Erica Lindsey Busch

Email: erica.busch@yale.edu   **Website:** ericabusch.github.io

Github: github.com/ericabusch   **LinkedIn:** linkedin.com/in/erica-busch

Education

Yale University   New Haven, Connecticut
PhD Candidate, Neuroscience   August 2020 – Present
Master of Philosophy   June 2023
Master of Science   December 2022
Advisors: Nick Turk-Browne, BJ Casey
Thesis topic: Manifold learning and real-time neurofeedback

Dartmouth College   Hanover, New Hampshire
BA in Cognitive Science, Computer Science   September 2016 – March 2020
Advisors: James Haxby, Caroline Robertson   *GPA: 3.82; Cum Laude*
Thesis (High honors): A deep learning approach to scene perception in autism

Centro Tinku Academic Center   Cusco, Peru
Dartmouth Department of Spanish and Portuguese   Fall 2017
Advanced Spanish Language Study Abroad

Publications

Journal articles and conference proceedings

Busch, E.L., Rapuano, K.M., Anderson, K.M., Rosenberg, M.D., Watts, R., Casey, BJ, Haxby, J.V., & Feilong, M. (2024). Dissociation of reliability, predictability, and heritability in fine- and coarse-scale functional connectomes during development. *Journal of Neuroscience.* 44(6), doi:10.1523/JNEUROSCI.0735-23.2023. Paper, Code.

Skalaban, L.J., Chan, I., Lin, Q., Rapuano, K.M., Conley, M.I., **Busch, E.L.**, Watts, R., Murty, V., & Casey, B.J. Representational dissimilarity of faces and places during a working memory task is associated with subsequent recognition memory during development. (2024). *Journal of Cognitive Neuroscience.* 36(3) 415-434, doi:10.1162/jocn_a_02094. Paper.

Busch, E.L., Yates, T.S., & Turk-Browne, N.B. (2023). Tasks constrain the intrinsic dimensionality of activity in non-selective cortex. *Proceedings of the 7th Annual Conference on Cognitive Computational Neuroscience.* Paper.

Busch, E.L., Huang, J., Benz, A., Wallenstein, T., Lajoie, G., Wolf, G., Krishnaswamy, S.*, & Turk-Browne, N.B.* (2023). Multi-view manifold learning of human brain-state trajectories. *Nature Computational Science.* 3(3), 240-253, doi:10.1038/s43588-023-00419-0. Paper, Analysis capsule, Pip package.

Busch, E.L. & Krishnaswamy, S. (2023). Revealing trajectories of the mind via non-linear manifolds of brain activity. *Nature Computational Science.* 3(3), 192-193, doi: 10.1038/s43588-023-00423-4. *Invited research briefing.*

Huang, J.*, **Busch, E.L.***, Wallenstein, T., Gerasimiuk, M., Benz, A., Lajoie, G., Wolf, G., Turk-Browne, N.B., & Krishnaswamy, S. (2022). Learning shared neural manifolds from multi-subject FMRI data. *Proceedings of the 32nd IEEE Machine Learning for Signal Processing.* doi:10.1109/MLSP55214.2022.9943383. Paper, arXiv.

Busch, E.L.*, Slipski, L.*, Feilong, M., Guntupalli, J.S., Visconti di Oleggio Castello, M., Huckins, J.F., Nastase, S.A., Gobbini, M.I., Wager, T.D., & Haxby, J.V. (2021). Hybrid hyperalignment: A single high-dimensional model of shared information embedded in cortical patterns of response and functional connectivity. *NeuroImage.* 233, 117975, doi:10.1016/j.neuroimage.2021.117975. Paper, Code.

In revision

Roskies, A., **Busch, E.L.**, & Walton, A. Agency as a framework for thinking about neuropsychiatric disease: A prelude to asking causal questions.

In preparation

Busch, E.L., Conley, M.I., & Baskin-Somers, A. The embedded brain: Using a joint neural and environmental manifold to predict youth mental health.

Busch, E.L., Lajoie, G., Krishnaswamy, S., & Turk-Browne, N.B. Learning on the manifold of human brain activity via real-time neurofeedback.

