

Richard Hardstone

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Education:

- 04/2010 – 02/2016: VU University Amsterdam, Netherlands – **Neuroscience PhD**
Thesis: Neuronal oscillations as a critical phenomenon and its implications for information processing
Courses: Included functional neuroanatomy, cognitive neuroscience, statistics
- 09/2007 – 03/2010: Leiden University, Netherlands – Media Technology
Courses: Included neuroinformatics, cognitive neuroscience of language
- 09/2002 – 07/2006: Imperial College, London, England – **Computing MEng (Honours)**
Thesis: Policy prediction for swarm robotics
Courses: Included complexity, intelligent data and probabilistic inference

Employment:

- 12/2021 – Present: Laboratory for translational neurorecovery, Center for Neurotechnology and Neurorecovery, Dept. of Neurology, Massachusetts General Hospital, Boston
- 03/2016 – 08/2020: Perception and brain dynamics lab, Neuroscience Institute, NYU Grossman School of Medicine, NYU Langone Health, New York NY, Post-doctoral fellow
- 08/2015 – 02/2016: Perception and brain dynamics lab, National Institute of Neurological Disorders and Stroke, NIH, Bethesda MD, Pre-doctoral fellow
- 04/2010 – 03/2015: Neuronal oscillations and cognition lab, Dept. of Integrative Neurophysiology, VU University Amsterdam, Researcher
- 04/2005 – 09/2005: IT department, Intel International Group Ltd. Intern

Grants awarded:

- 04/2010: Neuroscience Campus Amsterdam: Young talent grant. 15 months funding to develop computational model of critical-state dynamics and neuronal oscillations

Published papers:

- **R. Hardstone**, M. Flounders, M. Zhu, and B.J. He 2022: Frequency-Specific Neural Signatures of Perceptual Content and Perceptual Stability. *ELife*, 11, e78108.
- M. Zhu, **R. Hardstone**, B.J. He 2022: Neural Oscillations Promoting Perceptual Stability and Perceptual Memory during Bistable Perception. *Scientific Reports* 12.1.
- **R. Hardstone**, M. Zhu, A. Flinker, L. Melloni, S. Devore, D. Friedman, P. Dugan, W.K. Doyle, O. Devinsky, B.J. He 2021: Long-term priors influence visual perception through recruitment of long-range feedback. *Nature communications* 12.1, 1-15.
- E.L. Juarez-Martinez*, J. Sprengers*, G. Cristian*, B. Oranje, D.M. van Andel, A.-E. Avramiea, **R. Hardstone**, G.J. van der Wilt, H.D. Mansvelder, R. Eijkemans, K. Linkenkaer-Hansen, H. Bruining 2021: Prediction of behavioral improvement through resting-state EEG and clinical severity in a randomized controlled trial testing bumetanide in autism spectrum disorder. *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging*. S2451-9022.
- B. Leeman-Markowski, **R. Hardstone**, L. Lohnas, B. Cowan, L. Davachi, W. Doyle, P. Dugan, D. Friedman, A. Liu, L. Melloni, I. Selesnick, B. Wang, K. Meador, O. Devinsky 2021: Effects of hippocampal interictal discharge timing, duration, and spatial extent on list learning. *Epilepsy & Behavior*, 123, 108209.
- A.-E. Avramiea*, **R. Hardstone***, J.-M. Lueckmann, J. Bim, H. D. Mansvelder, K. Linkenkaer-Hansen 2020: Pre-stimulus phase and amplitude regulation of phase-locked responses is maximized in the critical state. *eLife*, 9, e53016. (*Joint first author)
- H. Bruining*, **R. Hardstone***, E. Juarez-Martinez*, J. Sprengers*, A.-E Avramiea, S. Simpraga, S. Houtman, S.-S Poil, E. Dallares, S. Palva, B. Oranje, J. Palva, H. D. Mansvelder 2020. Measurement of excitation-inhibition ratio in autism spectrum disorder using critical brain dynamics. *Scientific Reports* 10, 9195. (*Joint first author)

- M.W. Founders, C. Gonzalez-Garcia, **R. Hardstone**, B.J. He 2019: Neural dynamics of visual ambiguity resolution by perceptual prior. *eLife*, 8, e41861.
- B. Diaz, **R. Hardstone**, H. D. Mansvelder, E. Van Someren & K. Linkenkaer-Hansen 2016: Resting-state subjective experience and EEG biomarkers are associated with sleep-onset latency. *Frontiers in Psychology*, 7, 492.
- B. Diaz, S. Van Der Sluis, J. Benjamins, D. Stoffers, **R. Hardstone**, H. D. Mansvelder, E. Van Someren, & K. Linkenkaer-Hansen 2014: The ARSQ 2.0 reveals age and personality effects on mind-wandering experiences. *Frontiers in Psychology*, 5, 271.
- B. Diaz, S. Van Der Sluis, S. Moens, J. Benjamins, F. Migliorati, D. Stoffers, A. Den Braber, S.-S. Poil, **R. Hardstone**, D. Van 't Ent, D. Boomsma, E. De Geus, H. D. Mansvelder, E. Van Someren, & K. Linkenkaer-Hansen 2013: The Amsterdam Resting-State Questionnaire reveals multiple Phenotypes of Resting-State Cognition. *Frontiers in Human Neuroscience*, 7, 446-446.
- **R. Hardstone**, S.-S. Poil, G. Schiavone., R. Jansen, V. V. Nikulin, H. D. Mansvelder, & K. Linkenkaer-Hansen 2012: Detrended fluctuation analysis: a scale-free view on neuronal oscillations. *Frontiers in Physiology*, 3, 1–13.
- S.-S. Poil*, **R. Hardstone***, H. D. Mansvelder, & K. Linkenkaer-Hansen 2012: Critical-state dynamics of avalanches and oscillations jointly emerge from balanced excitation/inhibition in neuronal networks. *The Journal of Neuroscience*, 32, 9817–23. (*Joint first author)

