# Maggie Henderson, Ph.D

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*EMPLOYMENT*

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|---|---|
| 2024 – present | **Assistant Professor (starting September 2024)**<br>Psychology Department and Neuroscience Institute<br>Carnegie Mellon University, Pittsburgh, PA |
| 2021 – 2024 | **Postdoctoral Research Associate**<br>Neuroscience Institute<br>Carnegie Mellon University, Pittsburgh, PA<br>Supervisors: Dr. Leila Wehbe and Dr. Michael Tarr |

*EDUCATION*

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|---|---|
| 2015 – 2021 | **Ph.D in Neurosciences with a Specialization in Computational Neurosciences**<br>University of California, San Diego, La Jolla, CA<br>Supervisor: Dr. John Serences |
| 2011 – 2015 | **B.S. in Biological Sciences**<br>Concentration in Neurobiology and Behavior<br>Cornell University, College of Agriculture and Life Sciences, Ithaca, NY<br>Summa Cum Laude with Distinction in Research |

*PUBLICATIONS & PRE-PRINTS*

Zawar, R., Dewan, S., Luo, A.F., **Henderson, M.M.**, Tarr, M.J, & Wehbe, L. (2024). StableSemantics: A Synthetic Language-Vision Dataset of Semantic Representations in Naturalistic Images. *arXiv.* https://arxiv.org/abs/2406.13735

Yeung, J., Luo, A.F, Sarch, G., **Henderson, M.M.**, Ramanan, D., & Tarr, M.J. (2024). Neural Representations of Dynamic Visual Stimuli. *arXiv.* https://arxiv.org/abs/2406.02659

Luo, A.F., **Henderson, M.M.**, Tarr, M.J, & Wehbe, L. (2024). BrainSCUBA: Fine-Grained Natural Language Captions of Visual Cortex Selectivity. *Proceedings of the International Conference on Learning Representations (ICLR).* https://doi.org/10.48550/arXiv.2310.04420

**Henderson, M.M.**, Serences, J.T., & Rungratsameetaweemana, N. (2023). Dynamic categorization rules alter representations in human visual cortex. *bioRxiv (under review).* https://doi.org/10.1101/2023.09.11.557257

Luo, A.F., Wehbe, L., Tarr, M.J., & **Henderson, M.M.** (2023). Neural Selectivity for Real-World Object Size in Natural Images. *bioRxiv.* https://doi.org/10.1101/2023.03.17.533179

Luo, A.F., **Henderson, M.M.**, Wehbe, L., & Tarr, M.J. (2023). Brain Diffusion for Visual Exploration: Cortical Discovery using Large Scale Generative Models. *Proceedings of the Conference on Neural Information Processing Systems (NeurIPS); oral presentation*. https://doi.org/10.48550/arXiv.2306.03089

**Henderson, M.M.**, Tarr, M.J., & Wehbe, L. (2023). A texture statistics encoding model reveals hierarchical feature selectivity across human visual cortex. *Journal of Neuroscience.* https://doi.org/10.1523/JNEUROSCI.1822-22.2023

**Henderson, M.M.**, Tarr, M.J., & Wehbe, L. (2023). Low-level tuning biases in higher visual cortex reflect the semantic informativeness of visual features. *Journal of Vision.* https://doi.org/10.1167/jov.23.4.8

Jain, N., Wang, A., **Henderson, M.M.**, Lin, R., Prince, J.S., Tarr, M.J., & Wehbe, L. (2023*)*. Selectivity for food in human ventral visual cortex. *Communications Biology.* https://doi.org/10.1038/s42003-023-04546-2

Jinsi, O.*, **Henderson, M.M.***, & Tarr, M.J. (2023). Early experience with low-pass filtered images facilitates visual category learning in a neural network model. *PLOS ONE.* https://doi.org/10.1371/journal.pone.0280145

