

Sean Matthew Polyn, Ph.D.
Curriculum Vitae

A. Contact information

Sean Matthew Polyn

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B. Degrees earned

- B.A. (1995-1999) University of Virginia, Echols Interdisciplinary Program
- Ph.D. (2000-2005) Princeton University, May 2005. Psychology and Neuroscience.
Ph.D. Thesis: Neuroimaging, behavioral, and computational investigations of memory targeting. Jonathan D. Cohen and Kenneth A. Norman, co-advisors

C. Employment history

- Post-doctoral Fellow University of Pennsylvania, Department of Psychology
2005-2009 Mentor: Michael J. Kahana
- Assistant Professor Vanderbilt University, Department of Psychology
2009-present Center for Integrative & Cognitive Science
Vanderbilt Brain Institute
Secondary Appointment, Department of Psychiatry

D. Honors and Awards

- Echols Scholar, University of Virginia, 1995-1998
- Bachelor of Arts with Distinction, January 1999
- Departmental Teaching Prize – Princeton University Psychology Department,
Academic year 2003–04

Junior Faculty Teaching Fellowship, 2010, *Center for Teaching*, Vanderbilt University.

President of Southeastern Workers in Memory (SWIM), 2013.

E. Research

2. Articles in refereed journals

- 20) Lohnas, L. J., Polyn, S. M., Kahana, M. J. (in revision) Expanding the scope of memory search: Intralist and interlist effects in free recall.
- 19) Polyn, S. M., McCluey, J. D., Burke, J. F. (in revision) Altering the flow of mental time.
- 18) Kragel, J. E., and Polyn, S. M. (in press) Functional interactions between large-scale networks during memory search. *Cerebral Cortex*.
- 17) Polyn, S. M., and Sederberg, P. B. (2013) Brain rhythms in mental time travel. *NeuroImage*, 85, 678-684.
- 16) Miller, J. F., Neufang, M., Solway, A., Brandt, A., Trippel, M., Mader, I., Hefft, S., Merkow, M., Polyn, S. M., Jacobs, J., Kahana, M. J., Schulze-Bonhage, A. (2013) Neural activity in human hippocampal formation reveals the spatial context of retrieved memories. *Science*, 342, 1111-1114.
- 15) Morton, N. W., Kahana, M. J., Rosenberg, E. A., Baltuch, G. H., Litt, B., Sharan, A. D., Sperling, M. R., Polyn, S. M. (2013) Category-specific neural oscillations predict recall organization during memory search. *Cerebral Cortex*, 23 (10), 2407–2422.
- 14) Miller, J. F., Lazarus, E. M., Polyn, S. M., and Kahana, M. J. (2013) Spatial clustering during memory search. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 39 (3), 773–781.
- 13) Polyn, S. M., Kragel, J. E., Morton, N. W., McCluey, J. D., Cohen, Z. D. (2012) The neural dynamics of task context in free recall. *Neuropsychologia*, 50, 447–457.
- 12) Manning, J. M., Polyn, S. M., Baltuch, G., Litt, B., Kahana, M. J. (2011) Oscillatory patterns in temporal lobe reveal context reinstatement during memory search. *Proceedings of the National Academy of Sciences USA*, 108 (31), 12893–12897.
- 11) Sederberg, P. B., Gershman, S. J., Polyn, S. M., and Norman, K. A. (2011) Human memory reconsolidation can be explained using the Temporal Context Model. *Psychonomic Bulletin and Review*, 18 (3), 455–468.

