Erica Lindsey Busch

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Education

Yale University — August 2020 – Present
PhD Candidate, Neuroscience — Department of Psychology
Master of Philosophy, Master of Science — June 2023
Advisor: Nicholas Turk-Browne
Thesis topic: Manifold learning and real-time neurofeedback

Dartmouth College — September 2016 – March 2020
BA in Cognitive Science, Computer Science — High Honors
Advisors: James Haxby, Caroline Robertson
Thesis topic: A deep learning approach to scene perception in autism

Centro Tinku Academic Center — August – November 2017
Dartmouth Department of Spanish and Portuguese — Cusco, Peru

Awards and fellowships

ReproNim/INCF Fellowship	2024
Society for Neuroscience Meeting Travel Award, *Wu Tsai Institute*	2023
Data Competition 1st Prize, *Social and Affective Neuroscience Society*	2022
Graduate Research Fellowship Program, *National Science Foundation*	2021-2024
Outstanding Undergraduate Research Award 2nd Prize, *Neukom Institute*	2020
Made at Dartmouth Research Competition Grand Prize	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, *Neukom Institute for Computational Science*	2020
Citation for Academic Excellence in Machine Learning	2019
Research Experience for Undergraduates Grant, *National Science Foundation*	2019
Citation for Academic Excellence in Cognitive Neuroscience	2019
William H. Neukom Scholarship Award, *Neukom Institute for Computational Science*	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

Peer-reviewed articles and conference proceedings

Busch, E.L.*, Conley, M.I.*, & Baskin-Somers, A. Manifold learning uncovers nonlinear interactions between the adolescent brain and social environment that predict psychopathology. (In Press, *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging*) Preprint.

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.

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).

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.

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. (*Machine as Medium: Proceedings of the Center for Collaborative Arts and Media*, Fall 2024 Volume)

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

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

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)

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

* Denotes equal contribution.

Invited Talks

Kavli 20th Anniversary Symposium, New Haven, CT upcoming: Sept. 2024
Learning along the manifold of human brain activity via real-time neurofeedback

ABCD Insights & Innovations Meeting, NIH Campus Mar. 2024
Dissociable dimensions reveal scales of individual differences in the functional connectome.

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

Conference presentations

Busch, E.L., Fincke, E.C., Lajoie, G., Krishnaswamy, S., & Turk-Browne, N.B. (2024) Learning along the manifold of human brain activity via real-time neurofeedback. *Oral Presentation, Real-time Functional Imaging and Neurofeedback Meeting.* Heidelberg, Germany.

Busch, E.L., Fincke, E.C., Lajoie, G., Krishnaswamy, S., & Turk-Browne, N.B. (2024) Learning along the manifold of human brain activity via real-time neurofeedback. *Contributed Talk and Poster at 8th Annual Conference on Cognitive Computational Neuroscience.* Cambridge, M.A., USA.

Busch, E.L., Conley, M.I., & Baskin-Sommers, A. (2024). Using manifold learning to uncover the embedded brain and implications for mental health in youth. *Poster, Organization for Human Brain Mapping Annual Meeting.* Seoul, South Korea.

Busch, E.L., Fincke, E.C., Lajoie, G., Krishnaswamy, S., & Turk-Browne, N.B. (2024). Learning on the manifold of human brain activity through real-time neurofeedback. *Poster, Organization for Human Brain Mapping Annual Meeting.* Seoul, South Korea.

Busch, E.L., Fincke, E.C., Lajoie, G., Krishnaswamy, S., & Turk-Browne, N.B. (2023). Learning on the manifold of human brain activity through real-time neurofeedback. *Talk at the Society for Neuroscience Annual Meeting Nanosymposium on Neural Decoding and Neuroprosthetics.* Washington, D.C., USA.

Busch, E.L., Yates, T.S., & Turk-Browne, N.B. (2023). Tasks constrain the intrinsic dimensionality of activity in non-selective cortex. *Poster, 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, 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, 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, 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, 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, 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, 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, 7th 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, 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. *6th 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 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.* 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.* Hanover, NH, USA.

Teaching experience

Instructor, Interdepartmental Neuroscience Program Yale University August 2024
fMRI Tutorial, INP First-Year Student Bootcamp.

Teaching Fellow, Department of Psychology Yale University Spring 2022 & 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 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)

Sonia Kovalevsky Math Day Cryptography Instructor Spring 2018

College Access Coach, Let's Get Ready Summer 2017

Private tutor 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

Trainee Committee, Cognitive Computational Neuroscience 2024

Innovators in Cognitive Neuroscience Organizer (Founding member) 2020–present

Wu Tsai Institute Student-Postdoc Committee Fellow 2022–present

Yale Psychology Colloquium Committee 2021–2023

Yale Psychology Diversity Committee Sneak Peek Mentor 2021–2023

DLAB Program Facilitator (Nelson A. Rockefeller Center for Public Policy) 2018–2019

SIBS Mentoring Program Director (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

E. Chandra Fincke (Yale undergraduate and honors thesis student) 2022–Present

David Lee (Yale undergraduate and first-year fellow) 2024–Present

Ariadne Letrou (Lab manager and postgraduate researcher) 2021–2023
Now: PhD student, Princeton Psychology (PI: Ken Norman)

Kyle Andruczk (Yale undergraduate) 2022–2023

Reviewing

PNAS, Imaging Neuroscience, International Conference on Learning Representations (ICLR), Proceedings on Cognitive Computational Neuroscience (CCN).

Other skills

Neuroimaging: rt-cloud (Real-time fMRI with cloud computing), MRI operator certified, MEG/EEG experienced. BrainIAK & 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: Competitive equestrian, pet enthusiast, runner, freelance data scientist.