

Erik Peterson

Curriculum Vitae

Education

- 2012 **PhD in Cognitive and Computational Neuroscience**, *Colorado State University, Department of Psychology*, Fort Collins, CO.
ADVISOR: Carol A Seger, TITLE: REWARDS ARE CATEGORIES?
- 2010 **MS in Psychology**, *Colorado State University, Department of Psychology*, Fort Collins, CO.
TITLE: MANY HATS: INTRA-TRIAL AND REWARD-LEVEL DEPENDENT BOLD ACTIVITY IN THE STRIATUM AND PREMOTOR CORTEX.
- 2004 **BS in Chemistry and BS in Biochemistry, with a minor in Philosophy**, *California Polytechnic State University*, San Luis Obispo, CA.
SENIOR THESIS: TRANSPORT MECHANISMS OF ALKANETHIOL INKS IN DIP PEN NANOLITHOGRAPHY (DPN).

Scientific Interests

The big picture, briefly, in first person: I want to understand the math inside my head. I want to understand not by division, levels of analysis, but by synthesis. Detailed biological models and data-driven methods *combined* are the right approach to make cellular, systems and cognitive theory intertwine. We'll find parsimony from plurality.

Current Projects

- #! Code for many current and past projects is available under a BSD license at <https://github.com/parenthetical-e?tab=repositories>.
- Neural modeling Developing large-scale neural models of aging and ECoG data.
- Machine learning Using “pattern reinstatement” approaches to compare BOLD data from five separate sequential decision-making experiments, covering around 80 participants.
- Sequential analysis Developing a simulation and analysis environment to exhaustively compare human models of 2 choice sequential decisions.
- Visualization Developing a R package to create clean yet dense displays of high-dimensional fMRI timecourses.
- fMRI simulation Authored a (pythonic) fMRI simulation environment tailored towards the analysis of model-based approaches.

Publications and Posters

Neuroscience

- Machine learning Peterson EJ and Wheeler MW, *The diversity of distributed decisions.*, Cerebral Cortex, under preparation.
- Reinforcement learning Peterson EJ and Seger CA, *Rewards are categories?*, Neuron, under preparation.
- fMRI simulation Peterson EJ and Seger CA, *In model-based fMRI significant is less than specific.*, Neuroimage, under review.
- Visuomotor learning Peterson EJ, Seger CA and Anderson CA, *Many Hats: Changes in the Striatal Bold Signal Across Stimulus, Preparation, Response and Feedback*, Journal of Neurophysiology (2013), 110(7) 1689-1702.
- Categorization Seger CA and Peterson EJ, *Categorization = Decision Making + Generalization*, Neurosci Biobehav Rev (2013), 37(7), pp1187-1200
- Memory and categorization Seger CA, Dennison CM, Lopez-Paniagua DL, Peterson EJ, and Roark AA, *Dissociating Hippocampal and Basal Ganglia Contributions to Category Learning Using Stimulus Novelty and Subjective Judgments*, Neuroimage (2011), 55(4), pp1739-53.
- Reinforcement and connectivity Seger CA, Peterson EJ, Cincotta C, Lopez-Paniagua DL and Anderson C, *Dissociating the Contributions of Independent Corticostriatal Systems to Visual Categorization Learning Through the Use of Reinforcement Learning Modeling and Granger Causality Modeling*, NeuroImage (2010), 50(2) pp644-656.
- Glutamate receptor trafficking Bedoukian MA, Whitesell J, Peterson EJ, Clay C and Partin KM, *The Stargazin C Terminus Encodes an Intrinsic and Transferable Membrane Sorting Signal*, J. Biol. Chem. (2008), 283(3), pp1597-1600.

Posters

- fMRI simulation Peterson EJ and Seger CS, *'A precise problem in model-based fMRI?'*, presented at Cognitive Neuroscience Society Meeting (CNS), San Francisco, CA, May 2013.
- Reinforcement learning Evidence for generalizable reward representations in the basal ganglia examined using fMRI and reinforcement learning, International Meeting of the Basal Ganglia Society 11, Eilat, Israel, March 2013.
- Sequential analysis Peterson EJ and Wheeler M, *Looking everywhere for the right model of perceptual decision making*, Computational Neuroscience Poster Session, Center for the Neural Basis of Cognition, Pittsburgh, PA, January 2013.
- Reinforcement learning Peterson EJ and Seger CA, *Many Hats: Using fMRI to Characterize the Roles and Reward Sensitivity of the Striatum Across Stimulus, Response and Feedback.*, International Meeting of the Basal Ganglia Society 10, Long Branch, NJ, 2010.
- Visuomotor learning Peterson EJ and Seger, CA, *Reward-level dependent activity proceeding and following response selection: an fMRI study*, presented at SFN2009, Chicago, IL, Fall 2009.
- Reinforcement learning Peterson EJ and Seger, CA, *To Do the Right Thing: Temporal Difference Learning As Tool to Dissect the Role of Feedback in the Striatum*, presented at Cognitive Neuroscience Society Meeting (CNS), San Francisco, CA, May 2007.