**Henderson, M.M**., Rademaker, R.L., & Serences, J.T. (2022). Flexible utilization of spatial- and motor-based codes for the storage of visuo-spatial information. *eLife.* https://doi.org/10.7554/eLife.75688

**Henderson, M.M**., & Serences, J.T. (2021). Biased orientation representations can be explained by experience with non-uniform training set statistics. *Journal of Vision.* https://doi.org/10.1167/jov.21.8.10

**Henderson, M.M**.*, Vo, V.A.*, Chunharas, C., Sprague, T.C., & Serences, J.T. (2019). Multivariate analysis of BOLD activation patterns recovers graded depth representations in human visual and parietal cortex. *eNeuro.* https://doi.org/10.1523/ENEURO.0362-18.2019

**Henderson, M.M**. & Serences, J.T. (2019). Human frontoparietal cortex represents behaviorally relevant target status based on abstract object features. *Journal of Neurophysiology.* https://doi.org/10.1152/jn.00015.2019

**Henderson, M.M**., Gardner, J., Raguso, R.A., & Hoffman, M.P. (2017). Trichogramma ostriniae (Hymenoptera: Trichogrammatidae) response to relative humidity with and without host cues. *Biocontrol Science and Technology.* https://doi.org/10.1080/09583157.2016.1262327

**Henderson, M.M**., Pinskiy, V., Tolpygo, A., Savoia, S., Grange, P., & Mitra, P. (2014). Automated placement of stereotactic injections using a laser scan of the skull. *arXiv.* https://doi.org/10.48550/arXiv.1410.5914

* These authors made equal contributions.

## *SELECTED PRESENTATIONS*

**Henderson, M.M.**, Wehbe, L., & Tarr, M.J. (2024). Using texture synthesis to identify the features supporting coarse and fine object categorization. Poster at Vision Sciences Society meeting, St. Pete Beach, FL.

Luo, A.F., **Henderson, M.M.**, Wehbe, L., & Tarr, M.J. (2024). Leveraging vision and language generative models to understand the visual cortex. Poster at Vision Sciences Society meeting, St. Pete Beach, FL.

**Henderson, M.M.**, Tarr, M.J., & Wehbe, L. (2023). A texture statistics encoding model reveals sensitivity to mid-level features across human visual cortex. Talk at Vision Sciences Society meeting, St. Pete Beach, FL. https://doi.org/10.1167/jov.23.9.5520

**Henderson, M.M.**, Tarr, M.J., & Wehbe, L. (2022). Informative associations between feature, spatial, and category selectivity in human visual cortex. Poster at Conference on Cognitive Computational Neuroscience, San Francisco, CA. https://doi.org/10.32470/CCN.2022.1043-0

Luo, A., Wehbe, L., Tarr, M.J., & **Henderson, M.M.** (2022). The Neural Representation of Real-World Object Size in Natural Images. Poster at Conference on Cognitive Computational Neuroscience, San Francisco, CA. https://doi.org/10.32470/CCN.2022.1136-0

**Henderson, M.M.**, Tarr, M.J., & Wehbe, L. (2022). Interpretable mid-level encoding models of human visual cortex reveal associations between feature and semantic tuning for natural scene images. Poster at Vision Sciences Society meeting, St. Pete Beach, FL. https://doi.org/10.1167/jov.22.14.4118

**Henderson, M.M**., & Serences, J.T. (2020). Anisotropic representation of orientation by convolutional neural networks. Talk at Vision Sciences Society meeting, held virtually. https://doi.org/10.1167/jov.20.11.224

**Henderson, M.M**., Rademaker, R.L., & Serences, J.T. (2019). Complementary strategies for encoding information in working memory. Nanosymposium talk at Society for Neuroscience meeting, Chicago, IL.