- 10) Polyn, S. M., Erlichman, G., & Kahana, M. J. (2011) Semantic cuing and the scale-invariance of recency and contiguity. *Journal of Experimental Psychology: Learning, Memory & Cognition*, 27 (3), 766–775.
- 9) Lohnas, L. J., Polyn, S. M., & Kahana, M. J. (2011) Contextual variability in free recall. *Journal of Memory and Language*, 64, 249–255.
- 8) Polyn, S. M., Norman, K. A., & Kahana, M. J. (2009) Task context and organization in free recall. *Neuropsychologia*, 47 (11), 2158-2163.
- 7) Polyn, S. M., Norman, K. A., & Kahana, M. J. (2009) A context maintenance and retrieval model of organizational processes in free recall. *Psychological Review*, 116 (1), 129-156.
- 6) Polyn, S. M. & Kahana, M. J. (2008) Memory search and the neural representation of context. *Trends in Cognitive Science*, 12 (1), 24-30.
- 5) Norman, K. A., Polyn, S. M., Detre, G. J., and Haxby, J. V. (2006) Beyond mind reading: Multi-voxel pattern analysis of fMRI data. *Trends in Cognitive Science*, 10 (9), 424-430.
- 4) Norman, K. A., Newman, E., Detre, G., and Polyn, S. M. (2006) How inhibitory oscillations can train neural networks and punish competitors. *Neural Computation*, 18, 1577-1610.
- 3) Polyn, S. M., Natu, V. S., Cohen, J. D., and Norman, K. A. (2005) Category-specific cortical activity precedes retrieval during memory search. *Science*, 310, 1963-1966.
- 2) Polyn S., Levy W.B. (2001) Dynamic control of inhibition improves performance of a hippocampal model. *Neurocomputing*, 38-40, 823-829.
- 1) Polyn S., Wu X.B., Levy W.B. (2000) Entorhinal / dentate excitation of CA3: A critical variable in hippocampal models. *Neurocomputing*, 32-33, 493-499.

3. Book chapters

- 3) Pachur, T., Raaijmakers, J. G. W., Davelaar, E. J., Daw, N. D., Dougherty, M. R., Hommel, B., Lee, M. D., Polyn, S. M., Ridderinkhof, K. R., Todd, P. M., and Wolfe, J. M. (2012). Unpacking cognitive search: mechanisms and processes. In P. M. Todd, T. T. Hills, and T. W. Robbins (Eds.), *Cognitive Search: Evolution, Algorithms, and the Brain*. (pp. 237-254). Cambridge, MA: MIT Press.
- 2) Kahana, M. J., Howard, M. W., & Polyn, S. M. Associative Processes in Episodic Memory. In H. L. Roediger, III, editor, *Cognitive psychology of memory. Vol. 2 of Learning and memory: A comprehensive reference, 4 vols. (J. Byrne, Editor)*. Elsevier, Oxford, 2008.

- 1) Norman, K. A., Detre, G. J., and Polyn, S. M. Computational models of episodic memory. In R. Sun, editor, *The Cambridge Handbook of Computational Psychology*. Cambridge University Press, Cambridge, 2008.

4. Research grants received

National Science Foundation research grant. Project title: Neural Mechanisms of Memory Targeting (Proposal #1157432). Period of award: 1/1/2012–12/31/2014. Direct costs: \$266,609. Indirect costs: \$142,010. Principal Investigator: Sean M. Polyn.

Vanderbilt University Discovery Grant. Project title: Using an integrative model of human memory to understand schizophrenia. Period of award: 5/11/2012–6/30/2014. Total funding: \$100,000. Principal Investigator: Sean M. Polyn; with Co-PIs Sohee Park and Stephan Heckers.

Postdoctoral National Research Service Award. Prefrontal and medial temporal contributions to memory. National Institute of Mental Health (F32 MH078513). Award dates: 07/01/2006–06/30/2009. Funded.

Predoctoral National Research Service Award. Prefrontal and medial temporal contributions to memory. National Institute of Mental Health (F31 MH070177). Award dates: 09/29/2003–05/31/2005. Funded.

National Science Foundation Graduate Research Fellowship, 2000-2003. NSF Fellowship grant. Funded.

5. Research grants currently under review

National Institute of Mental Health R01 proposal. Project title: Brain Networks and Representational Structure in Episodic Memory. Proposed award period: 12/01/2014–11/30/2019.

