unfinished). — 2009 - 2010

Selected Publications

Journal Papers

[1] **Eckstein MK** (2026). "The Data-Driven Shift in Modeling Human Reward Learning," *Current Opinion in Behavioral Sciences*. [Link]

[2] Kasenberg D, ..., **Eckstein MK**, ..., Stachenfeld KL & Miller JK (2026). "AI-Discovered Cognitive Models Reveal Novel Insights into Human and Animal Learning," *bioRxiv*. [Link]

[3] Daie K, ..., **Eckstein MK**, ... & Svoboda K (2026). "Functional Reorganization of Motor Cortex Connectivity During Learning," *bioRxiv*. [Link]

[4] Seak LCU, Luettgau L, **Eckstein MK**, Moran R & Dolan RJ (2026). "Reuse of Learned Subtask Representations During Human Planning," *bioRxiv*. [Link]

[5] Veselic S, ..., **Eckstein MK**, ... & Kurth-Nelson Z (2025). "Reasoning with Programs in Replay," *psyArxiv*. [Link]

[6] Weinhardt D, Plomecka M, Tezcan I, **Eckstein MK** & Musslick S (2026). "Automated Discovery of Sparse and Interpretable Cognitive Equations," *bioRxiv*. [Link]

[7] Castro PD, ..., **Eckstein MK**, ... & Stachenfeld KL (2025). "Discovering Symbolic Cognitive Models from Human and Animal Behavior," *bioRxiv*. [Link]

[8] Bruijns SA, **Eckstein MK** & Dayan P (2025). "Low Dimensional Latent Structure Underlying the Choices of Mice," *bioRxiv*. [Link]

[9] **Eckstein MK**, Summerfield C, Daw N & KJ Miller (2026). "Hybrid Neural-Cognitive Models Reveal How Memory Shapes Human Reward Learning," *Nature Human Behavior*. [Link]

[10] Rmus M, **Eckstein MK** & Collins AGE (2025). "Subgoals in Hierarchical Reinforcement Learning," *psyArxiv*. [Link]

[11] Qü AJ, ..., **Eckstein MK**, ... & Wilbrecht L (2024). "Nucleus Accumbens Dopamine Release Reflects Bayesian Inference During Instrumental Learning," *eLife*. [Link]

[12] Binz M, ... **Eckstein MK** ... & Schulz E (2024). "Centaur: A Foundation Model of Human Cognition," *ArXiv*.

[13] **Eckstein MK**, Master S, Xia L, Dahl R, Wilbrecht L & Collins AGE (2022). "The interpretation of computational model parameters depends on the context," *eLife*. [Link]

[14] **Eckstein MK**, Master S, Dahl R, Wilbrecht L & Collins AGE (2022). "Reinforcement learning and Bayesian inference provide complementary models for the unique advantage of adolescents in stochastic reversal," *Developmental Cognitive Neuroscience*. [Link]

[15] Leibo JZ, Vezhnevets A, **Eckstein MK**, Agapiou JP & Duéñez-Guzmán EA (2022). "Learning agents that acquire representations of social groups," *Behavioral and Brain Sciences*. [Link]

[16] **Eckstein MK**, Wilbrecht L & Collins AGE (2021). "What do reinforcement learning models measure? Interpreting model parameters in cognition and neuroscience," *Current Opinion in Behavioral Sciences*. [Link]

[17] Xia L, Master S, **Eckstein MK**, Dahl R, Wilbrecht L & Collins AGE (2021). "Modeling changes in probabilistic reinforcement learning during adolescence," *PLOS Computational Biology*. [Link]

[18] Master S, **Eckstein MK**, Gotlieb N, Dahl R, Wilbrecht L & Collins AGE (2020). "Disentangling the systems contributing to changes in learning during adolescence," *Developmental Cognitive Neuroscience*. [Link]

[19] **Eckstein MK** & Collins AGE (2020). "Computational evidence for hierarchically structured reinforcement learning in humans," *Proceedings of the National Academy of Sciences*. [Link]

[20] **Eckstein MK**, Starr A & Bunge SA (2019). "How the inference of hierarchical rules unfolds over time," *Cognition*. [Link]

[21] **Eckstein MK**, Guerra-Carillo B, Miller Singley AT & Bunge SA (2017). "Beyond eye gaze: What else can eyetracking reveal about cognition and cognitive development?," *Developmental Cognitive Neuroscience*. [Link]

Peer-Reviewed Conference Papers

[1] Rmus M, **Eckstein MK** & Collins AGE (2023). "The role of subgoals in hierarchical reinforcement learning," *Annual Conference of the Cognitive Science Society*.

