

Em Heffernan, PhD

POSTDOCTORAL FELLOW

University of Toronto

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Summary

Insatiably curious electrical engineer turned computational neuroscientist with a passion for uncovering insights from complex data. With 5+ years of experience in experimentation, computational modelling, and statistical inference, I specialize in translating scientific concepts and results into clear, engaging narratives.

Skills

Programming: R, Python, MATLAB, Excel, BASH, Git, Javascript, Jupyter, SQL, TensorFlow, JAX, HTML

Research Methods: Experiment design, parametric and nonparametric statistics, A/B testing, regression

Other Tools: Prolific, Qualtrics, Microsoft Office, RStudio

Work Experience

Postdoctoral Fellow

APPLY GROUP, UNIVERSITY OF TORONTO

Mississauga, Ontario

September 2024–Present

- Currently exploring how **manipulating digital font** impacts a reader's ability to detect typos.
- In first 3 months in this role, conducted a literature review, developed an experiment in PsychToolbox (MATLAB), collected and analyzed pilot data in R, and prepared and submitted an abstract that was accepted for presentation at the Vision Sciences Society's 2025 meeting.
- Using **eye-tracking and drift-diffusion modelling** to evaluate how individual differences in search patterns change for easy- vs. hard-to-read fonts.

PhD Researcher

MACK LAB, UNIVERSITY OF TORONTO

Toronto, Ontario

September 2019–August 2024

- Designed experiments and collected, analyzed, and visualized data from hundreds of participants using R, Python, and MATLAB to explore how surprising information influences learning and attention (**7 peer-reviewed publications and over 50 citations**).
- Worked with behavioural and MRI data, neural networks, and statistical models (e.g., **linear and logistic regression, mixed-effects models, generalized additive models**) to evaluate human category learning and test predictions about hippocampal involvement.
- **Supervised and mentored**, on average, three undergraduate students each year; these students assisted with my own research and conducted independent projects under my guidance.

Copy Editor and Content Writer

LEARNEO

Remote

January 2019–Present

- Copyedited for Scribbr (2019–2024); my keen attention to detail helped me **edit over 250 academic works** (and over 1 million words!), with highly positive reviews from global clients.
- As a content writer at QuillBot (2024–Pres.), conduct **SEO analysis** and write research methods articles to inform and engage target audiences.
- Since I started writing research content at Quillbot, research category article **traffic has grown by 300%**, and my articles consistently achieve high rankings on Google (**4 currently ranked in the top 10**) with an 8.5% click-through rate to internal pages.

Teaching Assistant

UNIVERSITY OF TORONTO

Remote

August 2024–Present

- TAed courses in **statistics, cognitive science, and research methods**, developed and lead tutorials both in-person and online to make complex concepts accessible.
- **Evaluated and provided feedback** on hundreds of student assignments and exams, focusing on clarity, critical thinking, and methodological rigour.

Junior Account Executive

MICROSOFT

Mississauga, ON

June 2018–April 2019

- Advised law firm clients on Microsoft solutions, presenting on Azure and other products to address their business needs.
- Collaborated with a sales team to **develop strategies** for meeting quarterly targets, gaining insight into enterprise sales processes.

Projects

Learning exceptions to the rule in human and model

MACK LAB

- **Objective:** To better understand how people learn exceptions to the rule (e.g., bats fly, but aren't birds) and whether a neural network model of the hippocampus captures human behaviour.
- **What I Did:** Developed a behavioural task using Psychopy (Python), collected data, and analyzed performance in R using mixed-effects logistic regression. I also simulated my task with a neural network and used **representational similarity analysis** to explore activation in its hidden layers.
- **Outcomes:** Human and model performed better when exceptions were introduced after rule-followers. This work, published in Scientific Reports (19 citations), earned me the **Computational Modelling Award in Higher Level Cognition** at the international Cognitive Science Society Conference (2021).

Using mouse-tracking to explore attentional shifts during learning

MACK LAB

- **Objective:** To explore whether surprising information shifts a learner's attention and if this shift supports subsequent learning.
- **What I Did:** Designed a mouse-tracking task in JavaScript. Participants explored stimuli using their computer mouse and sorted them into categories. Using R, **analyzed the entropy of mouse movements**.
- **Outcomes:** Surprising information does elicit a shift in attention, but this shift only benefits learning if the surprising item is similar to previously encountered items. I **presented a talk** on this work at the 2023 CSBBCS conference and am currently preparing a manuscript for publication.

Comparing Diffusion MRI Preprocessing Pipelines

BUDDING MINDS LAB

- **Objective:** To assess how well two open-access diffusion MRI (dMRI) preprocessing pipelines eliminate motion in dMRI data.
- **What I Did:** Used SQL to query open-access pediatric dMRI datasets, then used a **high-performance computing cluster** to preprocess data with two separate pipelines. After controlling for confounds using generalized additive modelling in R, I evaluated residual motion artifacts.
- **Outcomes:** Both pipelines performed similarly, suggesting flexibility in preprocessing choices for pediatric MRI data. However, motion artifacts remained, emphasizing the importance of quantifying and reporting motion in dMRI studies.

Education

PhD, Computational Neuroscience

UNIVERSITY OF TORONTO

Toronto, Ontario

2020-2024

- **Dissertation:** What the...?! Transient Behavioural, Representational, and Attentional Shifts in the Face of Surprising Information
- **Scholarships:** NSERC CGS-D (105,000 CAD)

MA, Cognitive Psychology

UNIVERSITY OF TORONTO

Toronto, Ontario

2019-2020

- **Thesis:** The Impact of Learning Sequence on Performance in a Rule-Plus-Exceptions Categorization Task
- **Scholarships:** NSERC CGS-M (17,500 CAD), Ontario Graduate Scholarship (15,000 CAD; Declined)

BASc, Electrical Engineering

QUEEN'S UNIVERSITY

Kingston, Ontario

2013-2018

- **Capstone Project:** Robotics-Based Medical Simulator
- **Scholarships:** Chernoff Family Scholarship (60,000 CAD), Hydro One Women in Engineering Scholarship (5,000 CAD), Google Lime Connect Scholarship (5,000 USD), NSERC Undergraduate Student Research Award (4,500 CAD)