6. Invited presentations

Context and Episodic Memory Symposium, “Neural correlates of memory targeting in free recall.” New Orleans, LA, Nov. 2003.

Context and Episodic Memory Symposium, “Memory targeting in free recall.” Philadelphia, PA, March 2005.

Center for Functional Neuroimaging, University of Pennsylvania School of Medicine, “Tracking memory search and retrieval in an fMRI study of free recall.” Philadelphia, PA, Feb. 2006.

Pattern classification minisymposium at Vision Science Society conference, “Tracking category-specific stimulus representations during memory search.” Sarasota, FL, May, 2007.

Context and Episodic Memory Symposium, “The interaction of task context and temporal context in free recall.” Tampa, FL, Jan., 2008.

Spatial Cognition workshop, “Mental travel through space and time: Spatial organization in free recall.” Freiburg, Germany, Sept., 2008. All costs covered.

Memory Disorders Research Society meeting, "Models of context and memory." Chapel Hill, NC, Sept., 2009.

Context and Episodic Memory Symposium, “Extending the context maintenance and retrieval model of free recall.” Philadelphia, PA, Apr., 2010.

Winter Conference on the Neurobiology of Learning and Memory, “Memory search and the neural representation of context.” Park City, UT, Jan., 2011.

Context and Episodic Memory Symposium, “Neural correlates of organization and distinctiveness.” Philadelphia, PA, May 2011.

Memory Disorders Research Society meeting, "Neural signals revealing the organization of memory." Barcelona, Spain, Sept., 2011.

Memory Disorders Research Society meeting, "Competition, contiguity, and context: Multivariate techniques revealing the dynamics of memory search." Davis, CA, Sept., 2012.

Duke University Institute for Brain Sciences, invited colloquium speaker, “Neural signals revealing the organization of memory.” Durham, NC, Nov., 2012.

Miami University of Ohio, invited colloquium speaker, “Neural signals revealing the organization of memory.” Oxford, OH, Apr., 2013.

Medical Research Council, Cognition and Brain Sciences Unit, invited speaker, Memory & Perception group, “Neural signals revealing the organization of memory.” Cambridge, UK, May 2013.

Context and Episodic Memory Symposium, “Incorporating neural signals into computational models of memory search.” Philadelphia, PA, May 2013.

Memory Disorders Research Society meeting, “Incorporating multivariate neural signal into computational models of memory search.” Toronto, Ontario, October 2013.

7. Conference presentations

Polyn, S., Wu, X. B., Levy, W. B. Entorhinal / dentate excitation of CA3: A critical variable in hippocampal models. (1999, July) Eighth Annual Computational Neuroscience Meeting.

Polyn S., Levy W. B. Dynamic control of inhibition improves performance of a hippocampal model. (2000, July) Ninth Annual Computational Neuroscience Meeting.

Polyn, S. M., Norman, K. A., Cohen, J. D. Connectionist modeling of source memory phenomena. (2002, November) Society for Neuroscience 32nd Annual Meeting.

Polyn, S. M., Norman, K. A. & Cohen, J. D. Modeling prefrontal and medial temporal contributions to episodic memory. (2003, March) Tenth Annual Meeting of the Cognitive Neuroscience Society.

Polyn, S. M., Nystrom, L. E., Norman, K. A., Haxby, J. V., Gobbini, M. I. & Cohen, J. D. (2004). Using neural network algorithms to investigate distributed patterns of brain activity in fMRI. Human Brain Mapping conference, Budapest, Hungary.

Polyn, S. M., Cohen, J. D. & Norman, K. A. (2004) Detecting distributed patterns in an fMRI study of free recall. Society for Neuroscience conference, San Diego, CA.

Norman, K. A., Newman, E. L., Detre, G. J. & Polyn, S. M. (2004). How theta oscillations can train neural networks and punish competitors. Cognitive Neuroscience conference, San Francisco, CA.

Norman, K. A., Newman, E. L., Detre, G. J. & Polyn SM (2004). How inhibitory oscillations can train neural networks and punish competitors. Computational and Systems Neuroscience conference, Cold Spring Harbor, NY.