[2] **Eckstein MK**, Summerfield C, Daw N & Miller KJ (2023). "Predictive and interpretable: combining artificial neural networks and classic cognitive models to understand human learning and decision making," *Annual Conference of the Cognitive Science Society*.

[3] Miller KJ, **Eckstein MK**, Botvinick MM & Kurth-Nelson Z (2023). "Cognitive model discovery via disentangled RNNs," *Advances in Neural Information Processing Systems*.

[4] **Eckstein MK** & Collins AGE (2021). "How the mind creates structure: hierarchical learning of complex action sequences," *Annual Conference of the Cognitive Science Society.*

[5] Xia L, Master S, **Eckstein MK**, Wilbrecht L & Collins AGE (2020). "Learning under uncertainty changes during adolescence," *Annual Conference of the Cognitive Science Society.*

[6] Vezhnevets A, Wu YT, **Eckstein MK**, Leblond R, Leibo JZ (2020). "OPtions as REsponses: grounding behavioural hierarchies in multi-agent reinforcement learning," *International Conference on Machine Learning.*

[7] **Eckstein MK**, Master S, Dahl R, Wilbrecht L & Collins AGE (2019). "Modeling the development of decision making in volatile environments using strategies, reinforcement learning, and Bayesian inference," *Conference on Cognitive Computational Neuroscience*.

[8] **Eckstein MK** & Collins AGE (2017). "CHRL: Combining intrinsic motivation and hierarchical reinforcement learning," *Advances in Neural Information Processing Systems, Workshop on Hierarchical Reinforcement Learning.*

Media Coverage

[1] Fadelli I (2026). "An AI-Informed Model of Human Reward-Based Learning: Hybrid Approach Could Aid Studies of Mood Disorders," *Medical Xpress*.

Selected Conference Posters

[1] ***Eckstein MK**, Master S, Dahl R, Wilbrecht L & Collins AGE (2019). "Modeling the development of learning strategies in a volatile environment," *Cognitive Neuroscience Society*.

[2] **Eckstein MK** & Collins, AGE (2019). "Evidence for hierarchically-structured reinforcement learning in humans," *Sackler Colloquium: The Brain Produces Mind by Modeling, Irvine, CA, USA*

[3] ***Eckstein MK**, Wunderlich K & Collins AGE (2017). "Manipulating model-based and model-free reinforcement learning in humans," *Multi-Disciplinary Conference on Reinforcement Learning and Decision Making*.

[4] ***Eckstein MK** & Zehetleitner M (2013). "Experimental evaluation of the Zurich model of motivation with respect to smiling," *Interdisciplinary Kolleg Annual Spring School, Günne am Möhnesee, Germany*

***Poster prize or award**

Selected Talks

2026

Institute of Neuroinformatics at the Joint Institute of the University of Zurich and ETH Zurich (Prof. Mante). *Zurich, Switzerland*. Invited speaker.

Human Brain and Artificial Intelligence Workshop at ICJAI. *Bremen, Germany*. Invited speaker.

Control Processes (Prof. Senne Braem). *Ghent, Belgium*. Invited speaker.

Zurich Center for Neuroeconomics (ZNE; Profs. Ruff, Hare, Tobler). *Zurich, Switzerland*. Invited speaker.

World Wide Theoretical Neuroscience Seminar (VVTNS) (Prof. David Hansel & Prof. Ran Darshan). *Online*. Invited Speaker.

2024

Chen Institute and Science Joint Conference on AI & Mental Health (Dr. Peter Stern, MD). *Shanghai, China*. Invited Speaker.

DARPA Inspire Seminar on Computational Neuroscience (Dr. Emily Sherman). *Virtual*. Invited plenary speaker.

Bernstein Conference Workshop on the Physics of Cognition: Dynamical Models of the Ordered and Disordered Brain (Prof. Hamidreza Jamalabadi). *Frankfurt, Germany*. Invited speaker.

Conference on the Mathematics of Neuroscience. *Rome, Italy*. Invited plenary speaker.

