Grace W. Lindsay
Assistant Professor
Psychology and Data Science
New York University
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Education

Doctorate (PhD), Neurobiology and Behavior Program
Columbia University, New York, NY
December 2017

Bachelor of Science in Neuroscience
University of Pittsburgh, Pittsburgh, PA
May 2011

Positions Held

Assistant Professor September 2022- present
Psychology and Data Science, New York University.

Postdoctoral Research Fellow September 2019 - April 2022
Maternity Leave: Aug-Nov 2020, Apr-Sep 2022
Gatsby Computational Neuroscience Unit/Sainsbury Wellcome Center, in the labs of Maneesh Sahani and Tom Mrsic-Flogel/Sonja Hofer, University College London.

Postdoctoral Scientist January 2018-August 2019
Center for Theoretical Neuroscience, in the lab of Ken Miller, Columbia University.

Graduate Student September 2013-December 2017
Neurobiology and Behavior Program, in the lab of Ken Miller, Columbia University.

Research Fellow October 2011-July 2012
in the lab of Arvind Kumar, Bernstein Center for Computational Neuroscience in Freiburg im Breisgau.

Selected Publications

"Recent Advances at the Interface of Neuroscience and Artificial Neural Networks." Cohen, Yarden, Tatiana A. Engel, Christopher Langdon, Grace W. Lindsay, Torben Ott, Megan AK Peters, James M. Shine, Vincent Breton-Provencher, and Srikanth Ramaswamy. *Journal of Neuroscience* 42, no. 45 : 8514-8523 (2022).

"The neuroconnectionist research programme." Doerig, Adrien, Rowan Sommers, Katja Seeliger, Blake Richards, Jenann Ismael, Grace Lindsay, Konrad Kording et al. arXiv preprint arXiv:2209.03718 (2022).

"Bio-inspired neural networks implement different recurrent visual processing strategies than task-trained ones do." Grace W. Lindsay, Tom Mrsic-Flogel, and Maneesh Sahani. bioRxiv 2022.03.07.483196 (2022).

"Testing the Tools of Systems Neuroscience on Artificial Neural Networks." Grace W. Lindsay. arXiv:2202.07035 (2022).

"Divergent representations of ethological visual inputs emerge from supervised, unsupervised, and reinforcement learning" Grace W. Lindsay, Josh Merel, Tom Mrsic-Flogel, and Maneesh Sahani. arXiv:2112.02027 (2021).

"Attention in Psychology, Neuroscience, and Machine Learning." Grace W. Lindsay. *Frontiers in Computational Neuroscience* 14 (2020): 29.

"Convolutional neural networks as a model of the visual system: past, present, and future." Grace W. Lindsay. *Journal of Cognitive Neuroscience* (2020): 1-15.

"A unified circuit model of attention: Neural and behavioral effects." Grace W. Lindsay, Daniel B. Rubin, and Kenneth D. Miller. *bioRxiv* (2019).

"A deep learning framework for neuroscience." Blake A. Richards, Timothy P. Lillicrap, Philippe Beaudoin, Yoshua Bengio, Rafal Bogacz, Amelia Christensen, Claudia Clopath et al. *Nature neuroscience* 22, no. 11 (2019): 1761-1770.

"How biological attention mechanisms improve task performance in a large-scale visual system model" Grace W. Lindsay and Kenneth D. Miller. *eLife*. 2018 Oct 1;7. pii: e38105. doi: 10.7554/eLife.38105.

"Hebbian Learning in a Random Network Captures Selectivity Properties of the Prefrontal Cortex." Grace W. Lindsay, Mattia Rigotti, Melissa R. Warden, Earl K. Miller, and Stefano Fusi. *Journal of Neuroscience* 8 November 2017, 37 (45) 11021-11036.

"Parallel processing by cortical inhibition enables context-dependent behavior." Kishore V. Kuchibhotla, Jonathan V. Gill, Grace W. Lindsay, Eleni S. Papadoyannis, Rachel E. Field, Tom A. Hindmarsh Sten, Kenneth D. Miller, and Robert C. Froemke. *Nature Neuroscience* 20, no. 1 (2017): 62-71.