Busch, E.L., & Turk-Browne, N.B. Diverse tasks constrain and inflate intrinsic dimensionality of cortical activity.

Walton, A., **Busch, E.L.**, Ratoff, W., Smith, W., Holtzheimer, P., & Roskies, A. An assessment tool for understanding changes in agency with neurointerventions.

* Denotes equal contribution.

Grants		
Graduate Research Fellowship Program		2021-2024
National Science Foundation.		$147,000
Title: *Enhancing human learning along the neural manifold.*		
William H. Neukom Scholar Award		2020
Neukom Institute for Computational Science.		$1000
Research Experience for Undergraduates Grant		2019
National Science Foundation.		$5500
William H. Neukom Scholar Award		2019
Neukom Institute for Computational Science.		$1000
David C. Hodgson Endowment Award		2019
Dartmouth Undergraduate Award in Cognitive Neuroscience.		$5000
James O. Freedman Presidential Scholar Award		2018
Dartmouth Undergraduate Advising and Research.		$2000
Sophomore Research Scholar Award		2018
Dartmouth Undergraduate Advising and Research.		$1000

Awards and Honors	**Wu Tsai Travel Award, Society for Neuroscience Meeting**	2023
	Wu Tsai Institute, Yale University	
	Data competition; first prize team	2022
	Social and Affective Neuroscience Society	
	Outstanding Undergraduate Research Award	2020
	Neukom Institute for Computational Science; 2nd Prize	
	Made at Dartmouth Research Competition Winner	2020
	Dartmouth Undergraduate Advising and Research; Grand Prize	
	Academic Achievement Prize	2020
	Dartmouth College Cognitive Science Program	
	Fulbright Fellowship Finalist (Withdrew due to COVID-19)	2020
	Fulbright Committee	
	High Honors in Cognitive Science	2020
	Dartmouth College Cognitive Science Program	
	Citation for Academic Excellence in Machine Learning	2019
	Dartmouth College Department of Computer Science	
	Citation for Academic Excellence in Cognitive Neuroscience	2019
	Dartmouth College Department of Psychological and Brain Sciences	
	Citation for Academic Excellence in Intro to Programming	2017
	Dartmouth College Department of Computer Science	
	Dartmouth College Honors List	2017-2020
	National Merit Scholarship Finalist	2015

Talks	**ABCD Insights & Innovations Meeting, NIH Campus**	Mar. 2024
	Dissociable scales reflect reliable, heritable, and behaviorally-relevant individual differences in the developing connectome.	
	Society for Neuroscience Annual Meeting, Washington D.C.	Nov. 2023
	Nanosymposium on Neural Decoding and Neuroprosthetics	
	Learning on the manifold of human brain activity via real-time neurofeedback	
	Projects in Progress, Wu Tsai Institute	Nov. 2023
	Learning on the manifold of human brain activity via real-time neurofeedback	
	Shine Lab Meeting, University of Sydney	Apr. 2023
	Multi-view manifold learning of human brain-state trajectories.	
	Yale Brain Imaging Center Users Meeting	Oct. 2022
	Enhancing human learning along the neural manifold.	
	ABCD Imaging Analytics Working Group	Sept. 2022
	The LEGO theory of the developing functional connectome.	
	Current Works in Behavior, Genetics, and Neuroscience	Apr. 2022
	The LEGO theory of the developing functional connectome.	
	Guest lecture in NSCI 270: Yale University	Nov. 2021
	Advanced fMRI analysis techniques.	
	FINN Lab Meeting, Dartmouth College	Apr. 2021
	Hyperalignment: Foundations, flavors, and functions	

Posters and Presentations	**Busch, E.L.**, Yates, T.S., & Turk-Browne, N.B. (2023). Tasks constrain the intrinsic dimensionality of activity in non-selective cortex. *Poster at 7th Annual Conference on Cognitive Computational Neuroscience.*, Oxford, United Kingdom.

