Maedbh **King**

· Ph.D. Candidate in Cognitive Neuroscience · UC Berkeley ·

67 Glen Avenue, #202, Oakland, CA, USA

(510) 570-5306 | maedbhking@gmail.com | www.maedbhking.com | maedbhk | maedbhking | Maedbh King

Summary

5+ years experience in designing multi-task fMRI/eye-tracking/behavioral experiments and applying machine learning to build predictive models of cerebellar function. Research pursuits dovetail with keen interest in technology policy. "We see things not as they are, but as we are" (Anaïs Nin).

Education

University of California, Berkeley — *Berkeley, California*

Ph.D. in Cognitive Neuroscience (GPA: 3.96/4.00) — *Sep. 2017 - Expected: Dec. 2022*

- **Advisor: Richard Ivry, Ph.D.**
- Applied Data Science Certificate, School of Information.
- *Awards: Mark R. Rosenzweig Graduate Fellowship (2021); Cognitive Computational Neuroscience Travel Award (2020)*

Western University — *London, Ontario*

M.Sc. in Neuroscience (GPA: 4.0) — *Sep. 2015 - May. 2017*

- **Advisor: Joern Diedrichsen, Ph.D.**
- *Awards: Gordon Cerebellum Student Travel Award (2017)*

Trinity College Dublin — *Dublin, Ireland*

B.A. in Psychology and French (Double Major; GPA: 4.0) — *Sep. 2010 - May. 2014*

- **Advisor: Redmond O'Connell, Ph.D.**
- *Awards: Irish Research Council Postgraduate Scholarship (2015); Ussher Fellowship, Trinity College Dublin (2015); US Fulbright Program (shortlisted); Wellcome Trust Biomedical Scholarship (2014); Entrance Scholarship, Trinity College Dublin*

Experience

Thesis: Mapping cerebro-cerebellar networks of the human brain during learning — *Github [Link]*

University of California, Berkeley — *Graduate Researcher (2017-)*

- *Led a team of 9* (3 Ph.D. students, 5 research assistants, 1 postbac student) to design and collect *300* hours of *fMRI* and *eye-tracking* data.
- Used *machine learning* to predict *cerebro-cerebellar connectivity* across learning, features were *extracted* by parcellating the human cerebral cortex and *feature selection* was performed with *L1 regularization*. Used *dimensionality reduction* (PCA, ICA), *clustering*, *regression*, *permutation tests* to analyze *behavioral* and *eye-tracking* data to predict *learning* performance on *movie-based* action tasks.
- Used *dimensionality reduction* (PCA, ICA), *clustering*, *regression*, *permutation tests* and other machine learning techniques to analyze *behavioral* and *eye-tracking* data to predict human *learning* performance on *movie-based* action prediction tasks.

Thesis: Understanding the functional organization of the human cerebellum — *Paper [Link]*

Western University — *Graduate Researcher (2015-2017)*

- *Led a team of 2* (1 research assistant and one post-doctoral fellow) to design and collect a 26-task *fMRI* experiment and used *machine learning* (*semi non-negative matrix factorization*) to generate a *novel functional map* of the human cerebellum.
- Applied *natural language processing and regularized regression* to assign cognitive labels (*cognitiveatlas.org*) to the human cerebellum. Invested in *open-source science*. My data, which are publicly available on *openneuro.org*, have been downloaded by *hundreds of researchers*.
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Selected Projects

SUITPy: Open-source package for the visualization of cerebellum imaging data — *Library [Link]*

2021

- Core developer of *SUITPy*, an open-source *python* toolbox based on a highly popular *MATLAB* toolbox. I implemented *mapping* of brain data to 2D surface space and incorporated *brain atlases* from *open-source* repositories.

Evaluating functional boundaries of the brain using a novel distance coefficient — *Paper [Link]*

2021

- Co-developed a novel *statistical metric* to evaluate the validity of *brain parcellations*, an advancement on *Homogeneity and Silhouette coefficients*. Evaluated metric on *open-source* brain data from *Human Connectome Project*.