Funding

Marie Skłodowska-Curie Individual Fellowship (2019-2021)

Gatsby Unit/Sainsbury Wellcome Center Research Fellowship (2019-2022)

Google PhD Fellowship in Computational Neuroscience (2016-2018)

NSF Graduate Research Fellowship Honorable Mention (2013)

DAAD (Deutscher Akademischer Austausch Dienst) Study Scholarship for study at the Bernstein Center in Freiburg, Germany (2011-2012)

CBSG (Complex Biological Systems Group) Undergraduate Fellowship (2010-2011)

uPNC (Program in Neural Computation) Undergraduate Research Fellowship (2009-2010)

Conference Talks

*=invited

*"Applying representational analysis methods to networks trained with supervised, unsupervised, and reinforcement learning", Manhattan Representational Geometry Workshop, New York NY, January 2023.

*"Predicting mouse neural activity with models trained through supervised, unsupervised, and reinforcement learning", NeurIPS Sensorium Workshop, online, December 2022.

*"Visual processing in an embodied artificial rodent trained through reinforcement

learning", Montreal AI-Neuroscience Conference, Montreal/Virtual, December 2022.

*"Dissecting how recurrence helps processing of noisy images", Society for Neuroscience Meeting Minisymposium, San Diego CA, November 2022.

*"Exploring the function of different forms of visual recurrence with artificial neural networks", Optica Fall Vision Meeting, Rochester NY, October 2022.

*”Attention in deep learning and in neuroscience”, Workshop on Computational Cognition at Osnabrück University, online. October 2022.

*”Comparing visual representations learned through supervised, unsupervised, and reinforcement learning” CVPR Workshop: What can computer vision learn from visual neuroscience?, online. June 2022.

*“Transformation over Transmission: Shifting the Focus of the Information Metaphor in Computational Neuroscience” Philosophy of Science Association Conference, online. November 2021.

*“Hypothesis generation and testing in cognitive neuroscience with deep learning” European Society for Philosophy and Psychology, online. September 2021.

*“Discrete Symbols vs. Continuous Neurons” Numerous Numerosity Conference, online. May 2021.

*“Exploring the top-down signals needed for visual attention” Cognitive Neuroscience Society conference, online. March 2021.

*”Modeling the influence of feedback in the visual system” Shared Visual Representations in Human and Machine Intelligence, NeurIPS Workshop, online. December 2020.

*”Attention in neuroscience and machine learning” International Meeting on Artificial Intelligence and its Applications (RIIAA), online. August 2020.

*“Merging neural circuit models with deep learning” Cosyne Workshops, Breckenridge USA. March 2020.

*“Understanding the feedback needed for top-down attention” Workshop on Roles and Mechanisms of Cortico-cortical Feedback at EITN, Paris France, November 2019.

*“Combining neural circuit models with deep learning” ELLIS Meeting, Berlin Germany, September 2019.

*“Attention and Modeling of Cognitive Processes.” Organization for Human Brain Mapping (Educational Course), Rome Italy, June 2019.

*“The stabilized supralinear network captures neural and performance correlates of attention.” Gatsby Tri-Center Meeting, University College London, June 2019.

“How can we incorporate connectivity data into neural network models?” Cognitive Computational Neuroscience Meeting (Breakout Session), September 2018, Philadelphia USA.

*“Synthesizing Experimental Data with Circuit Models.” Cosyne Workshops, March

2018, Breckenridge USA.

"Understanding Biological Visual Attention Using Convolutional Neural Networks." Cognitive Computational Neuroscience Meeting 2017, New York City USA

"The stabilized supralinear network replicates neural and performance correlates of attention." Cosyne 2017, Salt Lake City USA

*"Studying visual attention in convolutional neural networks". Gatsby Tri-Center Meeting, University College London, June 2016.