**Henderson, M.M**. & Serences, J.T. (2019). Orientation representations in convolutional neural networks are more discriminable around the cardinal axes. Poster at Conference on Cognitive Computational Neuroscience, Berlin, Germany. https://doi.org/10.32470/CCN.2019.1122-0

**Henderson, M.M**., Rademaker, R.L., & Serences, J.T. (2019). Complementary visual and motor-based strategies for encoding information in working memory. Talk at Vision Sciences Society meeting, St. Pete Beach, FL. https://doi.org/10.1167/19.10.91

**Henderson, M.M**., Serences, J.T. (2017). Occipital and parietal cortex encode representations of match between a viewed and sought object during visual target search. Poster at Vision Sciences Society meeting, St. Pete Beach, FL. https://doi.org/10.1167/17.10.1136

**Henderson, M.M**., Vo, V.A., Chunharas, C., Sprague, T.C., & Serences, J.T. (2016). Reconstructing 3D stimuli using BOLD activation patterns recovers hierarchical depth processing in human visual and parietal cortex. Poster at Vision Sciences Society meeting, St. Pete Beach, FL. https://doi.org/10.1167/16.12.298

**Henderson, M.M**., Gardner, J., & Raguso, R.A. (2015). Determining the optimal relative humidity conditions for release of the pest control agent Trichogramma ostriniae. Poster at Cornell Biology Honors Program Final Symposium, Ithaca, NY.

## *AWARDS AND HONORS*

National Eye Institute Early Career Scientist Travel Grant, Vision Sciences Society (2023)
Distinguished Postdoctoral Fellowship from CMU Neuroscience Institute (2021-2023)
NIMH Predoctoral Fellowship in Cognitive Neuroscience, Institute for Neural Computation (2018-2019)
NSF GRFP honorable mention (2016)
Cornell University Academic Excellence Award (2015)
Cornell Hatch Supplement Grant (2012)
Alpha Xi Delta Slaymaker-Kinsey Award for Academic Achievement (2012)

*TEACHING & MENTORSHIP*

**Guest Lecturer – Representation and Generation in Neuroscience and AI**, CMU (Spring 2024)
Gave lecture entitled “Models of early and mid-level vision” in a seminar course taught by Professor Leila Wehbe.

**Guest Lecturer – Research Methods in Psychology,** CMU (Spring 2023)
Gave a lecture entitled “Machine Learning for Cognitive Neuroscience and Psychology” in a graduate-level course on Research Methods, taught by Professor Laurie Heller.

**Mentoring/Supervising students, Carnegie Mellon** (2021 - ongoing).
Supervising undergraduate students in collection of online behavioral data, image dataset labeling, computational analysis of neural data.
Co-supervised the Honors Thesis project of a student in CMU Psychology Department (Omisa Jinsi), focused on neural network modeling. Weekly meetings including hands-on supervision. Student was awarded a competitive prize for her work.
Mentees include Owen Hershey, Gaurika Sawhney, Omisa Jinsi.

**Teaching assistant for Data Analysis in MATLAB**, UCSD (2016)
Teaching assistant for graduate level course taught by John Serences. Reviewed student code & algorithmic solutions to weekly problem sets on advanced topics in data analysis, such as bootstrapping & permutation statistics, time-frequency analysis, pattern classification, and nonlinear curve & surface fitting.

**Mentoring/Supervising students, UCSD** (2016 – 2021).
Trained undergraduate students to collect behavioral, eye-tracking, and EEG data for ongoing projects, as well as basic programming and data analysis skills. Hold journal-club style meetings to discuss relevant papers and involve students in the research process. Supervised the Honors Thesis project of one student.
Mentees include: Kelvin Lam (Honors Program; went on to a PhD program at UC Santa Barbara), Yonghoon Chun (received a Psychology Department Undergraduate Research Fellowship; currently a PhD student at Dartmouth), Vanessa Cancio, Ben Carfano, Shruti Nishith, Julie Eitzen.

