Alex Bond, PhD

✉ 🐙 🌐

INTERESTS

natural intelligence (NI) | neurotech & neural decoding | reinforcement learning | human performance

RECENT EXPERIENCE

CARNEGIE MELLON UNIVERSITY Cognitive Axon Lab | Computational Cognitive Neuroscientist

May 2022 – Present, Pittsburgh, PA

Neural algorithms driving cognitive-computational models of naturalistic learning & decision-making. Developed a custom Bayesian-RL-drift-diffusion model and neural network simulation to predict behavior and neural network dynamics at the trial-by-trial level (on the order of seconds). Tested empirically using longitudinal precision neuroimaging in humans. **Showed that competing neural representations of choice shape dynamic decision policy. Replicated in 75% of human participants. Mean trial-by-trial cross-validated prediction accuracy using human fMRI -> 65% to 83% (AUCs: 0.72 to 0.92).**

Psychology Dept. | Adjunct Professor

Jan. 2022 – Present

A lot about research methods remains to be taught. How do you balance empiricism with theory? How do you form hypotheses? What is the value of uncertainty in the scientific process? **Partnered with the Eberly Center for Teaching Excellence & Educational Innovation to design a** course **addressing unmet needs from scratch, using empirically supported educational research principles and student feedback. Completed Eberly Center Future Faculty Program in 4 months.**

Cognitive Axon Lab | Graduate Student Researcher

July 2017 – May 2022

Cognitive-computational models of adaptive decision policy in naturalistic contexts using naturalistic agents. Developed evidence accumulation models & a custom Bayesian observer to predict behavioral responses at the trial-by-trial level. Used psychophysiology (pupillometry, ECG, pulse oximetry, respiration), built custom experimental rig for ambient light control, and developed custom games in Python for behavioral testing. **Discovered dynamic decision policy in the decision-making and graph navigation context. First human empirical evidence for how latent decision processes shape dynamic decision policy under multiple forms of environmental uncertainty. Replicated in humans & mice. Found evidence dynamic decision policy also aids metalearning in implicit graph navigation.**

PRINCETON UNIVERSITY Intelligent Performance and Adaptation Lab | Lab Manager

May 2014 – July 2017, Princeton, NJ

Conducted research at the intersection of cognitive science and motor learning. Built custom rigs for kinematic data collection. **Quantified the time scale of explicit and implicit components of visuomotor learning using custom games I developed in Python, reach kinematics, and a force manipulandum (robotic arm). Published 3 papers.**

EDUCATION

CARNEGIE MELLON UNIVERSITY | CARNEGIE MELLON NEUROSCIENCE INSTITUTE

PhD in Cognitive Neuroscience with computational emphasis

May 2022 | Pittsburgh, PA

Dissertation: Adaptive Decision Policy Dynamics

UNIVERSITY OF ALABAMA IN HUNTSVILLE

BS in Psychobiology

May 2012 | Huntsville, AL

EXPERIMENTAL SKILLS

Experimental design & validation | Eyetracking & pupillometry | Multimodal psychophysiological recording
Generalization testing | Behavioral analysis | fMRI

COMPUTATIONAL & ANALYTIC SKILLS

Applied machine learning | Artificial agent development | Cognitive modeling | Computational neuroimaging
and neural decoding | Precision neuroimaging | Inferential statistics | Simulation | Time series analysis
Bayesian analysis and numerical estimation | Signal processing | Python *(expert)* | R *(expert)* | SQL *(intermediate)*
High Performance Computing *(competent)* | Linux *(competent)*

HONORS

2023   Future Faculty Program, Eberly Center for Teaching Excellence and Educational Innovation
2020   Carnegie Mellon Graduate Student Representative Award
2019   Carnegie Mellon Neuroscience Institute Presidential Fellow
2017   National Institutes of Health (NIH) Behavioral Brain Research Training Fellowship

PUBLICATIONS

Bond K., Rubin, J., Verstynen, T. The representational form of spatial reinforcement learning. *In prep.*

Bond K., Rasero J., Madan, R., Bahuguna, J., Rubin, J., Verstynen, T. Competing neural representations of choice shape evidence accumulation in humans. bioRxiv. October 2022. Under review at eLife.

Bond K., Dunovan, K., Alexis Porter, Jonathan E Rubin, and Timothy Verstynen. Dynamic decision policy reconfiguration. eLife. December; 2021;10:e65540.

Bond K. and Taylor J.A. Structural learning in a visuomotor adaptation task is explicitly accessible. eNeuro. August; 10.1523/eneuro.0122-17.2017.

Bond K. and Taylor J.A. Flexible explicit but rigid implicit learning in a visuomotor adaptation task. The Journal of Neurophysiology. March; 10.1152/jn.00009.2015.

McDougle S.M., **Bond K.**, and Taylor J.A. Implications of plan-based generalization in sensorimotor adaptation. The Journal of Neurophysiology. April; 10.1152/jn.00974.2016.

McDougle S.M., **Bond K.**, and Taylor J.A. Explicit and implicit processes constitute the fast and slow processes of sensorimotor learning. The Journal of Neuroscience. July; 10.1523/jneurosci.5061-14.2015.

LEADERSHIP

CMU GRADUATE STUDENT ASSEMBLY EXECUTIVE BOARD 1 OF 8 | VICE PRESIDENT OF ACADEMIC AFFAIRS
October 2021 – May 2022

My efforts were guided by two simple ideas. Grad. students should have 1) effective mentors and 2) health insurance. I formed and led an initiative to look at the time course of GS needs as they go through the program to inform a university-wide mentorship education initiative. **I partnered with Institutional Research to collect data from 30% of the GS population. Then I used this data to form time-dependent mentorship policy. I also partnered with University leadership to give ALL GS free insurance, including mental health support (implemented Fall 2022).**

CMU VICE PROVOST OF RESEARCH SEARCH COMMITTEE | INVITED ADVISOR
UNIVERSITY STUDENT ADVISING COMMITTEE | INVITED ADVISOR
UNIVERSITY EDUCATION COUNCIL | INVITED ADVISOR
ASSOCIATE DEANS FOR GRADUATE PROGRAMS | INVITED ADVISOR
THREE MINUTE THESIS (3MT) COMPETITION JUDGE 1 OF 1 | INVITED GRADUATE STUDENT THESIS JUDGE FOR CMU