Busch, E.L., Bhaskar, D., Letrou, A., Zhang, X., Noah, J.A., Lajoie, G., Hirsch, J., Turk-Browne, N.B., Krishnaswamy, S. (2022). An encoder-decoder framework for cross-modal translation of brain imaging data. *Poster and selected lightning talk, Montreal AI-Neuroscience Meeting.* Montreal, QC, Canada.

Busch, E.L., Letrou, A., Huang, J., Lajoie, G., Wolf, G., Krishnaswamy, S., & Turk-Browne, N.B. (2022). A neural manifold learning framework for real-time fMRI neurofeedback. *Poster at Society for Neuroscience Annual Meeting.* San Diego, CA, USA.

Busch, E.L., Letrou, A., Huang, J., Lajoie, G., Wolf, G., Krishnaswamy, S., & Turk-Browne, N.B. (2022). A neural manifold learning framework for real-time fMRI neurofeedback. *Poster at Real-time Functional Imaging and Neurofeedback Meeting.* New Haven, CT, USA.

Busch, E.L., Rapuano, K.M., Anderson, K.M., Rosenberg, M.D., Watts, R., Casey, BJ, Haxby, J.V., & Feilong, M. (2022). Heritable template underlies reliable idiosyncrasies in the developing fine-scale connectome. *Poster at Organization for Human Brain Mapping Annual Meeting.* Glasgow, Scotland.

Letrou, A., **Busch, E.L.,** & Turk-Browne, N.B., (2022). Relating neural dynamics and emotion dynamics with nonlinear manifold learning. *Poster and talk at Social and Affective Neuroscience Society Annual Meeting.* Virtual.

Busch, E.L., Huang, J., Benz, A., Wallenstein, T., Lajoie, G., Wolf, G., Krishnaswamy, S., & Turk-Browne, N.B. (2021). Manifold learning to capture brain-state trajectories in fMRI. *Poster at Society for Neuroscience Annual Meeting.* Virtual.

Walton, A.E., Nizzi, M.C., West, B., Mofe, E., Roth, R.M., **Busch, E.L.,** Holtzheimer, P.E., & Roskies A.L. (2021). The impact of anxiety and depression on dimensions of agency. *Poster at Seventh Annual NIH BRAIN Initiative Annual Meeting.* Virtual.

Sivitilli, D.M., Weertman, W.L., **Busch, E.L.**, Ullmann, J.F., Smith, J.R., Gire, D.H. (2021). Strategies of single arm foraging in Octopus rubescens in the absence of visual feedback. *Poster at Society for Integrative and Comparative Biology.* Virtual.

Busch, E.L., Haskins, A.J., Isik, L., & Robertson, C.E. (2020) A deep learning approach to understanding real-world scene perception in autism. *Presidential Undergraduate Research Symposium, Dartmouth College.* Virtual.

Walton, A.E., **Busch, E.L.**, Ratoff, W., Smith, W., Holtzheimer, P.E., & Roskies, A.L. (2020). Developing an agency assessment tool for understanding changes in agency with neurointerventions: Preliminary results. *Sixth Annual NIH BRAIN Initiative Annual Meeting.* Virtual.

Botch, T.L., **Busch, E.L.**, & Robertson, C.E. (2020). Application of deep neural networks to model omnidirectional gaze behavior in immersive VR. *Vision Sciences Society Annual Meeting.* Virtual.

Busch, E.L., Sivitilli, D.M., & Gire, D.H. (2019). Using deep learning to model octopus arm motion. *Center for Neurotechnology Research Symposium, University of Washington.* Seattle, WA, USA.

Busch, E.L., Ma, F., Nastase, S.A., & Haxby, J.V. (2019). Individual differences in fine-grained neural correlates of mental states. *Wetterhahn Science Symposium, Dartmouth College.* Hanover, NH, USA.

Research experience	**Turk-Browne Lab**	2020 – Present
	Mentor: Nick Turk-Browne	Yale University

Research focus: Machine learning, real-time fMRI, neurofeedback, manifold learning.

Fundamentals of the Adolescent Brain (FAB) Lab   2020 – Present
Mentor: B.J. Casey   Yale University
Research focus: Computational models of heritability, functional connectivity, and neurocognition in adolescents.