Neurotheory Forum (Prof. Rui Ponte Costa). *Oxford, UK*. Invited speaker.

Department of Cognitive Sciences, Colloquium Series (Profs. Angela Yu and Constantin Rothkopf). *Darmstadt, Germany*. Invited speaker.

Department of Psychology. *Harvard University, Boston, USA*. Invited speaker.

Neuroeconomics Seminar (Prof. Stefano Palminteri). *École Normale Supérieure, Paris, France*. Invited speaker.

Center for Theoretical Neuroscience. *Columbia University, New York, USA*. Invited speaker.

Minds and Machines Initiative Launch Event (Profs. Tali Sharot, Bradley Love, Stephen Fleming). *UCL, London, UK*. Invited speaker.

Department of Psychology. *UC Davis, Davis, USA*. Invited speaker.

Department of Psychiatry (Prof. Angela Radulescu). *Icahn School of Medicine at Mt. Sinai, New York, USA*. Invited speaker.

2023

Cognitive Computational Neuroscience (CCN) Conference. *Oxford, UK*. Keynote and Tutorial.

Transcontinental Computational Psychiatry Workgroup (TCPW; Prof. Quentin Huys). *UCL, London, UK*. Invited speaker.

Human Intelligence meets Artificial Intelligence workshop (Prof. Daniel Durstewitz). *Heidelberg University, Heidelberg, Germany*. Invited speaker.

Bayesian and Not so Bayesian Belief Update in Economics, Neuroscience, and Machine Learning (Prof. Benedetto de Martino). *UCL, London, UK*. Invited speaker.

Meeting of the UCL NeuroAI community (Prof. Caswell Berry). *Sainsbury Wellcome Center, London, UK*. Invited speaker.

126th International Titisee Conference: NeuroAI—connecting advances in machine learning and neuroscience (Prof. Caswell Berry & Prof. Matt Botvinick). *Titisee, Germany*. Invited speaker.

Conference of the Cognitive Science Society (CogSci). *Sydney, Australia*. Contributed talk.

Shahar Lab, Tel Aviv University, Israel. *Virtual*. Invited speaker.

Research Group Computational Principles of Intelligence (Prof. Eric Schulz). *Max Planck Institute, Tübingen, Germany*. Invited speaker.

Center for Cognitive Neuroscience (Prof. Clay Holroyd). *Ghent University, Ghent, Belgium*. Invited speaker.

Costa Lab (Prof. Rui Ponte Costa). *Bath, UK*. Invited speaker.

2022

Conference on Computational and Systems Neuroscience (COSYNE), workshop "The What, How, and When of Reinforcement Learning". *Lisbon, Portugal*. Invited speaker.

Multi-disciplinary Conference on Reinforcement Learning and Decision Making (RLDM), workshop "Reinforcement Learning as a Model of Agency". *Providence, Rhode Island, USA*. Invited speaker.

Conference of the Bernstein Network of Computational Neuroscience, workshop "Surprise in the brain". *Berlin, Germany*. Invited speaker.

2020-2021

Hartley Lab, New York University, US. *Virtual*. Invited speaker.

Neural-AI Reading Group at Mila. *Virtual*. Invited speaker.

Flux Conference. *Virtual*. Contributed talk, selected for Jacobs Foundation Colloquium.

NeuroMatch Conference. *Virtual*. Contributed talk.

2018-2019

Donders Institute for Brain, Cognition and Behaviour (Prof. Roshan Cools). *Donders, Netherlands*. Invited speaker.

Max Planck Institute for Biological Cybernetics (Prof. Peter Dayan). *Tübingen, Germany*. Invited speaker.

Conference of the Cognitive Science Society (CogSci). *Madison, Wisconsin, USA*. Contributed talk.

before 2018

UC Berkeley Professional Development Class (Prof. Silvia Bunge). *Berkeley, CA*. Invited speaker.

