KEVIN L. MCKEE

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[Website](#) ⋄ [Google Scholar](#)

EDUCATION

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

ACADEMIC EXPERIENCE

Postdoctoral Associate, UC Davis, Computational Cognitive Neuroscience *2021 - 2022*
Studied 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 Associate, Virginia Tech, Department of Statistics *2020 - 2021*
Authored methodological manuscripts, led and participated in team efforts in COVID-19 and Opioid epidemiology research, designed and revised statistical methods for grant applications across disciplines including neuroscience, psychiatry, behavioral economics, and biomedical engineering. Teaching roles include undergraduate and graduate student mentorship, production and presentation of workshops and seminars.

Graduate Research Assistant, Primary Mentor: Dr. Michael Neale *2015 - 2020*
Studied for Ph.D. in psychiatric, statistical, and behavioral genetics under Dr. Michael Neale at VCU. Carried out research projects, teaching assistantship, and OpenMx statistical software development. Dissertation *Phenotype Extraction* demonstrates Bayesian multi-level genetic modeling of phenotypic parameters of state-space models.

KEY PROJECTS

Random Synaptic Failure as Monte Carlo Sampling *Fall 2022*
Demonstrated that random failures of synaptic transmission can produce accurate Monte Carlo sampling of learned probability distributions in spiking neural networks with lateral inhibitory dynamics.

Substance use and social influence NIH R01 grant applications *Summer 2020*
Contributed structural equation models, power calculations, and grant writing to Fralin Biomedical Research Institute (PIs King-Casas and Chiu) for multiple NIH R01 applications to study neural correlates of social influence on risk valuation and substance use. (Awarded March 25, 2021)

Computational Models of Panic Disorder *2019 - 2021*
Assisting Dr. Donald Robinaugh of Massachusetts General Hospital developing theoretical, computational models of panic disorder. Implemented statistical estimation models, demonstrated techniques for empirical validation of the models and estimation of clinically meaningful parameters of panic onset.

Brain Network Structure in Borderline Personality *2019 - 2020*
Completed brain network component extraction from fMRI data using CONN and GIFT for Dr. James Bjork to examine connectivity differences in Borderline Personality Disorder.

TEACHING EXPERIENCE

Workshop on Bayesian Hierarchical Hidden Markov Models *Spring 2022*
Created and presented a 3-hour workshop at UC Davis Center for Neuroscience. Reviewed recent work on the use of hidden markov models (HMM) of decision making in rodent studies. Demonstrated improvements to HMMs using Stan software to include prediction of state transitions and hierarchical priors for more efficient and rigorous multi-level modeling.

Variational Bayesian Neural Network Seminars *Fall 2022*
Multiple seminars presented to Randy O'Reilly lab at UC Davis on history and state of the art in variational inference (VI): Boltzmann machine, Helmholtz machine, VAE, weight dropout; including relationships between VI, models with constraint satisfaction, maximum likelihood estimation, sampling, and simulated annealing.

iTHRIV Seminar *Fall 2020*
Present November 6 talk titled *The Bigger Picture of Mediation and Moderation: Structural Equation Models and Path Analysis* to the clinical iTHRIV audience to teach conceptual and mathematical principles of mediation and moderation analyses in the context of SEM.
Lecture Video Link

CBHDS Internal Biweekly Seminar Series *Fall 2020*
Initiated biweekly seminars internally to CBHDS for mutual professional and statistical training between biostatisticians.

Undergraduate and Graduate Mentoring *Summer 2020*
Advised graduate students of Computational Modeling and Data Analytics (CMDA) in capstone project development and presentation. Advised undergraduate intern in R coding for analysis of neuroimaging data.

Graduate Teaching Assistant *Fall 2018 - 2020*
Produced educational class materials, substitute lecturer, lecturer for specialized topics (stochastic processes), graded assignments, managed online content distribution, tutored students, and provided suggestions and feedback on course design for CCTR 702, 703 / HGEN 651, 652 Statistics for Genetic Studies, a survey of statistical methods from probability theory to structural equation modeling.
Lecture Video Link

Introductory LaTeX Workshop *Spring 2019*
Designed and presented a series of workshop courses at VIPBG with introduction and basic instructions on the use of LaTeX for document typesetting, Overleaf for collaborative manuscript preparation, and other software such as R Markdown for streamlining publication of results.

Departmental Seminar *Spring 2016 - 2020*
Hour-length presentation of novel results to VIPBG department. Titles of talks included:
Teen Network Study: 24-Month EMA Social-spatial risk and protective mechanisms in urban adolescent substance use *Spring 2016*
Modeling Psychological Dynamics and Random Events: Simulations and Solutions for Time Series Data *Fall 2017*
Phenotype Extraction: Modeling Within-Person Processes as Dynamical Systems *Spring 2019*
Seminar Video link

Instructional Videography *2013 - 2015*
Worked closely with Dr. Alex Meredith and other professors of VCU Anatomy and Neurobiology to design and edit instructional videos of dissections for classroom use in the Gross Anatomy undergraduate course.