**Project Advisor**, UCSD Neurosciences Graduate Program Bootcamp (2018).
Led a week-long project for incoming Ph.D. students, in which they collected fMRI data and carried out a multivariate encoding model analysis in MATLAB. Presented lectures covering the basics of fMRI physics, experimental design, and analysis, guided students through data analysis and presentation of results.

**Study group leader for Biology Scholars Program**, Cornell University (2014)
Led weekly study groups for students in the Cornell Biology Scholars Program, an initiative aimed at improving the experience of under-represented students in biology. Prepared review lectures, hands-on educational activities, quizzes, exam prep materials.

*SERVICE & OTHER ACTIVITIES*

**Mentor for CMU Paths to AI Research** (2024 - ongoing).
Provide individual mentoring and advice for CMU undergraduates as they pursue research in artificial intelligence and related areas.

**Open Science Program Advisory Board** (2024 – ongoing).
Member of advisory board for CMU Libraries Open Science Program.

**Organizing Carnegie Mellon brAIn Seminars** (2021 – 2023).
Co-organized a multi-university weekly seminar series on topics at the intersection of neuroscience and artificial intelligence. Responsibilities included selecting and inviting speakers, hosting and introducing presentations.

**Career Development Committee**, UCSD Neurosciences Graduate Program (2017–2020).

Facilitate career-building opportunities for graduate students, including networking workshops and Q&A panels with speakers from academic and non-academic career paths.

**Paths to PhDs Panelist**, UCSD Psychology Department (2019).
Served as a panelist at event for psychology undergraduates, answered questions about graduate school applications, gave advice for choosing programs and advisors.

**Neurosciences Seminar Series Committee**, UCSD Neurosciences Graduate Program (2017–2018)
Organize weekly Neuroscience Seminar Series – includes selecting list of invited speakers (28/year), inviting speakers, arranging travel, assigning student hosts.

## *OTHER ACADEMIC TRAINING*

Computational Neuroscience: Vision, Cold Spring Harbor Laboratory summer course (2018).

## *PROFESSIONAL ACTIVITIES*

Academic Memberships:
Vision Sciences Society (2016–present), Society for Neuroscience (2015–2019, 2023)

Ad-hoc reviewer:
Conference on Cognitive Computational Neuroscience, eNeuro, Nature Neuroscience, Communications Biology, Psychonomic Bulletin & Review, Journal of Experimental Psychology: General, Cognitive Research: Principles and Implications, Nature Communications, Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies, Visual Cognition

## *OTHER RESEARCH EXPERIENCE*

**UC San Diego**, La Jolla, CA (2016).
Rotation in the lab of Dr. Takaki Komiyama.
Collected GCaMP calcium imaging data from premotor cortex of awake, behaving mice during learning of a lever press task. Performed surgeries to implant cranial windows.

**UC San Diego**, La Jolla, CA (2016).
Rotation in the lab of Dr. Tatyana Sharpee.
Applied dimensionality reduction techniques (maximum noise entropy, maximally informative dimensions) to various data sets, including floral scent profiles and calcium imaging data.

**Cornell University**, Ithaca, NY (2012–2015).
Undergraduate thesis research, advised by Dr. Robert Raguso and Jeffrey Gardner.
Designed and carried out behavioral experiments investigating the use of the parasitic wasp species Trichogramma ostriniae as a biological pest control agent, and influence of environmental conditions such as humidity on parasitism efficacy.
Awarded an internal Cornell grant to fund this project.

**Cold Spring Harbor Laboratory**, Cold Spring Harbor, NY (2014).
Undergraduate summer research program, advised by Dr. Partha Mitra.
Developing a graphical software interface in MATLAB to automate the placement of stereotactic tracer injections, for use in the Mouse Brain Architecture Project.

**Uppsala University**, Uppsala, Sweden (2013)
Research assistant for Dr. Magne Friberg.
Used GC/MS analysis to identify compounds present in floral and leaf emissions of the flower Primula farinose.