Teaching

4th & 6th Advanced Course and Symposium on Artificial Intelligence and Neuroscience (ACAIN) — *Castiglione della Pescaia, Italy*
Teaching faculty — 2024, 2026

Summer Seminar on Automated Discovery and Active Learning — *Virtual*
Teaching faculty — 2024

Barcelona Summer School for Advanced Modeling of Behavior (BAMB) — *Barcelona, Spain*
Teaching faculty — 2023, 2024

TREND in Africa, Summer School on Computational Neuroscience — *Accra, Ghana*
Co-organizer; Teaching faculty — 2023

Summer School on Analytical Connectionism — *London, United Kingdom*
Teaching faculty — 2023

International Interdisciplinary Computational Cognitive Science Summer School — *Tübingen, Germany*
Teaching faculty — 2023

NeuroMatch Conference — *Virtual*
Research project mentor — 2022

Introduction to Cognitive Science — *UC Berkeley, USA*
Graduate student instructor and guest lecturer with Paul Li. Taught 3 weekly discussion sections (class of about 200 students; personally responsible for 60) — 2019

Computational Models of Cognition — *UC Berkeley, USA*
Graduate student instructor and guest lecturer with Prof. Anne Collins. Three weekly discussion sections (class of 150 students; responsible for 60) — 2018

Basic Issues in Cognition — *UC Berkeley, USA*
Graduate student instructor with Dr. Jennifer Dorfman. Three weekly discussion sections (class of 150 students; responsible for 60) — 2015

Awards and Honors

2019	**Fellowship**: Sackler trainee fellowship for the colloquium brain produces mind by modeling
2019	**Award**: Cognitive neuroscience society graduate student award
2018	**Award**: Society for neuroscience trainee professional development award
2018	**Fellowship**: UC Berkeley SURF fellowship for research mentorship
2018	**Fellowship**: UC Berkeley SMART fellowship for research mentorship
2015/2016	**Fellowship**: Gateway fellow at Berkeley international house
2015	**Research Grant**: UC Berkeley XLAB research grant
2013/2014	**Scholarship**: German academic exchange service (DAAD) annual scholarship
2009/2010	**Scholarship**: Sparkasse college fellowship
2008	**Valedictorian**: Gymnasium Tegernsee

Service to the Scientific Community

MindRL Modeling Challenge — *Worldwide, Virtual*
Mentor — 2026

Computational Cognitive Neuroscience (CCN) Conference — *New York, USA*
Area Chair — 2026

3-Day Collaborative Research in Computational Neuroscience (CRCNS) Grant Proposal Review Panel — *NSF / NIH / DOE / BMBF / ANR / BSF / NICT / AEI*
Invited reviewer — 2024, 2026

Conference of the Bernstein Network of Computational Neuroscience — *Frankfurt, Germany*
Workshop committee chair — 2024

Google DeepMind NeuroLab Workshop — *Google DeepMind, London, UK*
Co-organized an international, 3-day workshop with 50 attendees — 2024

Computational Cognitive Neuroscience (CCN) Conference — *Oxford, UK*
Program committee member. Involved in designing the program, selecting invited speakers, and reviewing submitted contributions — 2024

Google DeepMind NeuroLab Workshop — *Google DeepMind, London, UK*
Co-organized an international, 2-day workshop with over 40 attendees — 2023

Computational Cognitive Neuroscience (CCN) Conference — *Oxford, UK*
Program committee member. Involved in designing the program, selecting invited speakers, and reviewing submitted contributions — 2023

Conference of the Bernstein Network of Computational Neuroscience — *Berlin, Germany*
Workshop committee co-chair — 2023

TREND in Africa, Summer School on Computational Neurosciences — *Accra, Ghana*
Co-organizer and instructor — 2023

UC Berkeley Pupillometry Working Group — *Berkeley, US*
Co-founder — 2015-2016

Review Activity

Scientific Journals

Nature Communications; Science Advances; Nature Machine Intelligence; Psychological Review; PLOS Computational Biology; Journal of Experimental Psychology: Learning, Memory, and Cognition; Cognition; Developmental Science; Scientific Reports; Developmental Cognitive Neuroscience

Grant Reviews

Eurpean Research Council grant reviewer (2026); Collaborative Research in Computational Neuroscience (CRCNS) 3-day grant panel (2024 & 2026); National Science Foundation (NSF) grant reviewer; Google PhD scholarship reviewer (2025)

Conference Reviews

Reinforcment Learning Conference (RLC) 2026; Computational Cognitive Neuroscience (CCN) Conference (including area chair), Cognitive Science Conference, Neural Information Processing Systems (NeurIPS) Conference, International Conference on Machine Learning (ICML), Computational and Systems Neuroscience (COSYNE)