

Travis Monk, Ph.D.
Postdoctoral Researcher
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1. Education

- Ph.D., Applied Statistics/Zoology, University of Otago, New Zealand (exceptional thesis)
- M.Sc., Theoretical and Computational Neuroscience, 2007, University of Plymouth, UK (high distinction)
- B.Sc., Physics, 2006, Truman State University, USA (Departmental Honors, Cum Laude)

2. Publications

- T. Monk, S. Mani, P. Hurley, A. van Schaik. The time constant rule for neural change detection. *Neural Comput*, 2026.
- T. Monk, S. Mani, S. Afshar. Sequential analysis and its applications to neuromorphic engineering. *Front Neurosci*, 2026.
- S. Mani, P. Hurley, A. van Schaik, T. Monk. The leaky integrate-and-fire neuron is a changepoint detector for compound Poisson processes. *Neural Comput*, 2025.
- T. Monk et al. Electrical signaling beyond neurons. *Neural Comput*, 2024.
- T. Monk, A. van Schaik. Martingales and the fixation time of evolutionary graphs with arbitrary dimensionality. *R Soc Open Sci*, 2022.
- Md Islam, Y. Xu, T. Monk, S. Afshaar, A. van Schaik. Noise-robust Text-dependent Speaker Identification using Cochlear Models. *J Acoust Soc Am*, 2022.
- T. Monk, A. van Schaik. Martingales and the Characteristic Functions of Absorption Time on Bipartite Graphs. *R Soc Open Sci*, 2021.
- T. Monk, A. van Schaik. Wald's Martingale and the Conditional Distributions of Absorption Time in the Moran Process. *Proc R Soc A*, 2020.
- T. Monk. Martingales and the Fixation Probability of High-Dimensional Evolutionary Graphs. *J Theor Biol*, 2018.
- T. Monk, C. Savin, J. Lucke. Optimal Neural Inference of Stimulus Intensities. *Sci Rep*, 2018.
- T. Monk, C. Savin, J. Lucke. Neurons Equipped with Intrinsic Plasticity Learn Stimulus Intensity Statistics. *Adv Neural Inf Process Sys*, 2016.
- T. Monk, P. Green, M. Paulin. Martingales and Fixation Probabilities of Evolutionary Graphs. *Proc R Soc A*, 2014.
- T. Monk, M. Paulin, P. Green. Ecological Constraints on the Origin of Neurons. *J Theor Biol*, 2014.
- T. Monk, M. Paulin. Predation and the Origin of Neurons. *Brain Behav Evol*, 2014.
- E. P. Furlani, Y. Sahoo, K. Ng, J. C. Wortman, T. Monk. A Model for Predicting Magnetic Particle Capture in a Microfluidic Bioseparator. *Biomed Microdev* 2007.

3. Grants and Fundraising

- T. Monk, S. Afshar, D. Zahra. Angel investor. \$2,200,000 AUD. 26 June 2024 - Present. A neuromorphic golf launch monitor.
- P00024867 G. Cohen (PI), A. van Schaik, Y. Xu, M. Wang, T. Monk (CI). Australian Department of Defence. \$4,960,396 AUD. 22 Jan 2018 - 22 Dec 2022. Neuromorphic vision systems for next generation space situational awareness capabilities.

- P00025373 G. Cohen (PI), T. Monk, A. van Schaik, M. Wang, A. Nicholson (CI). Australian Department of Defence. \$264,833 AUD. 30 Oct 2018 - 31 May 2019. Reference pixel design for event-based imager.
- P0025351 G. Cohen (PI), T. Monk, A. van Schaik, M. Wang (CI). Australian Department of Defence. \$264,832 AUD. 01 Sep 2018 - 07 Dec 2018. Reference pixel design for event-based imager.
- T. Monk (PI). Australian Department of Education. \$24,500 AUD. 01 Oct 2016 - 31 Mar 2017. Neural changepoint detection.

4. Teaching and Supervision

- Mani, S. Spiking neurons are changepoint detectors. PhD thesis, Western Sydney University (current).
- Early animal evolution. Introduction to neuroscience guest lectures and laboratories. MSc module, Western Sydney University, 2022-present.
- Electrical signaling beyond neurons. Neural sensing guest lectures. MSc module, Western Sydney University, 2022-present.
- Changepoint detection. Neuromorphic algorithms guest lectures. MSc module, Western Sydney University, 2022-present.
- Andrew, E. Event-based probabilistic suffix trees. PhD thesis, Western Sydney University, passed September 2023.
- Islam, M. Auditory peripheral models in speaker identification. PhD thesis, Western Sydney University, passed June 2022.
- Probabilistic machine learning II. MSc module, Universität Oldenburg, spring semester 2016.
- Meister, M. Multilayer perceptrons implementing binary sparse coding. MSc thesis, Universität Oldenburg, passed Dec 2017.
- Luberadzka, J. A deep unsupervised network for uncertainty-based binaural source localization. MSc thesis, Universität Oldenburg, passed May 2016.

5. Skills

- Computational Neuroscience: Neural electrophysiology, cellular plasticity, non-neural electrical signaling, neuromorphic engineering
- Statistics: Changepoint detection, particle filtering, information theory, stochastic processes, martingales, sequential analysis
- Mathematical Biology: stochastic models of selection, birth-death processes, evolutionary graph theory
- Zoology: early animal evolution, phylogenetics, basal metazoan phyla, early trace fossil record, origin of predation
- Computer Programming: Python, Netlogo, L^AT_EX

6. Research Interests

- Sports applications of event sensors
- Stochastic models of evolutionary processes
- Probabilistic models of neural computation
- Implement Bayesian inference with networks of spiking neurons
- Design *in silico* neural changepoint detectors
- Neuroanatomy and neurophysiology of simple nervous systems

7. Research Experience

- Spiking neurons are changepoint detectors for compound spatiotemporal point processes. April 2024 - present, CI.
- Neural time constants and input spiking rates are related. July 2024 - present, CI.
- A neuromorphic golf launch monitor, November 2022 - present, CEO and co-founder ES Sports Pty Ltd.
- Leaky Integrate-and-Fire Neurons are Changepoint Detectors on Compound Poisson Processes, April 2023 - present, CI.
- Review of cellular stimulus transductions, January 2023 - May 2024, self-supervised.
- Barn Owl Auditory Neurons as Changepoint Detectors, March 2018 - present, under Prof. Andre van Schaik.
- Martingales and Evolutionary Graph Theory, Postdoctoral Position, March 2018 - present, under Prof. Andre van Schaik.
- Unsupervised Neural Networks for Pattern Recognition, Postdoctoral Position, December 2014-October 2017, under Prof. Jorg Lucke.
- The Early Evolutionary History of Nervous Systems and Implications for Neural Computation, Doctoral Thesis, February 2010-August 2014, under Dr. Michael Paulin.

8. References

- Prof. Andre van Schaik, postdoctoral advisor. a.vanschaik@westernsydney.edu.au
- Prof. Paul Hurley, colleague and co-author. paul.hurley@westernsydney.edu.au
- Assoc. Prof. Mike Paulin, PhD advisor. mike.paulin@otago.ac.nz