

Erie D. Boorman, PhD
edboorman@ucdavis.edu | [LDMLab](#)
Associate Professor, UC Davis

Academic positions

- 2021-present Associate Professor, Center for Mind and Brain and Dept. of Psychology, and Director, Learning and Decision Making Lab, UC Davis
- 2016-2021 Assistant Professor, Center for Mind and Brain and Dept. of Psychology, and Director, Learning and Decision Making Lab, UC Davis
- 2014-2016 Postdoctoral Research Fellow, Computational Cognitive Neuroscience Lab, University of Oxford and University College London (UCL). Professor Tim Behrens
- 2010-2014 Sir Henry Wellcome Postdoctoral Fellow, California Institute of Technology and University of Oxford. Professors Tim Behrens and Antonio Rangel

Education

D.Phil (Ph.D.), Experimental Psychology (Feb 2010), University of Oxford. Advisor: Matthew Rushworth

M.Sc. (Distinction), Neurosciences (Aug 2006), University of Oxford

B.A. (Honors), Psychology (June 2004), Stanford University. Advisor: John Gabrieli

Select Fellowships and Awards

NSF CAREER Award, 2019-present

Sir Henry Wellcome Postdoctoral Fellowship, 2010-2014

Wellcome Trust Prize Studentship, University of Oxford, 2005-2010

Overseas Research Student Award, University of Oxford, 2006-2009

Select Publications

Yu L.Q. *, Park S.A. *, Sweigart S.C., **Boorman E.D.** †, Nassar M.R. † (in review). *Do grid codes afford generalization and flexible decision-making?* *arXiv* :2106.16219.

*,† These authors contributed equally to this work. *Preprint*: <https://arxiv.org/pdf/2106.16219>

Crivelli-Decker J., Clarke A., Park S.A., Huffman D.J., **Boorman E.D.**, Ranganath C.R. (in press). *Goal-centered representations in the human hippocampus*. ***Nature Communications***.

Witkowski P.P., Park S.A., **Boorman E.D.** (2022). *Neural mechanisms of credit assignment for inferred relationships in a structured world*. ***Neuron***, 110, 1-11.

Park, S.A., Miller, D.S., **Boorman, E.D.** (2021). *Novel Inferences in a Multidimensional Social Hierarchy Use a Grid-like Code.* **Nature Neuroscience**, 24: 1292–1301.

News and Views by Du, M. and Parkinson, C. (2021). *Navigating Social Knowledge.* *Nature Neuroscience* 24, 1195–1197.

Boorman E.D., Witkowski P., Zhang Y., Park S.A. (2021). *The orbital frontal cortex task structure, and inference.* **Behavioral Neuroscience**, 135: 291-300.

Boorman E.D., Sweigart, S.C., Park S.A. (2021). *Cognitive maps and novel inferences: a flexibility hierarchy.* **Current Opinions in Behavioral Sciences**, 38: 141-149.

Park, S.A., Miller D.S., **Boorman, E.D.** (2021). *Protocol for building a cognitive map of structural knowledge in humans by integrating piecemeal learned abstract relationships from separate experiences.* **Star Protocols**, 2.

Park S.A., Miller D.S., Nili H., Ranganath C.R., **Boorman E.D.** (2020). *Map Making: Constructing, Combining, and Inferring on Abstract Cognitive Maps.* **Neuron**. S0896-6273(20).

Commentary by Bellmund J.L.S. (2020). *Piecing Together Cognitive Maps One Dimension at a Time.* *Neuron*. 107:996-999.

Park, S.A., Sestito, M., **Boorman, E.D.**, Dreher, J.C. (2019). *Neural computations underlying strategic social decision-making in groups.* **Nature Communications** 10:5287.

Hill, M.R., **Boorman, E.D.**, Fried, I. (2016). *Observational learning computations in single neurons of the human anterior cingulate cortex.* **Nature Communications**: 7:12722.

Boorman, E.D., Rajendran, V., O'Reilly, J.X., Behrens, T.E. (2016). *Two computationally and anatomically distinct learning signals predict changes to stimulus-outcome associations in hippocampus.* **Neuron**: 89:1343-54.

Boorman, E.D., O'Doherty, J.P., Adolphs, R., Rangel, A. (2013). *The behavioral and neural mechanisms underlying the tracking of expertise.* **Neuron**: 80:1558-71.

Boorman, E.D., Rushworth, M.F., Behrens, T.E. (2013). *Ventromedial prefrontal and anterior cingulate cortex adopt choice and default reference frames during sequential multialternative choice.* **Journal of Neuroscience**: 33:2242-53.

Rushworth, M.F., Noonan, M.P., **Boorman, E.D.**, Walton, M.E., Behrens, T.E. (2011). *Frontal cortex and reward-guided learning and decision-making.* **Neuron**: 70:1054:69.

