

# Erica Lindsey Busch

Updated December 5, 2023

**Email:** [erica.busch@yale.edu](mailto:erica.busch@yale.edu)

**Github:** [github.com/ericabusch](https://github.com/ericabusch)

**Website:** [ericabusch.github.io](https://ericabusch.github.io)

**LinkedIn:** [linkedin.com/in/erica-busch](https://linkedin.com/in/erica-busch)

## Education

### **Yale University**

PhD Candidate, Neuroscience

Master of Philosophy

Master of Science

Advisors: Nick Turk-Browne, BJ Casey

Thesis topic: Manifold learning and neurofeedback with fMRI

New Haven, Connecticut

August 2020 – Present

June 2023

December 2022

### **Dartmouth College**

BA in Cognitive Science, Computer Science

Advisors: James Haxby, Caroline Robertson

Thesis (High honors): A deep learning approach to scene perception in autism

Hanover, New Hampshire

September 2016 – March 2020

GPA: 3.82; Cum Laude

### **Centro Tinku Academic Center**

Dartmouth Department of Spanish and Portuguese

Advanced Spanish Language Study Abroad

Cusco, Peru

Fall 2017

## 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. Dissociation of reliability, predictability, and heritability in fine- and coarse-scale functional connectomes during development. (Accepted November 2023, *The Journal of Neuroscience*). [bioRxiv](#)

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. (Accepted November 2023, *Journal of Cognitive Neuroscience*)

**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 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	<b>Graduate Research Fellowship Program</b>	2021-2024
	National Science Foundation.	\$147,000
	Title: <i>Enhancing human learning along the neural manifold</i> .	
	<b>William H. Neukom Scholar Award</b>	2020
	Neukom Institute for Computational Science.	\$1000
	<b>Research Experience for Undergraduates Grant</b>	2019
	National Science Foundation.	\$5500
	<b>William H. Neukom Scholar Award</b>	2019
	Neukom Institute for Computational Science.	\$1000
	<b>David C. Hodgson Endowment Award</b>	2019
	Dartmouth Undergraduate Award in Cognitive Neuroscience.	\$5000
	<b>James O. Freedman Presidential Scholar Award</b>	2018
	Dartmouth Undergraduate Advising and Research.	\$2000
Awards and Honors	<b>Sophomore Research Scholar Award</b>	2018
	Dartmouth Undergraduate Advising and Research.	\$1000
	<b>Wu Tsai Travel Award, Society for Neuroscience Meeting</b>	2023
	Wu Tsai Institute, Yale University	
	<b>Data competition; first prize team</b>	2022
	Social and Affective Neuroscience Society	

<b>Outstanding Undergraduate Research Award</b>	2020
Neukom Institute for Computational Science; 2nd Prize	
<b>Made at Dartmouth Research Competition Winner</b>	2020
Dartmouth Undergraduate Advising and Research; <a href="#">Grand Prize</a>	
<b>Academic Achievement Prize</b>	2020
Dartmouth College Cognitive Science Program	
<b>Fulbright Fellowship Finalist</b> (Withdrew due to COVID-19)	2020
Fulbright Committee	
<b>High Honors in Cognitive Science</b>	2020
Dartmouth College Cognitive Science Program	
<b>Citation for Academic Excellence in Machine Learning</b>	2019
Dartmouth College Department of Computer Science	
<b>Citation for Academic Excellence in Cognitive Neuroscience</b>	2019
Dartmouth College Department of Psychological and Brain Sciences	
<b>Citation for Academic Excellence in Intro to Programming</b>	2017
Dartmouth College Department of Computer Science	
<b>Dartmouth College Honors List</b>	2017-2020
<b>National Merit Scholarship Finalist</b>	2015

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, B.J., 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.

