

# Erica Lindsey Busch

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Education	<b>Yale University</b>	August 2020 – Present
	PhD Candidate, Neuroscience	Department of Psychology
	Master of Philosophy, Master of Science Advisor: Nicholas Turk-Browne Thesis topic: Manifold learning and real-time neurofeedback	June 2023
	<b>Dartmouth College</b>	September 2016 – March 2020
	BA in Cognitive Science, Computer Science Advisors: James Haxby, Caroline Robertson Thesis topic: A deep learning approach to scene perception in autism	High Honors
	<b>Centro Tinku Academic Center</b>	August – November 2017
	Dartmouth Department of Spanish and Portuguese	Cusco, Peru
Awards and fellowships	ReproNim/INCF Fellowship	2024
	Google PhD Fellowship Finalist (Pending further notice)	2024
	Society for Neuroscience Meeting Travel Award, <i>Wu Tsai Institute</i>	2023
	Data Competition 1st Prize, <i>Social and Affective Neuroscience Society</i>	2022
	Graduate Research Fellowship Program, <i>National Science Foundation</i>	2021-2024
	Outstanding Undergraduate Research Award 2nd Prize, <i>Neukom Institute</i>	2020
	Made at Dartmouth Research Competition <a href="#">Grand Prize</a>	2020
	Academic Achievement Prize in Cognitive Science	2020
	Fulbright Fellowship Finalist (Withdrew due to COVID-19)	2020
	High Honors in Cognitive Science	2020
	William H. Neukom Scholarship Award, <i>Neukom Institute for Computational Science</i>	2020
	Citation for Academic Excellence in Machine Learning	2019
	Research Experience for Undergraduates Grant, <i>National Science Foundation</i>	2019
	Citation for Academic Excellence in Cognitive Neuroscience	2019
	William H. Neukom Scholarship Award, <i>Neukom Institute for Computational Science</i>	2019
	David C. Hodgson Endowment Award in Cognitive Neuroscience	2019
	James O. Freedman Presidential Scholar Award	2018
	Sophomore Research Scholar Award	2018
	Citation for Academic Excellence in Intro to Programming	2017
	Dartmouth College Honors List	2017-2020
	National Merit Scholarship Finalist	2015
Publications	<i>Peer-reviewed articles and conference proceedings</i>	
	<b>Busch, E.L.*</b> , Conley, M.I.*, & Baskin-Somers, A. Manifold learning uncovers nonlinear interactions between the adolescent brain and social environment that predict psychopathology. (Accepted, <i>Biological Psychiatry: Cognitive Neuroscience and Neuroimaging</i> ) <a href="#">Preprint</a> .	

**Busch, E.L.**, Fincke, E.C., Lajoie, G., Krishnaswamy, S., & Turk-Browne, N.B. Learning along the manifold of human brain activity via real-time neurofeedback. *Proceedings of the 8th Annual Conference on Cognitive Computational Neuroscience*. [Paper](#).

**Busch, E.L.**, Rapuano, K.M., Anderson, K.M., Rosenberg, M.D., Watts, R., Casey, B.J., 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*. [Article](#).

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., Visconti di Oleggio Castello, M., Huckins, J., Nastase, S., Gobbini, M.I., Wager, T., & Haxby, J. (2021). Hybrid hyperalignment: A single high-dimensional model of shared information embedded in cortical patterns of response and functional connectivity. *NeuroImage*. 233, doi:10.1016/j.neuroimage.2021.117975. [Paper](#), [Code](#).

#### *Manuscripts*

Roskies, A., **Busch, E.L.**, & Walton, A. Agency as a framework for thinking about neuropsychiatric disease: A prelude to asking causal questions. (In press, *Philosophical Issues in Psychiatry VI: Causal Concepts in Psychopathology*, Cambridge University Press).

Afrasiyabi, A., **Busch, E.L.**, Singh, R., Bhaskar, D., Capette, L., Turk-Browne, N.B., Krishnaswamy, S. Looking through the mind's eye via multimodal encoder-decoder networks. (Accepted, *Machine as Medium: Proceedings of the Center for Collaborative Arts and Media*, Fall 2024 Volume)

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

Afrasiyabi, A., Bhaskar, D., **Busch, E.L.**, Singh, R., Capette, L., Turk-Browne, N.B., Krishnaswamy, S. Spatiotemporal interlinking of brain modalities. (In prep)

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

\* Denotes equal contribution.