Book chapters:

- **R. Hardstone**, H. Mansvelder, K. Linkenkaer-Hansen 2014: The neuronal network oscillation as a critical phenomenon. *Criticality in neural systems*, 293-318, John Wiley & Sons.

Conference proceedings:

- MGH Clinical Research Day, Boston, MA, 2022: Persistent asymmetry of aperiodic resting-state neural activity in both cortical and sub-cortical strokes
- ASNR, St Louis, MS, 2022: Persistent asymmetry of aperiodic resting-state neural activity in both cortical and sub-cortical strokes
- SFN, San Diego CA, 2018: Neural signatures of perceptual content and memory trace during bistable perception
- Neuroscience Institute Retreat, Mohonk NY, 2017: Large scale neural dynamics in bistable perception
- Resting state conference, Boston MA, 2014: EEG correlates of resting state cognition
- Biomag, Halifax NS, 2014: Critical-state dynamics of neuronal oscillations leads to optimal range of evoked responses and information processing
- Biomag, Halifax NS, 2014: EEG correlates of resting state cognition
- Brainmodes, Amsterdam, 2013: Critical-state dynamics of spontaneous oscillations leads to optimal range of stimulus-evoked phase locking
- Criticality in Neural Systems, NIH Bethesda MD, 2012: Critical-state dynamics of avalanches and oscillations jointly emerge from balanced excitation/inhibition in neuronal networks
- FENS, Amsterdam, 2010: Multi-scale criticality in neuronal network models of ongoing oscillations

Talks:

- Group Meeting, Max Planck Institute, Leipzig, 2020: Non-invasive estimation of excitation/inhibition balance in humans
- iEEG Meeting, NYUMC, 2018: Resolving ambiguous perception through frequency-dependent feedforward and feedback communication
- Group Meeting talk, Neuroscience Institute, NYUMC, 2017: Large-scale neural dynamics in bistable perception
- iEEG Meeting, NYUMC, 2016: Neuronal population dynamics in bistable perception
- Department Seminar, CNCR VU Amsterdam, 2015: Implications of scale-free neuronal oscillations for perception and behaviour
- Post-doctoral candidate seminar, NINDS NIH Bethesda, 2015: Implications of scale-free neuronal oscillations for perception and behavior

- Graduate School Neurosciences Amsterdam Rotterdam, 2014: Understanding complex variability in stimulus response
- Swammerdam Master Class, University of Amsterdam, 2014: Stimulus-evoked responses depend on criticality of spontaneous neuronal oscillations
- Annual meeting, Neuroscience Campus Amsterdam, 2014: To make or break connections
- Foundations meeting, Radboud University, 2013: A scale-free view on neural dynamics

Patents:

- [PCT/NL2019/050167](#): Method of determining brain activity. Priority Date 16 March 2018

Teaching:

- 2011 – 2014 Human neurophysiology 2011-2014, VU University Amsterdam, Tutor
- 2011 – 2014 Advanced human neurophysiology, VU University Amsterdam, Tutor
- 2013 – 2015 Mind and machine, VU University Amsterdam, Tutor

Reviewer:

- Neuroimage
- Frontiers in computational neuroscience
- Journal of Neuroscience (with advisor)
- PNAS

Technical skills:

- Human neural recordings, stimulation, analysis: M/EEG (Experienced), ECOG (Experienced), fMRI (Basic), Laminar electrodes, UTAH array, Neuropace RNS (Basic), tDCS (Basic)
- Experiment software: Eprime, PsychToolbox, PsychoPy, Presentation
- Programming: Java (Experienced), Matlab (Experienced), C/C++ (Basic), Python (Basic)
- Development team Neurophysiological Biomarker Toolbox: www.nbtwiki.net
- Linux: Server administrator for Lab Servers
- High Performance Computing: SLURM, SGE scheduling

References:

- PhD Advisor: Klaus Linkenkaer-Hansen, PhD (k.linkenkaerhansen@vu.nl), PI in Dept. of Integrative Neurophysiology, CNCR, VU University Amsterdam
- Post-Doc Advisor: Biyu Jade He, PhD (biyu.he@nyulangone.org), PI in Neuroscience Institute, NYU Langone Health
- Post-Doc Advisor: David J. Lin, MD (dlin7@mgh.harvard.edu), Instructor, Department of Neurology, Massachusetts General Hospital