Low dimensional embedding of genetic gradients in the human cerebellum — *Paper [Link]*

2021

- Investigated *genetic gradients* in the *human cerebellum* using postmortem data from the *Allen Human Brain Atlas*. Used feature-based encoding to locate gene samples in the cerebellum, and *hierarchical clustering and PCA* to determine *organizational structure* of genetic gradients

Predicting brain activation maps for arbitrary tasks with cognitive encoding models — *Poster [Link]*

2021

- Evaluated cognitive *encoding models* on brain data and used *natural language processing* to extract features from a formal *cognitive ontology*.

Predicting penalty shots using markerless pose estimation — *Github [Link]*

2020

- Implemented *markerless labeling* of video data (>12 hours of soccer players taking penalty shots) and feature-based encoding to *compare model and human performance* in predicting penalty outcomes.

Predicting COVID-19 mortality rates across the U.S. using mobility and census data *Report [Link]*

2020

- Implemented *elastic net* regularization using *economic* and *mobility* features to *predict COVID-19* deaths across the U.S. in 2020 using data from the 2019 *U.S. Census* and *Google Maps* mobility reports.
- Model *features* were extracted using *dimensionality reduction* and *elastic net* regularization and *ridge regression* was used to *train and test models*.

Papers

In Prep

Putting the cerebellum to the test: introducing a falsifiable model of cerebro-cerebellar connectivity *In Prep*

M King, L Shahshahani, R Ivry, J Diedrichsen *2021*

Changes in cerebro-cerebellar connectivity across learning *In Prep*

M King, J Diedrichsen, R Ivry *2021*

30 years later: where are we in understanding the cerebellum's role in cognition? *In Prep*

M King, J Tsay, R Ivry *2021*

Published/Under Review

Evaluating brain parcellations using the distance controlled boundary coefficient *bioRxiv*

D Zhi, M King, J Diedrichsen *2021*

Continuous manipulation of mental representations is compromised in cerebellar degeneration *bioRxiv*

SD McDougle, J Tsay, B Pitt, M King, W Saban, JA Taylor, RB Ivry *2021*

Transcriptomic Gradients Of The Human Cerebellum *bioRxiv*

M King, Z Zhen, RB Ivry, KS Weiner *2020*

Functional boundaries in the human cerebellum revealed by a multi-domain task battery *Nature Neuroscience*

M King, CR Hernandez-Castillo, RA Poldrack, RB Ivry, J Diedrichsen *2019*

Universal transform or multiple functionality? Understanding the contribution of the human cerebellum across task domains *Neuron*

J Diedrichsen, M King, C Hernandez-Castillo, M Sereno, RB Ivry *2019*

Visualizing Topographic Independent Component Analysis with Movies *arXiv*

Z Chen, D Parvin, M King, S Hao *2019*

Unique degeneration signatures in the cerebellar cortex for spinocerebellar ataxias 2, 3, and 7 *NeuroImage: Clinical*

CR Hernandez-Castillo, M King, J Diedrichsen, J Fernandez-Ruiz *2018*

Individual differences in resting corticospinal excitability are correlated with reaction time and GABA content in motor cortex *Journal of Neuroscience*

I Greenhouse, M King, S Noah, RJ Maddock, RB Ivry *2017*

Towards a multi-function mapping of the cerebellar cortex *Brain*

M King, C Hernandez-Castillo, J Diedrichsen *2017*

Neural adaptations associated with interlimb transfer in a ballistic wrist flexion task *Frontiers in human neuroscience*

KL Ruddy, AK Rudolf, B Kalkman, M King, A Daffertshofer, TJ Carroll, R Carson *2016*

Registered reports for student research *Journal of European Psychology Students*

M King, F Dablander, L Jakob, M Agan, F Huber, J Haslbeck, K Brecht *2016*

A critical evaluation of the essentialist debate: do fathers make a unique contribution to child development? *Student Psychology Journal of Ireland*

M King *2015*

The locus coeruleus-noradrenergic arousal function modulates perceptual decision-making in humans: evidence from pupillometry
M King, R O'Connell
Unpublished Undergraduate Honors Thesis
2014

Poster Presentations

Cerebro-cerebellar connectivity is dominated by divergent mapping
M King, L Shahshahani, Ivry, J Diedrichsen
2021
Society for Neuroscience Conference
Virtual Conference