Lenartowicz, A., Detre, G. J., Polyn, S. M., Chein, J., Yeung, N., Nystrom, L. E., Norman, K. A. & Cohen, J. D. (2005) Characterization of brain states during task-switching using a neural network classifier. Cognitive Neuroscience Society conference, New York, NY.

Polyn, S. M., Detre, G. J., Takerkart, S., Natu, V., Benharrosh, M., Singer, B., Cohen, J. D., Haxby, J. V. & Norman, K. A. (June, 2005) A Matlab-based toolbox to facilitate multi-voxel pattern classification of fMRI data. Annual Meeting of the Organization of Human Brain Mapping, Toronto, Canada.

Polyn, S. M., Norman, K. A., & Kahana, M. J. (Nov., 2006) Tracking the stimulus representation in an fMRI study of free recall. Society for Neuroscience conference, Atlanta, GA.

Polyn, S. M., Morton, N. W., Kogen, D. K., Norman, K. A., & Kahana, M. J. (Nov., 2006) Task effects on memory accessibility in free recall. Psychonomic Society annual meeting, Houston, TX.

Polyn, S. M., Norman, K. A., & Kahana M. J. (July, 2006) Context and episode in a model of human memory. Society for Mathematical Psychology meeting, Vancouver, BC.

Polyn, S. M., Morton, N. W., Kogen, D., Norman, K. A., & Kahana, M. J. (May, 2007) Task context and memory accessibility in free recall. Cognitive Neuroscience conference, New York, NY.

Polyn S. M., & Kahana M. J. (2007) The interaction of task context and temporal context in memory search. Society for Mathematical Psychology conference, Irvine, CA.

Miller J. F., Polyn S. M., & Kahana M. J. (2007) Clustering by spatial proximity during memory search. Society for Mathematical Psychology conference, Irvine, CA.

Polyn, S. M., Koshkin, V. S., Morton, N. W & Kahana, M. J. (2007) Tracking category-related neural patterns during free recall using scalp EEG. Society for Neuroscience conference, San Diego, CA.

Morton, N. W, Polyn, S. M. & Kahana, M. J. (2007) Tracking encoding task context during free recall using scalp EEG. Society for Neuroscience conference, San Diego, CA.

Polyn S. M., Norman K. A., & Kahana M. J. (2008) Context maintenance and retrieval: A model of episodic and semantic organization in free recall. Society for Mathematical Psychology meeting, Washington, DC.

Morton, N. W, Burke, J. F., Hollidge, B. S., Polyn, S. M., Kahana, M. J. (Jul., 2008) Recency and contiguity in a temporal-context model of paired-associate learning. Society for Mathematical Psychology meeting, Washington DC.

Polyn, S. M., & Kahana, M. J. (Nov., 2008) Bridging cognitive and neural theories of memory search with the Context Maintenance and Retrieval model. Society for Neuroscience conference, Washington, DC.

Polyn, S. M., Morton, N. W, & Kahana, M. J. (Oct., 2009) Unraveling subsequent memory: Tracking category-specific and category-general neural patterns using scalp EEG. Society for Neuroscience conference, Chicago, IL.

Polyn, S. M., Erlichman, G. & Kahana, M. J. (Nov., 2009) The persistence of recency: Extending context-based models of free recall. Psychonomic Society annual meeting, Boston, MA.

Lohnas, L. J., Polyn, S. M. & Kahana, M. J. (Nov., 2009) Encoding variability revisited in the spacing and lag effects of free recall. Psychonomic Society annual meeting, Boston, MA.

Lohnas, L. J., Polyn, S. M. & Kahana, M. J. (Apr., 2010) A computational model of interlist effects in free recall. Context and Episodic Memory Symposium, Philadelphia, PA.