*"Hebbian learning in a random network replicates pattern of selectivity seen in PFC". Gatsby Tri-Center Meeting, Columbia University, June 2015

*Invited seminar/lab speaker at: Bristol University, Brown University, Cambridge University, CogIST, Cold Spring Harbor, Deep Learning: Classics and Trends Online Seminar, Duke University, École Normale Supérieure, Harvard University, Imperial College London, Intel Labs, Janelia Research Campus, Max Planck Institute for Human Cognitive and Brain Sciences, MIT, Neural Mechanisms Online, Northwestern University, Oxford University, Royal Holloway (University of London), SISSA, Stanford University, SUNY Downstate, Tilburg University, University College London, University of Houston, University of Osnabrück, University of Sussex, and Van Vreeswijk Theoretical Neuroscience Seminar.

Teaching and Mentoring

Lecturer for Machine Learning for Climate Change, CDS Undergraduate Advanced Topics Course, Spring 2023.

Mentor for Simons Collaboration on the Global Brain Undergraduate Research Fellowship, October 2021-April 2022.

Mentor for Neuromatch Academy Summer School project, July 2021.

Mentor for ATHENA Talaria program (research project for female high school students), July 2021.

Teaching assistant for IBRO-Simons Computational Neuroscience Imbizo (South African summer school), January 2019 and 2020

Teaching assistant for "Introduction to Theoretical Neuroscience" Graduate Course, Columbia University, Spring 2017

Teacher and course developer for "Introduction to Programming with Python" and "Artificial Intelligence" for Upward Bound Summer Academy (serving under-represented high school students), Summer 2016

Lecturer and curriculum developer for "Quantitative Approaches for Experimental Neuroscientists" Graduate Course, Columbia University, Fall 2015 and Fall 2017

Teaching assistant for "Systems & Developmental Neuroscience" undergraduate course, Columbia University, January-May 2014

Teacher and course developer for Columbia Splash! program, November 2013-December 2017

Teacher and course developer for BRAINYAC programming course, June-July 2013

Mentor for Masters student internship, Bernstein Center, June 2012

Tutor for Quantitative Methods course, Bernstein Center, May 2012

Academic Service

Reviewer for *eLife*, *Nature Neuroscience*, *PLoS Computational Biology*, *Neural Computation*, *Journal of Neuroscience*, *PNAS*, *Nature Communications*, *NBDT,* NeurIPS, ICML, Cosyne, the Cognitive Computational Neuroscience conference, and several others

External member, PhD defense committee (Sushrut Thorat and Lynn Sörensen), 2022-2023.

Lab Lead, Beaver Lab at Collaborative Earth, 2022-present.

Member, CDS Faculty Fellow Search Comittee, 2022-2023.

Co-organizer, "Top-down interactions" workshop at Cosyne, 2023.

Reviewer/Panelist, National Science Foundation, 2022.

Curriculum Day Lead, Climatematch Academy, 2022-2023.

Co-organizer, "All Things Attention" workshop at NeurIPS, 2022.

Social Media Chair, Cosyne Conference 2022.

Co-chair, Cognitive Neuroscience Society conference symposium on neuroscience and machine learning, 2021

Executive board member, Neuromatch Academy, 2020

Organizer and moderator, Neuromatch 2.0 conference, 2020

Panel moderator, "Biological and Artificial Reinforcement Learning" NeurIPS Workshop, 2019 and 2020

Organizer for Breakout Session at the Cognitive Computational Neuroscience conference, 2018

Communications and Outreach

Author of *Models of the Mind: How physics, mathematics and engineering have shaped our understanding of the brain*, published May 2021 (Bloomsbury Sigma)

Chair of Communications and Outreach, Neuromatch Academy (massive online computational neuroscience summer school), April-July 2020.

Producer and co-host of *Unsupervised Thinking* (monthly podcast on neuroscience and AI), October 2015-January 2020.

Freelance science writer for the Simons Foundation and other outlets, May 2015-present.

Neuwrite (Neuroscience-Journalist Collaborative) member, February 2013-present.

Harvard BHI Essay Competition Winner, 2018.

ICVSS Essay Competition Winner, 2015.

Nerve Newsletter Staff Writer, February 2014-March 2016.

Columbia University Neuroscience Outreach, August 2012-November 2017

-Social Media Coordinator, 2013-2014 Academic Year