KEVIN L. MCKEE

+1 703 593 1690 ◇ kevin@astera.org
Website ◇ Google Scholar

EDUCATION

Virginia Commonwealth University (VCU)
B.S., Psychology — *2008 - 2012*
Department of Psychology
Ph.D., Psychiatric, Behavioral, and Statistical Genetics (Statistical Modeling — *2015 - 2020*
Virginia Institute of Psychiatric and Behavioral Genetics (VIPBG)

EXPERIENCE

Senior Research Scientist, Obelisk lab, Astera Institute — *2024 - Present*
Led AGI R&D path called *Fluid*, a unique and complex AI agent with: short-term memory and reasoning via cellular automata, hierarchically clustered episodic memory, meta-learning based exploration policy, internal feedback control, and dynamic, selective attention to inputs. Hired engineering and research team, delegated experiments, and oversaw implementation in JAX.

Machine Learning Engineer / Research Scientist, Obelisk lab, Astera Institute — *2022 - 2024*
Assisted with spiking neural network based AI. Conducted broad research survey and experimentation over topics of interest to AGI: (1) neuroscience inspired algorithms: local learning, convolutional spiking nets, (2) reservoir computing with episodic memory for efficient meta-RL, (3) cellular automata and graph networks for neural algorithmic reasoning (NAR), (4) emergent multi-agent symbolic communication, (5) Hierarchical cluster-based memory structures for $O(d\log 2(n))$ vector lookup, and more.

Postdoctoral Researcher, UC Davis, Computational Cognitive Neuroscience — *2021 - 2022*
Researched sources and functions of randomness in neural activity. Modeled possible mechanisms of variational Bayesian inference in spiking neural networks. Fit Hierarchical Hidden Markov Models of decision making to experimental working memory data for schizophrenia research as part of the UC Davis Conte Center.

Postdoctoral Statistician, Virginia Tech, Department of Statistics — *2020 - 2021*
Translated research questions into statistical models and software across disciplines, including neuroscience, psychiatry, behavioral economics, and biomedical engineering. Led team efforts in COVID-19 and opioid epidemiology research. Designed and revised statistical methods for grant applications. Mentored undergraduate and graduate students. Produced and presented workshops and seminars on statistical methodology.

Graduate Research Assistant, VCU, Primary Mentor: Dr. Michael Neale — *2015 - 2020*
Dissertation *Phenotype Extraction* demonstrates Bayesian multi-level modeling for genetics: simultaneously extracts useful random-effects parameters of individual variation from state-space models while decomposing those distributions into genetic and environmental sources of variance.

Laboratory Staff, VCU, Multiple departments — *2011 - 2015*
Ran laboratory protocol for R&D of pharmacological interventions for substance use and relapse (Pharmacology & Toxicology). Educational videographer for human dissection lab (Anatomy and Neurobiology). Labeled cells in brain tissue from congenitally deaf cats to study bimodal neurons (Anatomy and Neurobiology). Ran laboratory protocol to study antipsychotic mechanisms in rodent models of schizophrenia and depression (Biopsychology).

SKILLS

Modeling: Any & all RL algorithms and ANN architectures, frequentist and Bayesian modeling strategies. Specialties: RNNs, state-space models, stochastic differential equations, spectral analysis.
Science: Independent research and literature review. Scientific illustration, preparation of manuscripts, grant applications, and educational materials. Reviewing manuscripts and grants applications. Mentoring early career researchers. Interviewing research candidates. Conducting educational workshops and technical seminars.

Programming Languages and Software:
Code: Python, R, MATLAB, Mathematica, Go, Java, C++, C#
Specialized: JAX, Pytorch, Stan, Rcpp, Unity
Presentation: LaTeX, Adobe Suite, Unity, R Markdown, R Shiny, Microsoft Office

SELECTED PAPERS

- Miconi, T., McKee, K., Zheng, Y., & McCaleb, J. (2025). Thinking agents for zero-shot generalization to qualitatively novel tasks. arXiv preprint arXiv:2503.19815.
- Zheng, Y., Wolf, N., Ranganath, C., O'Reilly, R. C., & McKee, K. L. (2025). Flexible prefrontal control over hippocampal episodic memory for goal-directed generalization. arXiv preprint arXiv:2503.02303.
- McKee, K. L. (2025). Meta-Learning to Explore via Memory Density Feedback. arXiv preprint arXiv:2503.02831.
- McKee, K. (2025). A Method of Selective Attention for Reservoir Based Agents. arXiv preprint arXiv:2502.21229.
- McKee, K. (2024). Reservoir computing for fast, simplified reinforcement learning on memory tasks. arXiv preprint arXiv:2412.13093.
- McKee, K., Crandell, I., Chaudhuri, R., & O'Reilly, R. (2022). Adaptive Synaptic Failure Enables Sampling from Posterior Predictive Distributions in the Brain. arXiv preprint arXiv:2210.01691.
- McKee, K. L., Crandell, I. C., Chaudhuri, R., & O'Reilly, R. C. (2021). Locally Learned Synaptic Dropout for Complete Bayesian Inference. arXiv preprint arXiv:2111.09780.