- Morton, N. W & Polyn, S. M. (Apr., 2010) Illuminating the dynamics of memory search: Tracking category-related oscillations during free recall. Context and Episodic Memory Symposium, Philadelphia, PA.
- Morton, N. W & Polyn, S. M. (Nov., 2010) Illuminating the dynamics of memory search: Tracking category-related oscillations during free recall. Society for Neuroscience meeting, San Diego, CA.
- Cohen, Z. D., Morton, N. W & Polyn, S. M. (Nov., 2010) Using the context maintenance and retrieval model to interpret task-related neural activity in free recall. Society for Neuroscience meeting, San Diego, CA.
- Manning, J. R., Polyn, S. M. & Kahana, M. J. (Nov., 2010) A neural signature of mental time travel. Society for Neuroscience meeting, San Diego, CA.
- Polyn, S. M., Morton, N. W & Kahana, M. J. (Nov., 2010) Using intracranial oscillatory patterns to bridge cognitive and neural theories of memory search. Society for Neuroscience meeting, San Diego, CA.
- Polyn, S. M., Kragel, J. E., McCabe, K. E., McCluey, J. D. & Morton, N. W. (Nov. 2011) Neural and cognitive dynamics of source context in memory search and task switching. Psychonomic Society Annual Meeting, Seattle, WA.
- Polyn, S. M., Morton, N. W., & Kahana, M. J. (Mar., 2012) Category-specific neural oscillations predict recall organization during memory search. Cognitive Neuroscience Society Annual Meeting, Chicago, IL.
- Polyn, S. M. (July, 2012) Using the Context Maintenance and Retrieval model to interpret the neural phenomena of memory search. Society for Mathematical Psychology Annual Meeting, Columbus, OH.
- Polyn, S. M., McCluey, J. D., Geoghegan, M. F., Bullard, Z. R., Woolard, A. A., Luksik, A. S. & Heckers, S. (Oct., 2012) Organizational impairment of memory search in schizophrenia. Society for Neuroscience Annual Meeting, New Orleans, LA.
- Morton, N. W, Polyn, S. M. (Nov., 2012) Manipulating the forward asymmetry of the contiguity effect with categorized stimuli. Psychonomic Society Annual Meeting, Minneapolis, MN.
- Chan, S. C. Y., Applegate, M. C., Morton, N. W, Polyn, S. M., Norman, K. A. (May 2013) Recall order is predicted by category-specific neural activity of preceding items at study. Context and Episodic Memory Symposium, Philadelphia, PA.
- Kragel, J. E., and Polyn, S. M. (May 2013) Parietal contributions to episodic memory during free recall and source recognition tasks. Context and Episodic Memory Symposium, Philadelphia, PA.
- Morton, N. W, and Polyn, S. M. (May 2013) A neurally constrained model of category clustering in free recall. Context and Episodic Memory Symposium, Philadelphia, PA.

Polyn, S. M., Kragel, J. E., Morton, N. W (Nov. 2013) Incorporating neural signals into computational models of memory search. Society for Neuroscience Annual meeting, San Diego, CA.

Morton, N. W, and Polyn, S. M. (Nov. 2013) Inter-item distraction dissociates temporal and semantic organization in free recall. Society for Neuroscience Annual meeting, San Diego, CA.

Kragel, J. E., and Polyn, S. M. (Nov. 2013) Representation of item and context specific information during memory retrieval in the human brain. Society for Neuroscience Annual meeting, San Diego, CA.

Miller, J. F., Neufang, M., Solway, A., Brandt, A., Hefft, S., Trippel, M., Mader, I., Polyn, S. M., Jacobs, J., Schulze-Bonhage, A., Kahana, M. J. (Nov. 2013) Reinstatement of place-responsive cell activity during episodic memory retrieval. Society for Neuroscience annual meeting, San Diego, CA.

Chan, S. C. Y., Applegate, M. C., Manning, J. R., Morton, N. W, Polyn, S. M., Norman, K. A. (Nov. 2013) Recall order is predicted by category-specific neural activity of preceding items at study. Society for Neuroscience annual meeting, San Diego, CA.