Predicting brain activation maps for arbitrary tasks with ontology-based encoding models
J Walters, M King, P Bissett, Ivry, J Diedrichsen, R Poldrack
2021
Organization for Human Brain Mapping Conference
Virtual Conference

Evaluating Brain Parcellations using the Multi-Domain Task Battery
J Diedrichsen, M King, C Hernandez-Castillo, D Zhi, R Ivry
2019
Organization for Human Brain Mapping Conference
Rome, Italy

Evaluating different functional parcellations of the basal ganglia
C Hernandez-Castillo, M King, I Harding, J Diedrichsen, R Ivry
2019
Organization for Human Brain Mapping Conference
Rome, Italy

Transcriptomic Gradients of the Human Cerebellum
M King, R Ivry, K Weiner
2019
Cerebellum Gordon Research Conference
Les Diablerets, Switzerland

A multi-domain task battery reveals the functional topography of the human cerebellum
M King, C Hernandez-Castillo, R Poldrack, R Ivry, J Diedrichsen
2018
The Society for Neuroscience Conference
San Diego, California

A multi-domain task battery reveals the functional topography of the human cerebellum
M King, C Hernandez-Castillo, R Poldrack, R Ivry, J Diedrichsen
2018
Computational and Cognitive Neuroscience Conference
Philadelphia, Pennsylvania

Navigating the "Little Brain": Comprehensive mapping of cognitive function in the human cerebellum
M King, R Ivry, J Diedrichsen
2017
Helen Wills Neuroscience Retreat
Lake Tahoe, California

Navigating the "Little Brain": Comprehensive mapping of cognitive function in the human cerebellum
M King, R Ivry, J Diedrichsen
2017
Organization for Human Brain Mapping Conference
Vancouver, British Colombia

Mapping the Human Cerebellum
M King, R Ivry, J Diedrichsen
2017
Cerebellum Gordon Conference
Lewiston, Maine

Transcranial magnetic stimulation measures of intrinsic motor system excitability and task-based inhibition exhibit intra-subject stability across weeks
I Greenhouse, M King, R Ivry
2015
Society for Neuroscience Conference
Chicago, Illinois

Electroencephalography (EEG) signatures of impairment in cognitive, sensory and motor networks in Amyotrophic Lateral Sclerosis (ALS) disease
B Nasseroleslami, K Mohr, M King, O Hardiman
2015
Annual ALS Irish Meeting
Dublin, Ireland

Invited Talks

Bringing a systems level perspective to neuroimaging analyses
Educational Symposium: Neuroanatomy for neuroimaging
2021
Organization for Human Brain Mapping
Virtual Conference

Transcriptomic gradients of the human cerebellum
Cognitive Neuroscience Colloquium
2020
University of California, Berkeley
Berkeley, California

Mapping the Human Cerebellum Using a Multi-Domain Task Battery
Symposium: New Perspectives on Cerebellar Function: Implications for Mental Health
2019
Society for Neuroscience
Chicago, Illinois

A multi-domain task battery reveals the functional topography of the human cerebellum — *Helen Wills Neuroscience Institute*
UCB Neuroscience Retreat — *Richmond, California*
2018

Mapping the Human Cerebellum — *Cerebellum Gordon Research Conference*
Seminar: Theories and Models of Cerebellar Function — *Lewiston, Maine*
2017

Teaching

General Psychology — ***Mount Tamalpais College***
Lecturer — *San Quentin State Prison*
Sep. - Dec. 2019

Biological Psychology, PSYCH 110; Cognitive Neuroscience, PSYCH 127 — ***University of California, Berkeley***
Graduate Student Instructor — *Berkeley, California*
Aug. - Dec. 2018 and Aug. - Dec. 2017

Introduction to Statistics, STAT 1024; Probability and Statistics, STAT 2857 — ***Western University***
Graduate Student Instructor — *London, Ontario*
Jan. - May. 2017; Sep. - Dec. 2016

Public Service & Outreach

Policy

Graduate Assembly Students of Psychology — ***Member and RSO Signatory***
University of California, Berkeley — *Sep. 2018 -*
- Co-organized *faculty fundraisers* in Silicon Valley as well as *Psychology "Big Give"* to fund-raise $15,000 for Berkeley Psychology.
- Assembled *working committee* to create *policy* to improve *lab culture* and *mentor-mentee* relationships, co-wrote subsequent *mentorship and lab policy agreements* resulting in new departmental policies.
- *Created*, *managed*, and *edited* Berkeley Psychology blog to *spotlight* graduate student research.
- *Co-founded and operated* Twitter account for Berkeley Psychology.
- *Writer and contributor* of Berkeley Psychology *newsletter*.
- *Data analysis, statistics* and *visualization* for Berkeley Psychology *state of the department* annual meeting.

