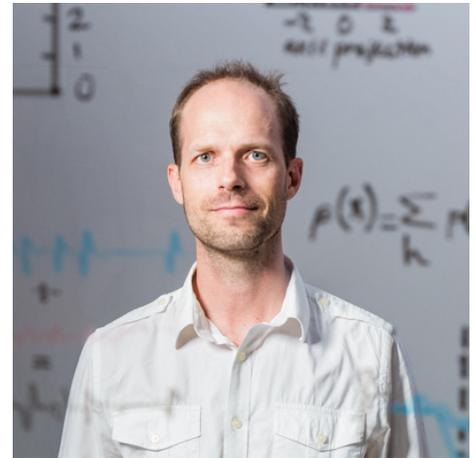




## BME Seminar Series

### Jonathan Pillow, PhD

Associate Professor of Psychology  
And The Princeton Neuroscience Institute  
Department of Psychology  
Center for Statistics and Machine Learning  
Princeton University



**Date:** Monday, January 28, 2019

**Time:** 1:30 pm

**Location:** Traylor 709, Talbot, Medicine Campus  
Video-teleconferenced to Clark Hall 110, Homewood Campus

## New methods for tracking and control of dynamic animal behavior during learning

**Abstract:** The process of learning new behaviors is of great interest in neuroscience and artificial intelligence. However, most standard analyses of training data either treat behavior as fixed, or track only coarse performance statistics (e.g., accuracy and bias), providing limited insight into behavioral strategies that evolve over the course of learning. To overcome these limitations, we propose a dynamic psychophysical model that efficiently tracks trial-to-trial changes in behavior over the course of training. In this talk, I will describe new work based on a dynamic logistic regression model that captures the dynamic dependencies of behavior on stimuli and common task-irrelevant variables including choice history, sensory history, reward history, and choice bias. We apply our method to psychophysical data from both human subjects and rats learning a delayed sensory discrimination task. We successfully track the dynamics of psychophysical weights during training, capturing day-to-day and trial-to-trial fluctuations that underly changes in performance, choice bias, and dependencies on task history. We leverage the model's flexibility model to investigate why rats frequently make mistakes on easy trials, demonstrating that so-called "lapses" often arise from sub-optimal weighting of task covariates. Finally, I will describe recent work on adaptive optimal training, which combines ideas from reinforcement learning and adaptive experimental design to formulate methods for inferring animal learning rules from behavior, and using these rules to speed up animal training.

**Bio:** Jonathan attended the University of Arizona, where he studied mathematics and philosophy, then spent a year as U.S. Fulbright fellow in Morocco before attending graduate school at NYU, where he received a Ph.D. in neuroscience working with Eero Simoncelli on statistical models of spike trains. He moved to London for a postdoctoral fellowship at the Gatsby Computational Neuroscience Unit at UCL, and in 2009 became an assistant professor at the University of Texas at Austin in the department of Psychology. In 2014, Jonathan moved to Princeton, where he is currently an associate professor in the Princeton Neuroscience Institute, Psychology department, and the Center for Statistics and Machine Learning. Jonathan's current research sits at the border between neuroscience and statistical machine learning, focusing on computational and statistical methods for understanding how large populations of neurons transmit and process information.