F. Teaching-related activities

Teaching

PSY 253: Human Memory
Spring 2012, Fall 2012; Fall 2013; Instructor, Vanderbilt University

PSY 303: Models of Memory
Fall 2011; Spring 2014; Instructor, Vanderbilt University

PSY 282: Special Topics in Cognition: Foundations of Human Memory
Spring 2011; Instructor, Vanderbilt University

PSY 208: Principles of Experimental Design
Spring 2010, Fall 2010; Instructor, Vanderbilt University

SC 250: Scientific Toolbox (taught by Prof. Thomas Palmeri)
Fall 2011, Fall 2012; Guest Lecturer, Vanderbilt University

NURO 340: Systems Neuroscience (taught by Profs. Wallace and Casagrande)
Fall 2009–2013; Guest Lecturer, Vanderbilt University
“The hippocampus: Insights into memory”

Foundations of Human Memory (taught by Prof. Michael J. Kahana)
Spring 2008; Guest Lecturer, University of Pennsylvania
“Context and the organization of memory”

Graduate level multivariate statistics (taught by Prof. Andrew Conway)
Fall 2005; Guest Lecturer, Princeton University
“Pattern classification”

Graduate student committees

Kristen Ekstrand (doctoral candidate; thesis committee)
Jennifer Richler (doctoral candidate; thesis committee)
Xiaoli Chen (graduate student)
Qianqian Fan (graduate student)
James Kragel* (graduate student)
Neal Morton* (graduate student)
Hyunyoung Park (graduate student)
Justin Siemann (graduate student)
Ana Van Gulick (graduate student)

* Graduate student in my laboratory

Undergraduate research projects supervised

Richard Arriviello (Neuroscience major)
Kelsey Bowman (Neuroscience major)
Zachary Bullard* (Psychology major)
Peter Cheng (volunteer in lab)
Meghan Collins (Neuroscience major)
Madeleine Hebert (Psychology major)
Michael Geoghegan (Neuroscience major)
Kristen McCabe* (Neuroscience major)
Zachary Roth (volunteer in lab)
Andrew Underwood (Neuroscience major; work-study employee)

G. Academic service

To department and university

July 2013. Presentation to the PAVE Pre-College Program at Vanderbilt University, "What is Psychology?"

October 2013 to present. Member of the Undergraduate Studies Committee, advising the Director of Undergraduate Studies (Prof. J. Bachorowski) on the structure of the undergraduate major in Psychology, as well as other undergraduate issues in the department.

October 2013. Participated in mock interviews with Honors Students in the Psychology major at Vanderbilt University.

October 2013. Worked with graduate students in the Vanderbilt Center for Teaching's Certificate in College Teaching program.

January 2011 to present. Administration of departmental website: Supervision of administrative staff who keep content up-to-date, interaction with developers at Vanderbilt's Web Communications office to ensure quality of website.

December, 2009. Participated in a workshop on Professional Development for graduate students and post-doctoral fellows.

To profession

February 2012 to present. Maintenance of a personal YouTube channel which hosts tutorial videos on computational memory topics. As of December 2013, these have been viewed over 10,000 times.

Ad Hoc Journal Reviewer: Brain Research; Cognitive Neuropsychology; Cognitive Psychology; Frontiers in Human Neuroscience; Hippocampus; Human Brain Mapping; Journal of Cognitive Neuroscience; Journal of Experimental Psychology: Learning, Memory, & Cognition; Memory & Cognition; Memory; Neuroimage; Neuropsychologia; Proceedings of the National Academy of Sciences (USA); Psychological Review; Psychonomic Bulletin & Review; Quarterly Journal of Experimental Psychology; Science.

Reviews for other organizations: The Wellcome Trust; Medical Research Council, UK; External examiner for Memorial University, Canada.

Professional Society Memberships:

Cognitive Neuroscience Society
Memory Disorders Research Society
Psychonomic Society
Society for Mathematical Psychology
Society for Neuroscience

References

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February 7th, 2014

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