Invited Talks	<b>Kavli 20th Anniversary Symposium, New Haven, CT</b>	upcoming: Sept. 2024
	<i>Learning along the manifold of human brain activity via real-time neurofeedback</i>	
	<b>ABCD Insights &amp; Innovations Meeting, NIH Campus</b>	Mar. 2024
	<i>Dissociable dimensions reveal scales of individual differences in the functional connectome.</i>	
	<b>Projects in Progress, Wu Tsai Institute</b>	Nov. 2023
	<i>Learning on the manifold of human brain activity via real-time neurofeedback</i>	
	<b>Shine Lab Meeting, University of Sydney</b>	Apr. 2023
	<i>Multi-view manifold learning of human brain-state trajectories.</i>	
	<b>Yale Brain Imaging Center Users Meeting</b>	Oct. 2022
	<i>Enhancing human learning along the neural manifold.</i>	
	<b>ABCD Imaging Analytics Working Group</b>	Sept. 2022
	<i>The LEGO theory of the developing functional connectome.</i>	
Conference presentations	<b>Current Works in Behavior, Genetics, and Neuroscience</b>	Apr. 2022
	<i>The LEGO theory of the developing functional connectome.</i>	
	<b>Guest lecture in NSCI 270: Yale University</b>	Nov. 2021
	<i>Advanced fMRI analysis techniques.</i>	
	<b>FINN Lab Meeting, Dartmouth College</b>	Apr. 2021
	<i>Hyperalignment: Foundations, flavors, and functions</i>	
	<b>Busch, E.L., Conley, M.I., &amp; Baskin-Sommers, A. (2024).</b> Using manifold learning to uncover the embedded brain and implications for mental health in youth. <i>Poster accepted, Organization for Human Brain Mapping Annual Meeting.</i> Seoul, South Korea.	
	<b>Busch, E.L., Fincke, E.C., Lajoie, G., Krishnaswamy, S., &amp; Turk-Browne, N.B. (2024).</b> Learning on the manifold of human brain activity through real-time neurofeedback. <i>Poster accepted, Organization for Human Brain Mapping Annual Meeting.</i> Seoul, South Korea.	
	<b>Busch, E.L., Fincke, E.C., Lajoie, G., Krishnaswamy, S., &amp; Turk-Browne, N.B. (2023).</b> Learning on the manifold of human brain activity through real-time neurofeedback. <i>Talk at the Society for Neuroscience Annual Meeting Nanosymposium on Neural Decoding and Neuroprosthetics.</i> Washington, D.C., USA.	
	<b>Busch, E.L., Yates, T.S., &amp; Turk-Browne, N.B. (2023).</b> Tasks constrain the intrinsic dimensionality of activity in non-selective cortex. <i>Poster at 7th Annual Conference on Cognitive Computational Neuroscience.</i> , Oxford, United Kingdom.	
	<b>Busch, E.L., Bhaskar, D., Letrou, A., Zhang, X., Noah, J.A., Lajoie, G., Hirsch, J., Turk-Browne, N.B., Krishnaswamy, S. (2022).</b> An encoder-decoder framework for cross-modal translation of brain imaging data. <i>Poster and selected lightning talk, Montreal AI-Neuroscience Meeting.</i> Montreal, QC, Canada.	
	<b>Busch, E.L., Letrou, A., Huang, J., Lajoie, G., Wolf, G., Krishnaswamy, S., &amp; Turk-Browne, N.B. (2022).</b> A neural manifold learning framework for real-time fMRI neurofeedback. <i>Poster at Society for Neuroscience Annual Meeting.</i> San Diego, CA, USA.	
	<b>Busch, E.L., Letrou, A., Huang, J., Lajoie, G., Wolf, G., Krishnaswamy, S., &amp; Turk-Browne, N.B. (2022).</b> A neural manifold learning framework for real-time fMRI neurofeedback. <i>Poster at Real-time Functional Imaging and Neurofeedback Meeting.</i> 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*.

Roskies, A., Walton, A., Roth, R.M., **Busch, E.L.**, Holtzheimer, P.E., (2022). Measuring the dimensions of agency: A data-driven approach. *Poster at the Philosophy of Science Association*. Pittsburgh, PA.

**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*.

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*.

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*.

**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*.

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*.

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*.

**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

**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

Teaching experience	<b>Teaching Fellow, Department of Psychology</b> Yale University	Spring 2022 & 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	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>Sonia Kovalevsky Math Day Cryptography Instructor</b> Spring 2018 <b>College Access Coach, Let's Get Ready</b> Summer 2017 Created and taught SAT prep classes for NYC low-income high school students. <b>Private tutor</b> 2012–Present K-12: NY State Regents math and sciences, English, Spanish; AP: Calculus AB and BC, Statistics, Physics, Computer Science; SAT / ACT; UG: Algebra, graph theory, Spanish.
Service and outreach	<b>Trainee Committee, Cognitive Computational Neuroscience</b> 2024 <b>Innovators in Cognitive Neuroscience Organizer</b> (Founding member) 2020–present <b>Wu Tsai Institute Student-Postdoc Committee Fellow</b> 2022–present <b>Yale Psychology Colloquium Committee</b> 2021–2023 <b>Yale Psychology Diversity Committee Sneak Peek Mentor</b> 2021–2023 <b>DLAB Program Facilitator</b> (Nelson A. Rockefeller Center for Public Policy) 2018–2019 <b>SIBS Mentoring Program Director</b> (Dartmouth Center for Social Impact) 2016–2020 Directed and mentored for a one-on-one youth mentorship program for Dartmouth undergrads and Upper Valley youth. Coordinated parents and social workers and trained mentors.
Mentorship	<b>E. Chandra Fincke</b> (Yale undergraduate and honors thesis student) 2022–Present <b>David Lee</b> (Yale undergraduate and first-year fellow) 2024–Present <b>Ariadne Letrou</b> (Lab manager and postgraduate researcher) 2021–2023 <i>Now: PhD student, Princeton Psychology (PI: Ken Norman)</i> <b>Kyle Andruczk</b> (Yale undergraduate) 2022–2023
Reviewing	PNAS, Imaging Neuroscience, International Conference on Learning Representations (ICLR), Proceedings on Cognitive Computational Neuroscience (CCN).
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> Competitive equestrian, running, hiking, freelance data science.