#### Invited talks

**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  
*Hyperalignment: Foundations, flavors, and functions*

Apr. 2021

Research experience	<b>Turk-Browne Lab</b>	2020 – Present
	Mentor: Nick Turk-Browne	Yale University
	Research focus: Machine learning, real-time fMRI, neurofeedback.	
	<b>Fundamentals of the Adolescent Brain (FAB) Lab</b>	2020 – Present
	Mentor: B.J. Casey	Yale University
	Research focus: Computational models of heritability, functional connectivity, and neurocognition in adolescents.	
	<b>Haxby Lab</b>	2018 – 2020
	Mentors: James V. Haxby and Feilong Ma	Dartmouth College
	Research focus: Hyperalignment algorithms, naturalistic stimuli.	
	<b>Robertson Lab</b>	2019 – 2020
Teaching experience	Mentor: Caroline Robertson	Dartmouth College
	Research focus: Deep learning models of visual perception in autism.	
	<b>Laboratory of Comparative Systems Neuroscience</b>	Summer 2019
	Mentor: David Gire	University of Washington
	Research focus: Deep learning models of octopus foraging.	
	<b>Teaching Fellow, Department of Psychology</b> Yale University	Spring 2023
	PSYC 258/558/NCSI 258: Computational methods in human neuroscience.	
	<b>Teaching Fellow, Department of Psychology</b> Yale University	Fall 2022
	NSCI 160/PSYC 160: The human brain.	
	<b>Teaching Fellow, Department of Psychology</b> Yale University	Spring 2022
	PSYC 258/558/NCSI 258: Computational methods in human neuroscience.	
	<b>Teaching Fellow, Department of Psychology</b> Yale University	Fall 2021
	PSYC 270 /NCSI 270: Research methods in cognitive neuroscience.	
	<b>TA, Department of Computer Science</b> Dartmouth College	Spring 2020
	COSC 74: Machine learning and statistical data analysis	
	<b>TA, Department of PBS</b> Dartmouth College	Winter 2019
	PSYC 6: Introduction to neuroscience	
	<b>Peer Tutor, Tutor Clearinghouse</b> 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)	
	<b>Instructor, Sonia Kovalevsky Math Day</b> Dartmouth College	Spring 2018
	Co-developed and facilitated workshop for young female students to learn the basics of cryptography.	
	<b>College Access Coach, Let's Get Ready</b>	Summer 2017

	Created and taught bi-weekly math and verbal SAT prep classes for NYC low-income high school students.	
	<b>Private tutor</b>	2012 – Present
	<i>Grade 3 - undergraduate</i>	
	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	<b>Innovators in Cognitive Neuroscience</b>	2020–present
	Founding member and Yale University coordinator for the Innovators in Cognitive Neuroscience speaker series.	
	<b>Wu Tsai Institute</b>	2022–present
	Student-Postdoc Committee Fellow.	
	<b>Yale Psychology Colloquium Committee</b>	2021–2023
	<b>Yale Psychology Diversity Committee Sneak Peek</b>	2021–2023
	Graduate school application mentor.	
	<b>SIBS Youth Mentoring Program</b>	2016 – 2020
	<i>Dartmouth Center for Social Impact</i>	
	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.	
	<b>Dartmouth Leadership, Attitudes, and Behaviors Program</b>	2018 – 2019
	<i>Nelson A. Rockefeller Center for Public Policy</i>	
	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	<b>Neuroimaging</b>	
	rt-cloud (Real-time fMRI with cloud computing), MRI operator certified, Magnetoencephalography experienced.	
	Software: BrainIAK Contributor, PyMVPA Contributor, FSL, FreeSurfer, AFNI.	
	<b>Programming</b>	
	Python, BASH, C, C++, C# for Unity, Java, MATLAB, R, HTML.	
	Unity, PsychoPy, PsychToolbox, PyTorch, Keras, TensorFlow.	
	<b>Languages</b>	
	Spanish (fluent), Italian and Portuguese (intermediate)	
	<b>Miscellaneous</b>	
	Equestrian, freelance data science, running, hiking, paddling, reading fiction.	
	Extensive dog and rabbit-sitting credentials and enthusiasm.	