

W. Jeffrey Johnston

Postdoctoral researcher in the Center for Theoretical Neuroscience at Columbia University
Pronouns: he/they

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Research positions

2020 - present Postdoctoral researcher, Center for Theoretical Neuroscience, Columbia University
2015 - 2020 Graduate student, Freedman Lab, The University of Chicago
2014 Summer intern, Allen Institute for Brain Science
2010 - 2014 Research assistant, Saxe Lab, Massachusetts Institute of Technology
2013 - 2014 Research assistant, Interdisciplinary Affective Science Lab, Northeastern University
2011, 2013 Research assistant, Redwood Center for Theoretical Neuroscience, UC Berkeley
2012 - 2013 Research assistant, Relational Agents Group, Northeastern University

Education

2014 - 2020 PhD in Computational Neuroscience, The University of Chicago
Committee: David J. Freedman (adviser), Stephanie E. Palmer (chair), John H.R. Maunsell, and Edward Awh
2010 - 2014 BS in Computer Science and Cognitive Psychology with a minor in Mathematics, Northeastern University

Awards, honors, and fellowships

2021 Best dissertation award, Computational Neuroscience Program at The University Chicago
2018 - 2020 NIH Kirschstein National Research Service Award Individual Predoctoral Fellowship
2019 Brien O'Brien and Mary Hasten Scholarship to attend Methods in Computational Neuroscience at the Marine Biological Laboratory
2016 BSD Recruitment Travel Award, The University of Chicago
2016 Gordon Research Seminar Neurobiology of Cognition Travel Award
2015 - 2016 Pritzker Fellowship, The University of Chicago
2014 University Honors, Northeastern University
2014 Class Marshall, Northeastern University
2014 Summa Cum Laude, Northeastern University
2010 - 2014 Dean's List, Northeastern University
2010 - 2014 Dean's Scholarship, Northeastern University
2012 Undergraduate Life and Physical Sciences award, RISE 2012, Northeastern University

Advanced coursework

2019 Methods in Computational Neuroscience, Marine Biological Laboratory
2018 Janelia Junior Scientist Workshop on Theoretical Neuroscience

Teaching and service experience

2023 Co-organizer, "Are neurons interpretable? Disentangled representations and modularity in biological and artificial brains" COSYNE workshop
2022 - 2023 Mentor, Simons Undergraduate Research Fellowship program
2022 - present Lecturer, Seminar in Advanced Topics in Theoretical Neuroscience

2022 Mentor, Neuromatch Academy: Computational Neuroscience
 2021 - 2022 Center for Theoretical Neuroscience Diversity & Inclusion Committee
 2018 - 2020 Co-organizer, Computational Neuroscience Journal Club
 2018 Co-organizer, Undergraduate Systems Neuroscience Journal Club
 2018 Teaching assistant, Quantitative Biology Bootcamp 4, Marine Biological Laboratory
 2017 Member, UChicago Neuroscience Retreat Planning Committee
 2016, 2017 Teaching assistant, Brains! Outreach Program
 2016 Teaching assistant, Theoretical Neuroscience III: Statistics and Information Theory, Prof. Stephanie E. Palmer
 2016 Co-organizer, Python for Neuroscientists Workshop
 2015 Teaching assistant, Theoretical Neuroscience I: Single Neuron Dynamics and Computation, Prof. Nicolas Brunel
 2012 Tutor and grader, Fundamentals of Computer Science I
 2012 Tutor, Bootstrap Program, Orchard Gardens K-8 School, Boston, MA

Publications

** indicates equal contribution*

Peysakhovich B, Tetrack SM, Silva AA, Li S, Zhu O, Ibos G, Johnston WJ, Freedman DJ (in press) Primate superior colliculus is engaged in abstract higher-order cognition. *Nature Neuroscience*, available on bioRxiv: <https://doi.org/10.1101/2023.01.17.524416>