PEER-REVIEWED PUBLICATIONS

- McKee, K.L. Hierarchical Biometrical Genetic Analysis of Longitudinal Dynamics. Behavior Genetics (2021). https://doi.org/10.1007/s10519-021-10060-0
- Kaplan, B. A., Franck, C. T., McKee, K. L., Gilroy, S. P., Koffarnus, M. N. (2021) Applying Mixed-Effects Modeling to Behavioral Economic Demand: An Introduction, Perspectives on Behavior Science (in press)
- Hunter, M. D., McKee, K. L., Turkheimer, E. (2021). Simulated Nonlinear Genetic and Environmental Dynamics of Complex Traits. Development and Psychopathology (in press)
- Saby, L., McKee, K. L., Lakshmi, V., Goodall, J. L., Band, L. E. (2021) Comparing SoilMERGE Root Zone Soil Moisture and IMERG Precipitation as Predictors of Vegetation Greenness in the Colorado River Basin, 2001-2019. JAWRA (in press)
- McKee, K. L., Crandell, I. C., Hanlon, A. L. (2020) US County-Level Social Distancing and Policy Impact: A Dynamical Systems Model. Journal of Medical Internet Research
- McKee, K. L., Russell, M., Mennis, J., Mason, M., & Neale, M. C. (2019). Emotion Regulation Dynamics Predict Substance Use in High-Risk Adolescents. Addictive Behaviors

- McKee, K. L., Phenotype Extraction: Estimation and Biometrical Genetic Analysis of Individual Dynamics, Virginia Commonwealth University. doi.org/10.25772
- McKee, K. L., & Neale, M. C. (2019). Direct estimation of the parameters of a delayed, intermittent activation feedback model of postural sway during quiet standing. PloS one, 14(9), e0222664.
- McKee, K. L., Hunter, M. D., & Neale, M. C. (2019). A Method of Correcting Estimation Failure in Latent Differential Equations with Comparisons to Kalman Filtering. Multivariate behavioral research, 1-20.
- McKee, K. L., Rappaport, L. M., Boker, S. M., Moskowitz, D. S., & Neale, M. C. (2018). Adaptive Equilibrium Regulation: Modeling Individual Dynamics on Multiple Timescales. Structural Equation Modeling: A Multidisciplinary Journal, 1-18.
- Moscati, A., Verhulst, B., McKee, K. L., Silberg, J., & Eaves, L. (2018). Cross-Lagged Analysis of Interplay Between Differential Traits in Sibling Pairs: Validation and Application to Parenting Behavior and ADHD Symptomatology. Behavior genetics, 48(1), 22-33.

CONFERENCE PRESENTATIONS

- McKee, K. L., Saby, L., Lakshmi, V., Goodall, J. L., Band, L. E. Comparing SoilMERGE Root Zone Soil Moisture and IMERG Precipitation as Predictors of Vegetation Greenness in the Colorado River Basin, 2001-2019. In AGU Fall Meeting, December 2020. AGU.
- McKee, K. L., Pritikin, J. N., Kirkpatrick, R. M., Hanlon, A. L., Structural Equation Modeling with Count Variables. Conference on Statistical Practice, February 17-19, 2021, Virtual
- McKee, K. L., Boker, S.M., Neale, M.C., Adaptive Equilibrium Regulation: Modeling Individual Dynamics on Multiple Time Scales. Richmond, Virginia, Advanced Statistical Epidemiology Workshop, October 23 - 27, 2017. Presented as a talk.
- McKee, K. L., Neale, M.C., Boker, S. M., Modeling Psychological Dynamics with Random Events. Oslo, Norway, Behavioral Genetics Association, June 28-July 3, 2017. Presented as a poster.
- Hillhouse TM, McKee KL, Joseph BL, Spindle TR, Steele FF, Negus SS, Porter JH. (2013) Differentiating the antidepressant and abuse-related effects of the N-Methyl-D-aspartate noncompetitive antagonists ketamine and MK-801. Presented at 25th Annual Symp. Central Virginia Chapter of the Society for Neuroscience, Roanoke, VA, March 2013. Presented as a poster.
- Hillhouse TM, McKee KL, Joseph BL, Spindle TR, Porter JH. (2012) Ketamine, but not MK-801, produces antidepressant-like effects in rats responding on differential-reinforcement-of-low-rate (DRL) 72 second operant schedule. 24th Ann. Symp. Central Virginia Chapter of the Society for Neuroscience , Richmond, VA, December 2012. Presented as a poster.

ACKNOWLEDGEMENTS

- Hillhouse, Todd M; Porter, Joseph H (2014) Ketamine, but not MK-801, produces antidepressant-like effects in rats responding on differential-reinforcement-of-low-rate (DRL) 72 second operant schedule. Behavioral Pharmacology, Vol. 25(1) 80-91. (For assistance with data collection)
- Hillhouse, Todd M; Porter, Joseph H (2015) A Brief History of Antidepressants: From Monoamines to Glutamate. Experimental and Clinical Psychopharmacology, Vol. 23(1) 1-21. (For graphics and illustration)
- Meredith, M. A., Clemo, H. R., Corley, S. B., Chabot, N., & Lomber, S. G. (2016). Cortical and thalamic connectivity of the auditory anterior ectosylvian cortex of early-deaf cats: Implications for neural mechanisms of crossmodal plasticity. Hearing research, 333, 25-36. (For static and animated illustrations)