Biochemistry, Nanotechnology and Surface Science

- Enzymology Johansson HE, Johansson MK, Wong AC, Armstrong ES, Peterson EJ, Grant RE, Roy MA, Reddington MV and Cook RM, *BT11, an Azoreductase with pH Dependent Substrate Specificity*, Applied Environmental Microbiology (2012), under review.

- Surface science Cheung CL, Rubinstein AI, Peterson EJ, Chatterji A, Sabirianov RF, Mei W, Lin T, Johnson JE and DeYoreo JJ, *Steric and Electrostatic Complementarity in the Assembly of Two-Dimensional Virus Arrays*, *Langmuir* (2010), 26 (5), pp3498–3505.
- Biotechnology Wong MK, Armstrong ES, Peterson EJ, Grant RE, Cook RM, and Johnanssen HJ, *The BIT1 Azoreductase Colormetric and Fluorometric Reporter System*, presented at Experimental Biology 2009, New Orleans, April 2009.
- Biochemistry Sowers BA, Peterson EJ, Grant RE, Lin WY, Dick DJ and Cook RM, *Optimization of Probe Performance in Real-Time PCR through an Understanding of Synthesis Impurities*, presented at Quantitative PCR, San Diego (CA) March, 2005.
- Nanotech Peterson, EJ, Weeks BL, De Yoreo JJ, and Schwartz PV, Effect of *Environmental Conditions on Dip Pen Nanolithography of Mercaptohexadecanoic Acid*, *J. Phys. Chem B* (2004), 108 (39), pp15206-15210.

Awards

- 2010 **Editor’s Choice Award, Systems Neuroscience Section**, *NeuroImage*, see Seger *et al* (2010) above.
- 2003 **Undergraduate Summer Research Fellowship**, *Lawrence Livermore National Laboratory*, Livermore CA.

Research experience

- 2014–Present **Postdoctoral Fellow, Voytek Lab**, *U.C. San Diego*, San Diego, CA.
Large scale neural modeling; machine learning.
- 2012–2013 **Postdoctoral Fellow, Wheeler Lab**, *University of Pittsburgh*, Pittsburgh, PA.
Projects focused on the theoretical and empirical analysis of human sequential analysis (i.e., decision making).
- 2006–2012 **Graduate Research Assistant**, *Colorado State University*, Fort Collins, CO.
Studied the neural correlate of reinforcement learning using fMRI, as well developed skills in MVPA. Authored a fMRI simulation environment.
- 2004–2006 **Research Assistant II, final position**, *Biosearch Technologies*, Novato CA.
Optimized high-throughput HPLC purification, mass spectrographic analysis of oligonucleotides (2004-2005) and, separately, assisted in the development of a novel reporter gene system (2005-2006).
- Summer 2003 **Undergraduate Fellowship**, *Lawrence Livermore National Laboratory*, Livermore CA.
Developed techniques to self-assemble virus particles into crystalline arrays then characterized these arrays by Atomic Force Microscopy.
- Summer 2002 **Internship**, *Biosearch Technologies*, Novato CA.

Professional Activities

- Summer 2014 **Summer School in Theoretical Neuroscience**, University of Waterloo, Learned to build large-scale state-of-the-art spiking neural network models using the Neural Engineering Framework (nengo.ca).

Computational Skills

- Languages Fluent in R and Python, comfortable with Matlab, Java, and Perl, with an ever-growing knowledge of Haskell.
- Machine learning Working knowledge of machine learning methods as applied to fMRI data analysis, specifically using scikit.learn.
- Statistical modeling Strong interest and knowledge of statistical methods, including model comparison approaches which were a key feature of my dissertation.

Teaching

- Fall 2011, **Teaching assistantship**, taught two upper-division laboratories – Sense and Perception (PSY 457) and the neuroanatomy section of Cognitive Neuroscience (PSY 459).
- Spring 2012