Higo, T., Mars, R.B., **Boorman, E.D.**, Buch, E.R., Rushworth, M.F. (2011). *Distributed and causal influence of frontal operculum in task control.* **PNAS**: 108:4230-5.

Boorman, E.D., Behrens, T.E., Rushworth, M.F. (2011). *Counterfactual choice and learning in a neural network centered on human lateral frontopolar cortex.* **PLoS Biology**: 9:e1001093.

Boorman, E.D., Rushworth, M.F. (2009). *Conceptual representation and the making of new decisions.* **Neuron**, 63:721-3.

Boorman, E.D., Behrens, T.E., Woolrich, M.W., and Rushworth, M.F.S. (2009). *How green is the grass on the other side? Frontopolar cortex and the representation of alternative courses of action.* **Neuron**, 62:733-43.

Boorman, E.D., O'Shea, J., Sebastian, C., Rushworth, M.F.S., Johansen-Berg, H. (2007). *Individual Differences in White-Matter Microstructure Reflect Variation in Functional Connectivity during Choice.* **Current Biology**, 17:1426-31.

Peer-reviewed Conference Proceedings

Seongmin A. Park*, Jacob L. Russin*, Maryam Zolfaghar*, Randall C. O'Reilly, **Erie D Boorman** (* contributed equally). (2022). *The geometry of map-like representations under dynamic cognitive control.* Proceedings of the annual meeting of the cognitive science society (CogSci).

Jacob L. Russin, Maryam Zolfaghar, Seongmin A. Park, **Erie D. Boorman**, Randall C. O'Reilly. (2022). *A neural network model of continual learning with cognitive control,* Proceedings of the annual meeting of the cognitive science society (CogSci).

Seongmin A. Park*, Jacob L. Russin*, Maryam Zolfaghar*, Randall C O'Reilly, **Erie D. Boorman** (* contributed equally). (2022). *The geometry of map-like representations under dynamic cognitive control,* Computational and Systems Neuroscience (COSYNE).

Jacob L. Russin, Maryam Zolfaghar, Seongmin A Park, **Erie D. Boorman**, Randall C. O'Reilly, *Complementary structure-learning neural networks for relational reasoning.* (2021). Proceedings of the annual meeting of the cognitive science society (CogSci).

Seongmin A. Park, Douglas S. Miller, **Erie D. Boorman**, *Hexadirectional coding of decision trajectories through abstract and discrete spaces.* (2020). Computational and Systems Neuroscience (COSYNE).

Funding

NIMH RO1 Award, Computational Neuroscience Program, UC Davis 06/01/21-05/31/26
Cognitive maps for goal-directed decision making

Role: Principal Investigator Total Amount: \$2,602,97

NIMH R56 Award, Learning and Memory Program, UC Davis 12/30/19-12/29/22
Model-based credit assignment

Role: Principal Investigator Total Amount: \$770,34

NSF CAREER Award, Science of Learning Program, UC Davis 08/01/19-07/30/24
Contingent Learning in a Structured World

Role: Principal Investigator Total Amount: \$753,918

ONR Grant, Computational Neuroscience Program, UC Davis 07/24/2020-04/12/2024
Dynamic Cortico-Hippocampal Interactions for Flexible Goal-driven Agents.

Role: Co-Investigator (O'Reilly and Ranganath PIs) Total Amount: \$2,250,000

NSF Grant, Cognitive Neuroscience Program, UC Davis, 9/1/2020-8/31/2023
Mechanisms for causal and non-causal predictive learning Total Amount: \$657,263
 Role: Co-Investigator (Leshinskaya PI)

NIMH R21, Social and Affective Neuroscience Program, UC Davis 04/2022 – 03/2024
Rethinking the Neural Correlates of Uncertain Threat Anticipation with a Statistical Learning Approach.
 Role : Co-Investigator (Fox PI) Total Amount: \$414,479

NIMH R01, Social and Affective Neuroscience Program, UC Davis 07/01/2022 – 06/30/2027
Using theory- and data-driven neurocomputational approaches and digital phenotyping to understand RDoC Acute and Potential Threat
 Role: Co-Investigator (Shackman PI) Total Amount: \$3,869,732.08

Teaching Experience

Lead lecturer in:

Neuroeconomics / Decision Neuroscience / Judgment and Decision Making (cross-listed in psychology, cognitive science, neurobiology, physiology and behavior, and economics) (undergraduate course ~100 students)

Cognitive Neuroscience (undergraduate course ~120 students)

Advanced Cognitive Neuroscience (undergraduate course ~50 students)

Seminars on Learning, Memory, and Decision Neuroscience (undergraduate and graduate seminars ~10-15 students)