Alleman M, Panichello MF, Buschman TJ, Johnston WJ (2023) The neural basis of swap errors in working memory. *bioRxiv*, <https://doi.org/10.1101/2023.10.09.561584>

Johnston WJ, Fusi S (2023) Abstraction emerges naturally in networks trained to perform multiple tasks. *Nature Communications*, <https://doi.org/10.1038/s41467-023-36583-0>

Johnston WJ, Freedman DJ (2023) Redundant representations are required to disambiguate simultaneously presented complex stimuli. *PLOS Computational Biology*, <https://doi.org/10.1371/journal.pcbi.1011327>

Johnston WJ,* Fine JM,* Yoo SBM, Ebitz RB, Hayden BY (2023). Semi-orthogonal subspaces for value mediate a tradeoff between binding and generalization. *arXiv*, <https://doi.org/10.48550/arXiv.2309.07766>

Johnston WJ, Tetrack SM, Freedman DJ (2022) The lateral intraparietal area is preferentially engaged in directed tasks rather than undirected free behavior. *bioRxiv*, <https://doi.org/10.1101/2022.03.09.483625>

Johnston WJ, Palmer SE, Freedman DJ (2020) Nonlinear mixed selectivity produces noise-tolerant neural representations. *PLOS Computational Biology*, <https://doi.org/10.1371/journal.pcbi.1007544>.

Open Science Collaboration (2015) Estimating the reproducibility of psychological science. *Science*, <https://doi.org/10.1126/science.aac4716>

Open Science Collaboration (2012) An open, large-scale, collaborative effort to estimate the reproducibility of psychological science. *Perspectives on Psychological Science*, <https://doi.org/10.1177/1745691612462588>

Conference, workshop, and seminar talks

The emergence of abstract and modular representations in simple neural networks. University of Pittsburgh and Carnegie Melon postdoc seminar series, November 31, 2023.

Why is everything everywhere? Center for Theoretical Neuroscience Lab Meeting, Columbia University, August 14, 2023

The emergence of abstract and modular representations in simple neural networks. The Center for Neuroscience Imaging Research, Sungkyunkwan University, Suwon, South Korea, June 14, 2023

The emergence of abstract representations in simple neural networks. Gatsby Tri-Centre Meeting, Hawarden, Wales, June 13, 2023

Selection from working memory can lead to catastrophic misbinding errors. Dynamical Geometric Transformations workshop, COSYNE, March 14, 2023.

Selection from working memory can lead to catastrophic misbinding errors. Center for Theoretical Neuroscience Lab Meeting, Columbia University, March 1, 2022.

Understanding the tradeoff between generalization ability and stimulus binding through the geometry of the neural code. Center for Theoretical Neuroscience Lab Meeting, Columbia University, October 18, 2021.

Reliable and distributed computation in the brain. The University of Chicago, August 26, 2020

The lateral intraparietal area is preferentially engaged in directed tasks rather than undirected free behavior. Computational and Theoretical Neuroscience Seminar Series, Duke University, August 20, 2020

Noise robust and metabolically efficient neural representations within and across brain regions. Computation & Theory Group, Janelia Research Campus, March 19, 2020

Noise robust and metabolically efficient neural representations within and across brain regions. Center for Theoretical Neuroscience, Columbia University, February 13, 2020

Nonlinear mixed selectivity supports reliable neural computation. UChicago Recruitment Weekend, February 9, 2020

This or that: How the brain makes sense of multiple representations of the same thing. UChicago Neuroscience Student Talk series, April 15, 2019

Channel coding for neuroscientists. Janelia Junior Scientist Workshop for Theoretical Neuroscience, October 21-26, 2018

Nonlinear mixed selectivity produces noise-tolerant neural representations. Janelia Junior Scientist Workshop for Theoretical Neuroscience, October 21-26, 2018