Schulich School of Medicine Graduate Council — ***Secretary***
Western University — *2015 - 2016*
- Oversaw a *budget of $5000*, did note-taking at biweekly meetings, and *voted* on council plans.

Niteline (Student Helpline) — ***Publicity Officer***
Trinity College, Dublin — *2011 - 2013*
- *Publicized* student helpline services at *national events* and fund-raised to increase the *yearly budget*.

Education

Prison University Project — ***Volunteer and Lecturer***
Richmond, California — *Sep. 2019 - Mar. 2021*
- *Designed* and *lectured* a course in General Psychology to incarcerated students in *San Quentin State Prison*.
- Created care packages and holiday art for incarcerated people in California prisons during the *COVID-19 pandemic*.

Bay Area Scientists in Schools (BASIS) — ***Volunteer***
University of California, Berkeley — *Jan. 2018 - Jan. 2020*
- *Presented* multiple lectures on the "Feel Human Brains" to *elementary school children* in Bay Area schools.

Journal of European Psychology Students — ***Junior Editor***
European Federation of Psychology Students' Association — *2014 - 2016*
- *Edited* research/review paper submissions, *recruited* reviewers, copy editors, and *communicated* decision outcomes to authors.

Women in STEM

Inspiring Young Women in STEM Inaugural Conference — ***Organizing Member***
Western University — *2016*
- *Co-organized* the first conference, *recruited* keynote speakers, and *evaluated* student research.

Western Women Neuroscientists in Schools — ***Volunteer***
Western University — *Oct. 2015 - May 2017*
- *Presented* multiple *lectures* on "Myths and the Brain" to *secondary school children* in London, Ontario schools.

Mentorship

Honors Thesis Students — *Shannon Lee; Sienna Bruinsma*
Sep. 2019 - May 2021 — *Cognitive Science; Psychology*
- Shannon Lee's thesis developed eye-tracking and context models to inform social learning.
- Sienna Bruinsma's thesis evaluated the functional role of the cerebellum in linguistic processing using neuropsychology.

Undergraduate Research Assistants

Zanib Naaem; Yiling Kao

Jan. 2021 - May 2021; Sep. 2019 - May 2020

Psychology; Computer Science

- Zanib Naaem tested healthy college-aged students on a multi-session eye-tracking and behavioral learning project.
- Yiling Kao developed a verb generation task and used machine learning to study speech envelopes.

Ph.D. Rotation Students

Amanda LeBel; Jacob Ziontz; Mark Gorenstein

Sep. - Dec. 2020; Jan. - May 2020; Sep. - Dec. 2018

Neuroscience

- Amanda LeBel developed encoding models using speech features to study task-evoked cerebellar activity.
- Jacob Ziontz set up fMRI preprocessing scripts (BIDS and fMRIPrep) on multi-session cerebellar data.
- Mark Gorenstein worked on preprocessing pipelines for cerebro-cerebellar connectivity models.

Post-Baccalaureate Students

Dylan Benkley

Sep. - Dec. 2018

Psychology

- Dylan Benkley conducted a literature review on the role of the cerebellum in social cognition.

Skills

Programming Languages	Python, SQL, R, MATLAB, HTML, Bash
Frameworks and Tools	Keras, OpenCV, Git, Vim, Blender, Nipype, Deeplabcut, PsychoPy, Pandas, NumPy, Scikit-learn, Scipy
Conceptual	High performance computing (Savio), MRI certificate from Henry H. Wheeler Jr. Brain Imaging Center
Languages	English (Native), Irish (Native), French (Proficient), German (Basic)