Haxby Lab   2018 – 2020
Mentors: James V. Haxby and Feilong Ma   Dartmouth College
Research focus: Hyperalignment algorithms, naturalistic stimuli.

Robertson Lab   2019 – 2020
Mentor: Caroline Robertson   Dartmouth College
Research focus: Deep learning models of visual perception in autism.

Laboratory of Comparative Systems Neuroscience   Summer 2019
Mentor: David Gire   University of Washington
Research focus: Deep learning models of octopus foraging.

Teaching experience   **Teaching Fellow, Department of Psychology** Yale University Spring 2023
PSYC 258/558/NCSI 258: Computational methods in human neuroscience.

Teaching Fellow, Department of Psychology Yale University   Fall 2022
NSCI 160/PSYC 160: The human brain.

Teaching Fellow, Department of Psychology Yale University Spring 2022
PSYC 258/558/NCSI 258: Computational methods in human neuroscience.

Teaching Fellow, Department of Psychology Yale University   Fall 2021
PSYC 270 /NCSI 270: Research methods in cognitive neuroscience.

TA, Department of Computer Science Dartmouth College   Spring 2020
COSC 74: Machine learning and statistical data analysis

TA, Department of PBS Dartmouth College   Winter 2019
PSYC 6: Introduction to neuroscience

Peer Tutor, Tutor Clearinghouse Dartmouth College   2017 - 2020
SPAN 1-3 (Intro Spanish), SPAN 9 (Culture and Conversation: Advanced), SPAN 20 (Writing and Reading)
COSC 1 (Intro to Programming and Computation), COSC 10 (Object-Oriented Programming), COSC 50 (Software Design), COSC 74 (Machine Learning)
PSYC 6 (Intro to Neuroscience), PSYC 10 (Statistics)
COGS 1 (Intro to Cognitive Science)

Instructor, Sonia Kovalevsky Math Day Dartmouth College Spring 2018
Co-developed and facilitated workshop for young female students to learn the basics of cryptography.

College Access Coach, Let's Get Ready Summer 2017
Created and taught bi-weekly math and verbal SAT prep classes for NYC low-income high school students.

Private tutor 2012 – Present
Grade 3 - undergraduate
K-12: New York State Regents mathematics and sciences, English, writing, Spanish, history, Advanced Placement (AP) Calculus AB and BC, AP Statistics, AP Physics, AP Computer Science, SAT / ACT
Undergraduate: Algebra, graph theory, programming in Java, Spanish.

Service and outreach **Innovators in Cognitive Neuroscience** 2020–present
Founding member and Yale University coordinator for the Innovators in Cognitive Neuroscience speaker series.

Wu Tsai Institute 2022–present
Student-Postdoc Committee Fellow.

Yale Psychology Colloquium Committee 2021–2023
Yale Psychology Diversity Committee Sneak Peek 2021–2023
Graduate school application mentor.

SIBS Youth Mentoring Program 2016 – 2020
Dartmouth Center for Social Impact
Directed and mentored for a one-on-one youth mentorship program for Dartmouth undergrads and Upper Valley youth. Responsible for communication with mentors, parents, and social workers, and interviewing/training mentors.

Dartmouth Leadership, Attitudes, and Behaviors Program 2018 – 2019
Nelson A. Rockefeller Center for Public Policy
Facilitated student discussion groups about value-driven leadership, both on campus and in practice.

Reviewing Proceedings of the National Academy of Sciences of the United States of America; International Conference on Learning Representations; Proceedings on Cognitive Computational Neuroscience.

Other skills **Neuroimaging**: rt-cloud (Real-time fMRI with cloud computing), MRI operator certified, Magnetoencephalography experienced.
Software: BrainIAK Contributor, PyMVPA Contributor, FSL, FreeSurfer, AFNI.
Programming: Python, BASH, C, C++, C# for Unity, Java, MATLAB, R, HTML, Unity, PsychoPy, PsychToolbox, PyTorch, Keras, TensorFlow.
Languages: Spanish (fluent), Italian and Portuguese (intermediate)
Miscellaneous: Equestrian, freelance data science, running, hiking.