Nonlinear mixed selectivity produces noise-tolerant neural representations. Gordon Research Seminar, Neurobiology of Cognition, July 21-22, 2018

Nonlinear mixed selectivity produces noise-tolerant neural representations. UChicago Neuroscience Student Talk series, April 9, 2018

Looking where we want to look: Relating neuronal and behavioral correlates of image familiarity. UChicago Neuroscience Student Talk series, April 17, 2017

Looking where we want to look: Relating neuronal and behavioral correlates of image familiarity. Gordon Research Seminar, Neurobiology of Cognition, July 23-24, 2016

Other conference presentations

Mehnoor K, Johnston WJ, Fusi S. Abstract representations emerge in linear networks trained to perform multiple tasks. Poster presented at: Simons Foundation Undergraduate Research Fellowship Symposium, April 17, 2023.

Johnston WJ, Fusi S. Modularity emerges in neural networks trained to perform context-dependent behavior. Poster presented at: COSYNE, March 9 - 12, 2023.

Alleman M, Panichello MF, Buschman TJ, Johnston WJ. Selection from working memory can lead to catastrophic misbinding errors. Poster presented at: COSYNE, March 17 - March 20, 2022

Johnston WJ, Fusi S. Abstract representations emerge naturally in neural networks trained to perform multiple tasks. Poster presented at: Simons Foundation Annual Meeting, March 11, 2022.

Johnston WJ, Freedman DJ. Solutions to the assignment problem balance tradeoffs between local and catastrophic errors. Poster presented at: COSYNE, February 27-March 1, 2020

Johnston WJ, Freedman DJ. Two tradeoffs between local accuracy and catastrophic errors in a solution to the representation assignment problem. Poster presented at: Society for Neuroscience, October 19-23, 2019

Peysakhovich B, Zhu O, Ibos G, Johnston WJ, Freedman DJ. Dissociating cognitive and sensory representations in posterior parietal cortex. Poster presented at: Society for Neuroscience, October 19-23, 2019

Johnston WJ, Mohan K, Freedman DJ. What goes where: Using stimulus representations from both visual streams to guide behavior. Poster presented at: Society for Neuroscience, November 3-7, 2018

Johnston WJ, Palmer SE, Freedman DJ. Nonlinear mixed selectivity produces noise-tolerant neural representations. Poster presented at: Gordon Research Conference, Neurobiology of Cognition, July 22-27, 2018

Johnston WJ, Palmer SE, Freedman DJ. Nonlinear mixed selectivity produces noise-tolerant neural representations. Poster presented at: COSYNE, March 1-4, 2018

Johnston WJ, Mohan K, Freedman DJ. Looking where we want to look: Relating neuronal and behavioral correlates of image familiarity. Poster presented at: Society for Neuroscience, November 12-16, 2016

Johnston WJ, Mohan K, Freedman DJ. Looking where we want to look: Relating neuronal and behavioral correlates of image familiarity. Poster presented at: Gordon Research Conference, Neurobiology of Cognition, July 24-29, 2016

Johnston WJ, Denman D, Gaudreault NG, Long B, Peng H, Blanche TJ. The path of least resistance: minimizing vascular damage from electrode array insertions. Poster presented at: Society for Neuroscience, October 17-21, 2015

Mohan K, Johnston WJ, Freedman DJ. Impact of visual familiarity on neuronal representations in inferotemporal cortex and behavior. Poster presented at: Society for Neuroscience, October 17-21, 2015

Johnston WJ, Bruneau E, Saxe R. Mind the gap: bridging the gap in intergroup empathy in arbitrary and real groups. Poster presented at: Northeastern University Research, Innovation, and Scholarship Expo, March 22, 2013

Johnston WJ, Koster-Hale J, Yazzolina L, Saxe R, Bedny M. To peek and to peer: “visual” verb meanings are largely unaffected by congenital blindness. Poster presented at: Northeastern University Research, Innovation, and Scholarship Expo, March 29, 2012