PROFESSIONAL EXPERIENCE

Senior Machine Learning Engineer, Astera Institute   *2022 - Present*
Designed and implemented algorithms for advancing computational capabilities of artificial intelligence. Wrote summary reports and gave technical presentations to identify targets for further research. Designed models of partial transfer learning, hybrid symbolic reasoning networks, and concept learning. Implemented state-of-the-art models (MuZero, DreamerV2) in a novel testing environment.

Laboratory Technician, VCU Pharmacology & Toxicology   *2013 - 2015*
Hourly technician running laboratory protocol for rodent studies of substance use and relapse for Drs. Patrick Beardsley and Keith Shelton. The studies developed pharmacological interventions to attenuate substance use relapse. Responsibilities included animal care, data collection, and survival surgeries to implant jugular catheters for rodent self-administration.

Neurobiology Internship, VCU Anatomy & Neurobiology   *2012 - 2013*
Used light microscopy to digitally map neural projections in the brain tissue of deaf cats for Dr. Alex Meredith. Produced graphics and animations for publication.

Biopsychology Internship, VCU Biopsychology   *2011 - 2012*
Internship assisting Drs. Joseph Porter and Todd Hillhouse with laboratory protocol and animal care for the the study of rodent models of schizophrenia and depression. Produced graphics for analysis and illustrations of synaptic diagrams and presented at the Society for Neuroscience.

Android App Development   *2011 - 2013*
Designed and developed a health and lifestyle app for Android devices titled *Insight* for user-customizable self-monitoring surveys and in-app analyses. Published to Google Play from 2013-2018.
[Archived here]

Artistic Exhibits   *2008 - 2016*
Produced a portfolio of paintings and solo exhibitions as part of the monthly First Friday event in Richmond, VA, at the Chicago School of Psychology, Washington D.C., and in Easton, Maryland.
[Portfolio and rèsumè]

SERVICE

CBHDS Walk-In Consulting   *2020 - 2021*
Hosted Monday walk-in consulting hours for Center of Biostatistics and Health Data Science to provide consultations for statistical analysis and mentoring to students and research faculty.

Peer Review   *2017 - Present*
Reviewed manuscripts by invitation for journals including Structural Equation Modeling, Psychometrika, and International Journal of Environmental Research and Public Health.

iTHRIV Reviewer   *2020 - 2021*
Reviewed applications for position of iTHRIV scholar and NIH R01 applications by iTHRIV scholars.

Organizer, Philosophy and ethics discussion group, VCU   *2017 - 2020*
Arranged monthly discussion groups led by VIPBG director Dr. Kenneth Kendler. Circulated literature, managed and edited video recordings, invited and coordinated guest speakers. Discussion groups included topics in philosophy of science and philosophy of mind and their relation to Psychiatric research, psychometric and clinical challenges in the development of psychiatry, the ethics of authorship and collaboration, the social and ethical consequences of genetic research, and both general and personal accounts of the history of psychiatry and genetics.

Designer, Virginia Science Community Interface (VSCI), UVA   *2019 - Present*
Editing, formatting, and graphical design for literature review documents in LaTeX. Review articles communicate scientific findings to advocates for evidence-based policy.

Statistical consultant, Geospacial opportunity mapping, Virginia Housing   *2016 - 2017*
Used structural equation modeling and cluster analysis to reproduce studies of social, economic, and logistical dimensions of opportunity in the Richmond, Virginia area.

Student Representative, Psychiatry Grand Rounds, VCU   *2015 - 2020*
Arranged meetings between trainees of VIPBG and guest speakers of the Psychiatry department.

AWARDS

Kenneth S. Kendler Award for Excellence in Pre-Doctoral Research (2019)

SKILLS

SPECIALIZED TRAINING
Machine learning: Variational Inference, Neural Networks, Random forest, Support Vector Machines
Statistics: Classical statistical inference and Bayesian inference, Structural Equation Modeling
Time Series: State-space modeling, stochastic differential equations, spectral analysis
Symbolic AI: PROLOG, PROGOL
Psychometrics: Item Response Theory, measurement modeling, instrument design
Image analysis: Segmentation, Object classification, Convolution filtering
Simulation: Method validation, theoretical modeling
Manuscript and grant writing
Scientific illustration and preparation of educational materials
Instructional video recording and editing

PROGRAMMING LANGUAGES AND SOFTWARE
Code: Python, R, MATLAB, Mathematica, Go, Java, C++, C#
Specialized: Pytorch, Stan, Rcpp, Tensorflow, Keras, Unity, OpenMx, CONN, GIFT
Presentation: LaTeX, R Markdown, R Shiny, Microsoft Office, Unity
Illustration: Adobe Photoshop, Illustrator, Unity

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.

OTHER PUBLICATIONS

- 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.

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 non-competitive 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.

for neural mechanisms of crossmodal plasticity. Hearing research, 333, 25-36. (For static and animated illustrations)